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Who are the active investors? Evidence from venture capital ☆

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ABSTRACT

This paper examines the determinants and consequences of investor activism in venture capital. Using a hand-collected sample of European venture capital deals, it shows the importance of human capital. Venture capital firms with partners that have prior business experience are more active recruiting managers and directors, helping with fundraising, and interacting more frequently with their portfolio companies. Independent venture capital firms are also more active than 'captive' (bank-, corporate-, or government-owned) firms. After controlling for endogeneity, investor activism is shown to be positively related to the success of portfolio companies.

1. Introduction

It is widely believed that venture capital plays an important role for innovation and economic growth. In the U.S., venture capital firms are typically organized as independent private partnerships, run by a relatively small number of general partners. While some of these partners previously worked in financial institutions, many

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have prior business experience. Take the example of Eugene Kleiner. Prior to founding the well-know Silicon Valley venture capital firm Kleiner Perkins, he had been an engineer and entrepreneur. In fact, he was one of the famous "traitorous eight" that left Shockley to start Fairchild Semiconductors. This brings up the question of what features make venture capital firms most effective. Is the human capital of venture partners important? And does the organizational structure of the venture capital firm matter?

The venture capital literature identifies a broad role for the investor, which goes beyond the simple provision of finance. Venture capitalists may engage in a number of value-adding activities, including monitoring, support, and control. Those activities are largely non-contractible, yet may have real consequences.[1] Industry insiders frequently distinguish between "hands-on" versus "hands-off" investment styles, and stress the importance of investor activism. A recent report by the European Venture Capital Association (EVCA, 2005), for example, notes:

> The degree of activism of Private Equity and Venture Capital investors will vary according to the nature and structure of investments made and the investor should therefore ensure adequate involvement relative to the circumstances of a particular investment.

Two open questions in the literature are (i) what investor characteristics may lead to more investor activism, and (ii) whether an active investment style matters for the success of portfolio companies. This paper examines how human capital and organizational characteristics affect the activity level of venture capital firms. It also considers how these activities, in turn, affect the likelihood of investment success.

The analysis is based on a hand-collected data set of European venture capital investments. The data cover the period 1998–2001, and consist of a sample of venture capital deals in 17 European countries. Our primary data source is a survey of venture capital firms, which we augmented with numerous secondary sources. Our data set consists of information on 119 venture capital firms, 503 partners, and 1,652 portfolio companies. The data collection required considerable time and effort, but resulted in a data set that is significantly larger than other hand-collected datasets on venture capital, and much richer than commercially available datasets.

The measurement of investor activism represents an empirical challenge. Investors' activities are largely non-contractible, and therefore are not specified in contracts, nor are they recorded in standard sources of venture capital data. As a consequence, surveys are an appropriate way of collecting direct evidence on the activities of investors. We obtain four measures of activism: whether a venture capital firm is involved with recruiting the management team, whether it helps assembling the company's board of directors, whether it provides any assistance with obtaining additional financing, and how often it interacts with a portfolio company. Our survey allows us to observe these activities separately for each company that a venture capitalist invests in.

Another advantage of our data approach is that we are able to construct several measures of human capital. From our survey, we obtain data on individual partners' backgrounds. We distinguish between three types of human capital effects. First, there may be some accumulation of job-specific knowledge, where venture capitalists become better over time at providing services. We measure this with a partner's years of experience as a venture capitalist. Second, there is a partner's knowledge of what it takes to create and run a company. We measure this with a partner's prior business experience. Third, there is a partner's formal knowledge. We measure this with a partner's scientific education. For each of these measures, we construct the average human capital profile of the venture firm. This allows us to examine what kind of human capital is conducive to an active investment style. In terms of organizational structure, we emphasize the distinction between private, independent venture capital firms and so-called captive firms, who are affiliated with corporations, banks or government.

Our first central finding is that human capital and organizational structure are significantly related to investor activism. Venture firms whose partners have prior business experience are significantly more active in the companies they finance. Interestingly, the venture experience of the firm's partners does not have a significant effect on this, and science education has little effect. In terms of organizational structure, we find that private independent venture capital firms are significantly more involved with their portfolio companies than captive ones. To examine whether these empirical relationships are not merely driven by selection effects we consider three alternative econometric approaches. Intuitively, these methods exploit the fact that companies in different countries face a different set of potential investors. A common thread across the three alternative approaches is to identify selection effects by exploiting exogenous market characteristics that affect the likelihood that specific investors are matched to specific companies. Our econometric analysis then suggests that selection effects do not explain away the effect of human capital and organizational structure on investor activism. We subject these results to several robustness checks and consistently find that they continue to hold.

Another unique feature of our data is that we have information about different partner roles inside venture capital firms. This allows us to examine the issue of task-allocation within venture firms. We find that having more venture experience or business experience increases the likelihood that a partner is put in charge of supervising portfolio companies. Moreover, in a fixed effects (conditional logit) model, we find that within venture capital firms, greater venture experience has a positive and significant effect on the level of activism.

The next important step is to examine whether these activities affect performance. We are faced with two main

[1] See Gompers (1995), Gorman and Sahlman (1989), Hellmann and Puri (2000, 2002), Hochberg (2004), Hsu (2006), Kaplan and Strömberg (2004), and Lerner (1994).

challenges: measurement and identification. Concerning the first, ideally one would like to measure investor returns, but it is well known that venture capital returns are not publicly available. We therefore follow the extant literature and adopt an approach similar to Gompers, Kovner, Lerner, and Scharfstein (2005) and Sørensen (2007) of measuring performance by whether the invested companies experience a successful exit, defined either as an Initial Public Offering (IPO) or an acquisition. The second challenge is identification. Simply regressing exits on investor activism yields mostly insignificant results. Yet, this regression may be affected by endogeneity, since investors might be more active with companies that are facing performance challenges. We therefore use an instrumental variable framework. The key identifying assumption is that the characteristics of venture capital firms do not affect the companies' outcomes directly, but affect them indirectly through their actions, i.e., their level of activism. We employ the human capital and organizational structure variables as instruments for investor activism. Our second central finding is then that a positive relationship exists between investor activism and exit performance, and that this relationship is both statistically and economically significant. In other words, our instruments deal with the reverse causality problem where firms that develop performance problems require more active involvement. We also verify that our performance results are not driven by selection effects related to the matching process between investors and companies.

These results provide some important answers to the question about what makes venture capital firms effective investors. The strongest predictor of whether a venture capital firm adopts an active investment style is whether the partners have prior industry experience. Moreover, activism seems to improve performance. These findings are interesting since in many countries venture capitalists have more financial than industry backgrounds. However, one should not simply conclude that hiring partners with prior industry experience will always increase activism and improve performance. Rather, our results can be interpreted as an economic equilibrium outcome, where talented venture capitalists with prior business experience are a scarce but valuable resource.

In a concurrent research project, Gompers, Kovner, Lerner, and Scharfstein (2005) examine the role of experience on the investment behavior of venture capital firms. They provide evidence that prior deal flow experience helps venture capital firms to take advantage of deal opportunities by ramping up investments when opportunities improve, and that ramp-up often leads to better exit performance. They use U.S. data from Thompson VentureXpert. This has the advantage of providing a long history of venture capital deals, but also the disadvantage of containing little deal-specific information. Our hand-collected data capture a shorter period of European venture capital deals with rich deal-specific information. Our data also allow us to build direct measures of the human capital of individual venture capitalists, while Gompers, Kovner, Lerner, and Scharfstein (2005) infer a venture firm's experience from the intensity of its prior deal flow. Moreover, they do not examine investor activism, but focus only on the relationship between experience and performance. Dimov and Shepherd (2005) and Zarutskie (2007) also report results about venture capitalists' human capital and investment performance, although neither explicitly consider causal mechanisms such as investor activism. Despite these differences—including the fact the above papers use U.S. data whereas we use European data—a common finding is that human capital specialization matters for investment performance.

Our emphasis on human capital is novel in the literature on financial intermediation. Financial intermediation requires substantial processing of "soft information" (Stein, 2002; Berger, Miller, Petersen, Rajan, and Stein, 2005), which may naturally generate differences in the levels of investor activism. In a related vein, the growing literature on the mutual fund industry examines the importance of individual fund managers (Chevalier and Ellison, 1999; Berk and Green, 2004). In a broader context, Bertrand and Schoar (2003) and Malmendier and Tate (2005) also find that individual managerial characteristics are a key determinant of firms' decision making. The recent work by Puri and Robinson (2007) complements our approach by examining human capital aspects of entrepreneurs.

The remainder of the paper is structured as follows. Section 2 discusses our data sources. Section 3 motivates our choice of dependent and explanatory variables, and provides their definition. Section 4 examines across-firms evidence on the role of human capital. Section 5 discusses selection issues. Section 6 discusses the relationship between investor activities and performance. Section 7 examines the role of human capital within venture capital firms. Section 8 considers several extensions and discusses additional robustness checks. It is followed by a brief conclusion.

2. Sources of data

We build this paper on data which come from a variety of sources. Our primary source is a survey that we sent to 750 venture capital firms in the following seventeen countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the U.K. This set of countries includes all the members of the European Union in the period under study, plus Norway and Switzerland.

Venture firms were included in our sample if they satisfied three conditions: (i) they were full members of the European Venture Capital Association (EVCA) or of a national venture capital organization in 2001, (ii) they were actively engaged in venture capital, and (iii) they were still in operations in 2002.[2]

[2] While we excluded private equity firms that only engage in non-venture private equity deals such as mezzanine finance, management buy-outs (MBOs) or leveraged buy-outs (LBOs), we included private equity firms that invest in *both* venture capital and non-venture private equity deals. For these, we considered only their venture capital

We collected our survey data between February 2002 and November 2003. We asked venture capital firms about the investments they made between January 1998 and December 2001. The questions centered on key characteristics of the venture firm, on the involvement with portfolio companies, on some characteristics of these companies, and on the educational background and work experience of each venture partner.[3]

We received 124 responses with various degrees of completeness. We excluded venture firms that had not yet made any investments. We contacted all the venture firms that had sent us incomplete answers and retrieved the missing information whenever possible. We then augmented the survey data with information from the Web sites of the respondents and their portfolio companies. We also turned to commercially available databases: Amadeus, Worldscope, and VentureXpert, as well as trade publications like the directories of national venture capital associations. We use information from these sources to obtain missing information, such as the dates, stages, and amounts of venture deals, and we also use it to cross-check the information obtained from respondents. Such cross-validation further enhances the reliability of our data. The resulting data set consists of data on 119 venture firms, 503 venture partners and 1,652 portfolio companies. Notice also that we only use data on a venture firm's first financing in the portfolio company, i.e., we do not count a follow-up investment as a separate deal.

We also collect some data on subsequent outcomes to companies, i.e., what is commonly called the "exit events." For each company we determine whether it has been listed on the stock market through an IPO or whether it has been acquired by another company. We performed this data collection in early 2006, so that we are able to assess exits up to the end of 2005. This gives us a considerable time lag between the initial investment, which makes us confident that we are able to capture a substantial fraction of successful investments. As data sources we use three commercial databases by Thomson Financial, namely VentureXpert, SDC's M&A database, and SDC's Global New Issues database. We then check the Web site of all European and North American stock exchanges for listed companies. Moreover, we check the Web sites of each company and venture capital firm. We use the data from the Web sites to augment and cross-check the data from the commercial databases. Finally, for data still missing, we contacted companies and venture firms directly.

Because of the survey nature of our data, we perform a variety of checks to assess how well the sample represents the population of European venture capital firms. Other papers in the literature avoid this type of question, because it is extremely difficult to gather information on the population. We use information from the main commercial database, VenturExpert, and from the EVCA. We also gathered additional data by contacting all firms in the population through phone calls and through their Web sites. This required considerable effort but allowed us to collect information on more than two-thirds of the population. We use this information in Table 1, which compares the sample with the population it is drawn from. Panel A looks at the country composition. While there is some variation in response rates across countries, our data represent a comprehensive cross-section which provides a good coverage of all countries, with an overall response rate of nearly 16%. This response rate is larger than the typical response rate for comparable surveys of industrial firms, which is around 9% (see the discussion by Graham and Harvey, 2001). No single country dominates

Table 1
Sample properties

This table compares our sample to the population it is drawn from. Panel A looks at the country composition and response rates, Panel B at the composition by venture firm type, and Panel C at the size composition. Variables are defined in Table 2. Partners are measured in units, the amount managed in million of current euros.

Panel A: Country composition and response rate

	Population	Sample	Response rate (%)
Austria	23	8	34.8
Belgium	34	4	11.8
Denmark	29	4	13.8
Finland	33	6	18.2
France	101	14	13.9
Germany	146	19	13.0
Greece	8	4	50.0
Ireland	15	3	20.0
Italy	37	5	13.5
Luxembourg	3	1	33.3
The Netherlands	52	4	7.7
Norway	22	2	9.1
Portugal	10	2	20.0
Spain	38	10	26.3
Sweden	17	6	35.3
Switzerland	43	6	14.0
U.K.	139	21	15.1
Total	*750*	*119*	*15.8*

Panel B: Composition by venture firm type

	Population (%)	Sample (%)
Independent	65.7	68.8
Corporate	8.0	9.4
Bank	19.3	16.8
Public	6.9	5.1

Panel C: Composition by size

	Mean	Median	Min.	Max.
Population				
Number of partners	4.3	3	1	25
Amount managed	333.4	60	1	14,200
Sample				
Number of partners	4.2	3	1	20
Amount managed	182.8	50	2	4,500

(*footnote continued*)
investments. See Fenn, Liang, and Prowse (1995) for a discussion of how the venture capital market is structured in two different segments, "venture capita" and "non-venture private equity".

[3] Throughout the paper we reserve the term 'firm' for the investor (i.e., the venture capital firm) and the term 'company' for the company that receives the venture capital financing.

the sample, and no country is left out. Remarkably, even the larger venture capital markets are well represented: France, Germany, and the U.K. all have response rates above 13%. Another strength of our data is that it is not dominated by a few large respondents: the largest venture capital firm accounts for only 5% of the observations, and the largest five venture capital firms for only 16% of the observations.

Panel B looks at the structure of both sample and population in terms of venture firm type. We partition the sample into independent, bank, corporate, and public venture capital firms. Clearly, our sample closely reflects the distribution of types in the population.

Panel C compares the size distribution of our respondents with that of the population. We consider two size measures: the number of partners, and the amount of funds under management, both measured at the end of 2001. The number of partners is a simple size measure for this form of financial intermediation, which crucially depends on a few high-quality professionals. For the sample and the population, both the mean and median values of partners virtually coincide. The amount under management includes all funds managed by a venture capital firm, including those invested in non-venture private equity. The average firm size is larger for the population, due to the presence of some very large private equity firms that invest mainly in non-venture private equity that chose not to respond to our survey. Consistent with this, the median firm size is very similar for the sample and the population.

A common criticism of sample-based data is that respondent reports may be biased, especially towards more successful deals. We deal with this concern in several ways. First, in late 2003 we checked the Web sites of all respondents. We find that venture firms reported to us over 90% of the portfolio companies listed on their Web sites (we exclude 15 venture firms whose Web site did not list portfolio companies). Since two years had elapsed from the closing of our sample, and new investments had naturally been made, we conclude that it is unlikely that our sample suffers from systematic under-reporting. Second, we compare the exit rates for our sample with the official statistics of the EVCA, which classifies as exits IPOs, mergers, and acquisitions. The EVCA is the most authoritative source of aggregate venture capital data for Europe, and collects these data with a systematic and consistent methodology across countries. We find that 23.6% of the companies in our sample had a successful exit rate over the period 1998–2005. This compares with an exit rate of 25.6% for the EVCA data, when we count investments and exits over the same period. Therefore, it appears that our sample is not biased towards more successful companies. Third, we also examine the possibility that our respondents might choose not to answer all of our questions about activism when their companies are not performing well. To see whether our data present any such bias, we performed some additional tests. For all of our dependent variables we correlate the exit rate with the response rate. We find that the correlation coefficients are all below 6%. In unreported regressions, we also estimated Probit models for the response rate of all of our dependent variables, to see whether the exit rate might explain them, after controlling for other observable characteristics. Naturally, we can only control for those characteristics for which we have complete or near-complete reporting, namely investor characteristics and company sectors (see Section 3). We find that the exit rate is statistically insignificant in terms of explaining response rates. All this suggests that there is no systematic reporting bias towards more successful companies. Finally, one might also be worried about recollection biases, where respondents might have different answers for more versus less recent transactions. Our analysis controls for this through the use of deal year controls.

3. Data variables

In this section we provide an economic motivation for our choice of variables. Table 2 summarizes the definitions of our variables, and how they have been constructed.

Table 2
Variable definitions

Variable	Description
(a) *Dependent variables*[a]	
RECRUITING	dummy variable that takes the value 1 if the venture capital firm is reported to be involved in recruiting senior management for the company; 0 otherwise. We obtain the data from our survey instrument, which asked: *Has your firm been involved in recruiting senior management for this company*? Possible answers were: *Yes*, *No*.
DIRECTORS	dummy variable that takes the value 1 if the venture capital firm is reported to be involved in the hiring of outside directors of the company; 0 otherwise. We obtain the data from our survey instrument, which asked: *Has your firm been involved in hiring some of this company's outside directors*? Possible answers were: *Yes*, *No*.
FUNDRAISING	dummy variable that takes the value 1 if the venture capital firm is reported to have helped the company obtain additional financing; 0 otherwise. We obtain the data from our survey instrument, which asked: *Has your firm helped this company obtain additional financing*? Possible answers were: *Yes*, *No*.
INTERACTION	dummy variable that takes the value 1 if the venture capital firm is reported to interact with the company on a monthly or weekly basis; 0 if it interacts on an annual or quarterly basis. We obtain the data from our survey instrument, which asked: *How many times per year does* (*did*) *the responsible partner*(*s*)/*manager*(*s*) *personally interact with this company*? (*check one*). Possible answers were: *annually*; *quarterly*; *monthly*; *weekly*.

Table 2 (*continued*)

Variable	Description
EXIT	dummy variable that takes the value 1 if the company has been acquired or has been listed through an Initial Public Offering; 0 otherwise. We measure exits at December 2005, and we obtain the data from a variety of sources described in Section 2.
(b) *Independent variables: human capital characteristics*[b]	
VENTURE-EXPERIENCE	logarithm of the average number of years of experience in venture capital of the venture firm's partners. We obtain the data from our survey instrument, which asked (for each partner/senior manager): *Indicate the years of experience as venture capitalist.*
BUSINESS-EXPERIENCE	fraction of the venture firm's partners who have prior business experience. We obtain the data from our survey instrument, which asked (for each partner/senior manager): *Indicate the professional background* (*multiple answers possible*). Possible answers were: *finance; industry (including previous entrepreneurial experience*); *accounting*; *consulting*; *legal*; *other* (*specify*).
SCIENCE-EDUCATION	fraction of the venture firm's partners who have an education in science or engineering. We obtain the data from our survey instrument, which asked (for each partner/senior manager): *Indicate the field of education* (*multiple answers possible*). Possible answers were: *business; humanities; engineering/science; law and social sciences; other* (*specify*).
(c) *Independent variables: organizational characteristics*[c]	
INDEPENDENT-VC	dummy variable that takes the value 1 if the venture capitalist defines itself as an independent venture firm; 0 otherwise.
VC-AGE	logarithm of the age of the venture capital firm, measured in months at the end of the sample period. We obtain the data from our survey instrument, which asked: *Indicate the date of creation of your firm* (*mm/yy*).
VC-SIZE	logarithm of the amount under management of the venture capital firm at the end of the sample period, in millions of current euros. We obtain the data by directly contacting respondent companies after receiving their main answers, or from commercial databases, company websites and industry sources.
(d) *Independent variables: contractual characteristics*[d]	
DOWNSIDE	dummy variable that takes the value 1 if the instruments used for financing the company includes one of the following: straight debt, convertible debt, or preferred equity; 0 otherwise. We obtain the data from our survey instrument, which asked: *Which of the following financial instruments has your firm used to finance this company*? Possible answers were: *common equity; straight debt; convertible debt; preferred equity; warrants.*
BOARD	dummy variable that takes the value 1 if the venture capital firm is reported to sit or have sat on the board of directors of the company; 0 otherwise. We obtain the data from our survey instrument, which asked: *Is* (*or was*) *your firm represented on this company's board of directors*? Possible answers were: *Yes*, *No.*
NO-SYNDICATE	dummy variable that takes the value 1 if the company is financed by a single investor; 0 otherwise. We obtain the data from our survey instrument, which asked:*Was the deal syndicated*? Possible answers were: *Yes*; *No.*
SYNDICATE-LEADER	dummy variable that takes the value 1 if the company is financed with a syndicated deal and the venture capital firm is the leader of the syndicate; 0 otherwise. We obtain the data from our survey instrument, which asked: *If the deal was syndicated, was your firm the lead investor*? Possible answers were: *Yes*; *No.*
SYNDICATE-FOLLOWER	dummy variable that takes the value 1 if the company is financed with a syndicated deal and the venture capital firm is not the leader of the syndicate; 0 otherwise. We obtain the data from our survey instrument, which asked: *If the deal was syndicated*, *was your firm the lead investor*? Possible answers were: *Yes*; *No.*
(e) *Independent variables: company characteristics*	
COMPANY-AGE	logarithm of the age of the company, measured in months at the time of funding. We obtain the data from our survey instrument, which asked (for each company): *Indicate the date of creation of the company* (*mm/yy*), and *Indicate the date of your first round of financing to this company (mm/yy).*
STAGE-DUMMIES	set of four dummy variables each of which takes the value 1 if a deal is reported as seed, start-up, expansion, or bridge (respectively); 0 otherwise. We obtain the data from our survey instrument, which asked: *Indicate the type of your first round of financing to this company* (*check one*). *Possible answers were*: *Seed*; *Start-up*; *Expansion*; *and Bridge.*
DEAL-YEAR	set of four dummy variables each of which takes the value 1 if a deal took place in 1998, 1999, 2000, or 2001 (respectively); 0 otherwise. We obtain the data from our survey instrument, which asked: *Indicate the date of your first round of financing to this company* (*mm/yy*).
INDUSTRY	set of a mutually exclusive dummy variables that take the value 1 if the company is reported to operate in one the following industries; 0 otherwise. We obtain the data from our survey instrument, which gave the following options: *Biotech and pharma*; *Medical products*; *Software and internet*; *Financial services*; *Industrial services*; *Electronics*; *Consumer services*; *Telecom*; *Food and consumer goods*; *Industrial products* (*incl. energy*); *Media* & *entertainment*; *Other.*

[a] The dependent variables are measured at the portfolio company level.
[b] Variables are measured at both the venture firm level and at the portfolio company level. We denote the latter case with the prefix 'PIC.'
[c] Variables are measured at the portfolio company level.
[d] Variables are measured at the portfolio company level. In the instructions to the survey we specified functional definitions of these different financial instruments in order to ensure consistency of responses.

Table 3
Descriptive statistics
This table provides descriptive statistics for all our dependent and independent variables. Variables are defined in Table 2. For dummy variables the Mean column reports the frequency of observations, and the Median is omitted.

Variable	Mean	Median	Min.	Max.	*Observations*
Recruiting	0.482	–	0	1	*1,548*
Directors	0.407	–	0	1	*1,523*
Fundraising	0.521	–	0	1	*1,481*
Interaction	0.693	–	0	1	*1,466*
Exit	0.236	–	0	1	*1,652*
Venture-Experience	1.925	1.926	0	3.060	*1,628*
Business-Experience	0.578	0.667	0	1	*1,643*
Science-Education	0.380	0.333	0	2	*1,643*
PIC-Venture-Experience	1.932	1.987	0	3.496	*1,588*
PIC-Business-Experience	0.579	0.500	0	1	*1,602*
PIC-Science-Education	0.467	0.000	0	1	*1,590*
IC-Venture-Experience	1.588	1.609	0	3.496	*7,464*
IC-Business-Experience	0.600	–	0	1	*7,668*
IC-Science-Education	0.562	–	0	1	*7,779*
Independent-VC	0.605	–	0	1	*1,652*
VC-Age	4.175	3.989	2.485	5.966	*1,652*
VC-Size	4.551	4.690	0.262	8.412	*1,640*
Downside	0.490	–	0	1	*1,611*
Board	0.662	–	0	1	*1,617*
No-Syndicate	0.359	–	0	1	*1,307*
Syndicate-Follower	0.408	–	0	1	*1,307*
Syndicate-Leader	0.233	–	0	1	*1,307*
Company-Age	2.984	3.258	0	7.073	*1,367*
Stage-seed	0.180	–	0	1	*1,489*
Stage-start-up	0.403	–	0	1	*1,489*
Stage-expansion	0.401	–	0	1	*1,489*
Stage-bridge	0.016	–	0	1	*1,489*
Deal-1998	0.120	–	0	1	*1,489*
Deal-1999	0.203	–	0	1	*1,489*
Deal-2000	0.378	–	0	1	*1,489*
Deal-2001	0.299	–	0	1	*1,489*
Biotech and pharma	0.140	–	0	1	*1,638*
Medical products	0.077	–	0	1	*1,638*
Software and internet	0.305	–	0	1	*1,638*
Financial services	0.035	–	0	1	*1,638*
Industrial services	0.036	–	0	1	*1,638*
Electronics	0.052	–	0	1	*1,638*
Telecom	0.082	–	0	1	*1,638*
Consumer services	0.113	–	0	1	*1,638*
Food and consumer goods	0.020	–	0	1	*1,638*
Industrial products	0.017	–	0	1	*1,638*
Media & entertainment	0.068	–	0	1	*1,638*
Other industries	0.056	–	0	1	*1,638*
Number of companies	–	–	–	–	*1,652*

Table 3 contains descriptive statistics for all the variables used in the analysis.

Our dependent variables concern actions that venture capitalists can perform for their companies. The main independent variables concern the human capital and the organizational structure of the venture capital firms. Our analysis also controls for the types of contracts used in the transaction, and for the characteristics of the recipient companies.

3.1. Motivating the dependent variables

Our dependent variables aim to capture venture capital firms' involvement with their companies. The strength of using hand-collected survey data is that it provides us with a variety of activism measures that are otherwise not available. Table 2(a) provides formal definitions of these variables.

The theoretical work of Casamatta (2003), Cestone (2004), Hellmann (2006), Inderst and Müller (2004), Repullo and Suarez (2004), and Schmidt (2003) shows how in a double moral hazard setting, effort levels of venture capitalists influence outcomes. This effort can be interpreted as a variety of activities that venture capitalists undertake.

One of the areas where effort might matter concerns the role that investors play in structuring the management team. Hellmann and Puri (2002) show that venture capitalists play a substantial role in the professionalization of management teams (see also Sahlman, 1990). Our first dependent variable (RECRUITING) therefore reports whether an investor gets involved in recruiting management teams.

The importance of active governance in venture capital is explained by Dessein (2005) and Hellmann (1998). Gompers (1995), Gompers and Lerner (1996), Hochberg (2004), Kaplan and Strömberg (2003, 2004), and Lerner (1995) provide supporting empirical evidence. Our second dependent variable (DIRECTORS) is a measure of how much the venture capital firm plays an active role in building a board of directors.

Fundraising is a vital process for entrepreneurial companies. While their own funding capabilities may be more limited, venture capital firms can play a key role in the process of obtaining additional financing from other financiers. Our third dependent variable (FUNDRAISING) examines whether an investor helped the company with raising funds from other sources.

The concept of monitoring pervades not only the venture capital literature, but the literature on financial intermediation more broadly (Petersen and Rajan, 1994, 1995; Hoshi, Kashyap, and Scharfstein, 1991). Venture capitalists also monitor their companies' progress, although they may differ in their monitoring intensities (Gompers, 1995). Note that monitoring need not be a value-adding activity per se, since it concerns mainly the amount of communication between the investor and the company. Our fourth dependent variable (INTERACTION) concerns the intensity of investor-company communication, measuring the reported frequency with which an investor communicates with the company.

In Sections 6–8 we introduce and motivate some additional dependent variables.

3.2. Motivating the independent variables

3.2.1. Motivating the human capital variables

Ultimately, financial intermediation is performed by people, suggesting that human capital is likely to matter.[4] We consider two possible reasons why human capital may affect investor activities. First, there may be some job-specific learning, where venture partners learn on the job how to become active investors. For this, we look at a partner's experience in venture capital, as measured by the number of years that s/he has worked in the venture capital industry. The natural conjecture is that having more experience improves a partner's ability to perform his/her tasks. Second, a partner's knowledge base may influence his/her investment activities. By knowledge base we mean the experience that the partner brings to the job from prior activities. We focus on two distinct sources of knowledge base: prior work experience and education. For work experience, we look at whether the individual partner had some business experience before becoming a venture capitalist, be it by working in industry (including being an entrepreneur) or consulting. Prior business experience might help a partner to better understand the challenges of portfolio companies, providing a measure of the partner's experience in handling business problems. To construct the business experience variable, we focus on industry and consulting experiences, where people are typically exposed to a broad set of managerial challenges, and distinguish this from more functionally specialized work experiences, such as accounting, finance, or law. In the press, this is often referred to as the difference between 'Main street' versus 'Wall street' types. For education, we specifically look at whether a partner has an education in science or technology. Formal education in science may give a partner a better and deeper knowledge that can facilitate the appreciation of the technological and operational challenges of the companies s/he oversees. Table 2(b) provides formal definitions of these variables.

For most of the analysis we measure human capital profiles at the level of the venture firm. For this we measure the human capital of each partner, and then take the average across all partners within the firm.[5] In Section 7 we also introduce alternative ways of measuring human capital.

3.2.2. Motivating the organizational variables

The organizational structure of a venture capital firm can influence its strategic objectives, and with it, its level of activism. The most important organizational dimension is whether a venture capital firm is independent or not. Independent firms are profit driven and can define their own investment styles. By contrast, the behavior of 'captive' venture capital firms—those owned by a bank, a corporation, or the government—can be strongly affected by the strategic goals of their parent organization. The work of Gompers and Lerner (2000), Hellmann (2002), and Hellmann, Lindsey, and Puri (2008) shows that captive venture capital firms behave differently than their independent counterparts.

Our analysis also controls for the age and size of venture capital firms. Looking at U.S. data, Gompers (1996) and Gompers and Lerner (1999) suggest that the size and age of a venture capital firm may be a proxy for its quality and reputation. Fulghieri and Sevilir (2004) theorize about complementarities between effort and the size of a venture capital portfolio. In the European context, the age of a venture capital firm also signals its vintage: older firms were founded at a time when the European venture capital industry was still in its infant stages (Bottazzi and Da Rin, 2004; Da Rin, Nicodano, and Sembenelli, 2006), so that the relationship between age and quality need not be as strong. Table 2(c) provides formal definitions of all the organizational variables.

3.2.3. Motivating the contractual variables

Security design has become a large part of the recent theoretical corporate finance literature. The theoretical venture capital literature mentioned above emphasizes the double moral hazard problem. It tries to explain how optimal contracts can address these incentive problems. A common conclusion is that the use of convertible securities can improve overall efficiency. The effect on the effort of the venture capitalist, however, can be ambiguous. In addition to an efficiency effect that increases effort, convertible securities also afford the investor greater downside protection, which might decrease effort. Our first contractual measure looks at the degree of downside protection that investors obtain from the securities they use to finance the company.

Another important contractual component is whether investors hold control rights, such as through direct participation on the board of directors. Hellmann (1998), for example, shows that board control can be a prerequisite for venture capital support, since without the control, the entrepreneur may hold up the value generated by the venture capitalist. This suggests that more investor control is likely to increase the investor effort provision. We capture this effect by looking at whether the investor has a seat on the company's board of directors.

One may wonder why we treat board participation as an independent variable, rather than as a dependent variable that measures yet another dimension of investor activism. Indeed, some of the corporate finance literature equates board participation with active investors. The problem with using board participation as a measure of activism is that one does not know how active or passive an investor actually behaves on the board. Board participation only gives investors a formal role, whereas our analysis focuses on the real role played by investors.[6] Put differently, in our analysis we want to capture variation in the real level of investor activism. By controlling for board participation we

[4] The seminal work of Hayek (1945) and Becker (1964) emphasizes the importance of individuals' human capital, in terms of acquiring specific knowledge about a narrow range of problems, and acquiring competencies valuable for decision making and value creation.

[5] In our survey we asked: *Identify anonymously all partners/senior managers active as of December 2001*; we specified that: *a partner or senior manager is a person with investment decision power within your firm, i.e., somebody who can decide whether or not to fund a company.*

[6] Aghion and Tirole (1997) explain the importance of distinguishing between formal and real control.

Table 4(a)
Univariate tests—venture firm level

This table presents univariate non-parametric tests for the difference of means of the dependent variables and venture firm characteristics. High (low) values of Business-Experience and VC-Age are those above (below) the median. Old/Young venture firms are those above/below median venture firm age. Differences significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	(i)		(ii)		(iii)		(iv)	
	Business-Experience		Independent-VC		VC-Age		VC-Alive	
	High	Low	Yes	No	Old	Young	Yes	No
Recruiting	0.569	0.433*	0.555	0.380**	0.493	0.511	0.516	0.471
Directors	0.456	0.324*	0.425	0.312	0.378	0.403	0.425	0.311
Fundraising	0.612	0.419***	0.551	0.434***	0.503	0.525	0.508	0.525
Interaction	0.809	0.816	0.855	0.719**	0.795	0.830	0.806	0.825
Exit	0.220	0.183	0.206	0.192	0.232	0.171*	0.221	0.161*
Venture-Experience	1.928	1.940	1.994	1.800*	2.048	1.816**	1.957	1.882
Business-Experience	–	–	0.563	0.626	0.576	0.588	0.622	0.495*
Science-Education	0.461	0.264***	0.390	0.299	0.357	0.367	0.381	0.323
Independent-VC	0.667	0.712	–	–	0.712	0.667	0.704	0.658
VC-Age	3.740	3.800	3.790	3.725	–	–	3.799	3.708
VC-Size	4.011	4.084	3.959	4.235	4.310	3.778**	4.405	3.270***

set ourselves a more stringent standard for this, since we already eliminate any variation in investor activism that is merely due to an investor's formal role.

Venture capital deals are often syndicated among several investors (Brander, Amit, and Antweiler, 2002; Lerner, 1994). Syndication is likely to reduce an investor's activity level, because of duplication of effort, and possibly also because of free-riding. Partly as a response to this, syndicates delegate the responsibility for interacting with the company to a syndicate leader, who is expected to remain more involved with the company. We therefore control not only for whether a deal is syndicated or not, but also for whether the venture firm is a leader or follower within the syndicate. Table 2(d) provides formal definitions of all the contractual variables.

3.2.4. *Motivating the company-level variables*

Our regressions include a number of company-specific characteristics, which we define formally in Table 2(e). We control for company age since younger companies are more likely to need support and advice from the venture investor; this results in losing several observations but makes us more confident of our results. Since market conditions varied over the time period we study, we include year dummies to account for the date at which a company received funding. We also control for the stage of the company. Early stage companies are typically more resource constrained, and may benefit more from the involvement of the venture capital firm. Finally, we control for industry, since different industries may have different needs for investor activism. We discuss several additions and extensions in Section 8.

4. Across-firms analysis

4.1. *Univariate analysis*

To explore our data and motivate our multivariate regression analysis, Table 4 provides a set of univariate comparisons of the main dependent and independent variables. Table 4(a) focuses on how these variables vary with key attributes of venture firms, using the venture firm as the unit of analysis. Table 4(b) focuses on how these variables vary with key deal characteristics, using the portfolio company as the unit of analysis. In both panels we report results for difference-of-means tests, but we obtain the same results with difference-of-median tests.

Column (i) of Table 4(a) compares venture capital firms with above and below median levels of their partners' average business experience. This variable will play a key role in our multivariate analysis, but we can already see that higher levels of business experience are associated with significantly higher levels of investor activism,

Table 4(b)
Univariate tests—company level

This table presents univariate non-parametric tests for the difference of means of the dependent variables and venture firm characteristics. Boom years are 1998 and 1999, bust years are 2000 and 2001. Early Stage are seed and start-up deals, Late Stage are expansion and bridge. Differences significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	(i)		(ii)	
	Cycle		Stage	
	Boom	Bust	Early	Late
Recruiting	0.478	0.473	0.509	0.389***
Directors	0.387	0.393	0.411	0.342***
Fundraising	0.520	0.498	0.550	0.429***
Interaction	0.618	0.722***	0.679	0.687
Exit	0.279	0.215***	0.198	0.288***
Venture-Experience	1.996	1.887***	1.913	1.980***
Business-Experience	0.559	0.584	0.615	0.526***
Science-Education	0.358	0.390*	0.420	0.331***
Independent-VC	0.583	0.617	0.657	0.560***
VC-Age	4.434	4.048***	4.115	4.244***
VC-Size	4.780	4.507*	4.479	4.637**

especially for recruiting management, hiring directors, and fundraising. The interaction variable shows no significant difference. The other rows look at venture capital firms' attributes. Business experience does not appear to be correlated with these attributes, except for a positive correlation between business experience and science-education.

Column (ii) shows how the organizational form of venture capital firms correlates with the activity variables. Independent venture capital firms have higher levels of activism, and these differences are statistically significant (the directors variable is only marginally insignificant at 13%).

Column (iii) compares younger with older venture capital firms, dividing them at the sample median of 54 months. A unique feature of the European venture capital market in the period under study, was the entry of many new venture capital firms. A natural question to ask is how this might affect our analysis. We find no strong differences for investor activism: younger venture capital firms show slightly higher levels, but these differences are all statistically insignificant. However, younger firms differ in terms of other characteristics. Not surprisingly, they have partners with less venture capital experience and they are smaller. Moreover, there is a lower rate of successful exits among the younger venture funds.

The exit rate of portfolio companies is the most common performance measure in venture capital studies (Sørensen, 2007). Kaplan, Martel, and Strömberg (2007) suggest an additional performance measure, namely the survival rate of venture capital firms themselves. This measure captures mainly long-term underperformance of venture capital firms, and is by construction less fine-grained than the company exit rate. However, for an analysis at the level of the venture capital firm, it provides a useful complementary performance measure. Column (iv) distinguishes between those venture capital firms that were still active in May 2007 from those that went out of business. We find that the survival of venture capital firms is clearly correlated with their exit rate of portfolio companies. Not surprisingly, larger firms are also less likely to go out of business. Partners' business experience is positively (and significantly) associated with venture firm survival, a finding which will remain central in our analysis. Note also that none of the activity variables show any significant correlation with firm survival. Below we will see that more sophisticated models, which take account of selection at the company level, are necessary to uncover performance effects of investor activism.

Table 4(b) considers additional univariate comparisons using the portfolio company as the unit of analysis. Our data cover the period 1998–2001, which witnessed a sharp turn of the cycle for the venture capital industry. In the multivariate analysis we use year fixed effects to account for this; in the univariate comparisons we divide our sample into two subperiods, the 'boom' period (1998 and 1999) versus the 'bust' period (2000 and 2001). Column (i) shows the result. As expected, the exit rate is significantly higher for boom period deals. Larger and older venture firms, and firms with more experienced partners were relatively more active in the boom period, whereas firms with more science-educated partners were relatively more active in the bust period. Interestingly, most of the activism variables do not show a clear cyclical behavior, the exception being that interactions between investors and companies were more frequent in the bust period.

Column (ii) distinguishes early and late stage deals. In the multivariate analysis we use a more fine-grained set of dummy variables, but for the univariate analysis we define 'seed' and 'start-up' as early stage investments and 'expansion' and 'bridge' as late stage investments.[7] The table shows that staging is correlated with many investor attributes. Larger firms, older firms, and firms with more experienced partners prefer late stage deals, whereas firms with partners that have more business experience or science education focus more on early stage deals. Investor activism is higher for early stage companies, presumably because there is greater need for recruiting managers, hiring board members, and additional fundraising. The frequency of interaction appears comparable across early and late stages. As expected, the exit rate of late stage deals is significantly higher.

Overall, the univariate analysis points to some key properties of the data and offers a first glance at some of the central results of the paper. We are now in a position to proceed to multivariate regressions, which constitute the core of the analysis.

4.2. Multivariate analysis

All our dependent variables are binary, so we use a Probit model—all our results continue to hold if we use a Logit model—with the following specification:

$$Y_c = \alpha + H_i\beta_H + R_i\beta_R + N_c\beta_N + X_c\beta_X + \varepsilon_c. \quad (1)$$

Variables indexed by c vary for every company whereas variables indexed by i vary for every investor. Y_c is the measure of investor activism (RECRUITING, DIRECTORS, FUNDRAISING, or INTERACTION) for the investment in company c by investor i. α is an intercept. H_i is the vector of human capital measures for venture firm i (VENTURE-EXPERIENCE, BUSINESS-EXPERIENCE, and SCIENCE-EDUCATION), and R_i is a vector of organizational variables (INDEPENDENT-VC, VC-AGE and VC-SIZE) for venture firm i. N_c is a vector of contractual variables (DOWNSIDE, BOARD, SYNDICATE-LEADER, and SYNDICATE-FOLLOWER) for investor i in company c. X_c is a vector of variables (COMPANY-AGE, STAGE, DEAL-YEAR, and INDUSTRY) which measures characteristics of company c. Since our data consist of multiple investments made by different venture capital firms, we cluster our standard errors by venture capital firms i. This allows for the error term ε_c to be correlated within the deals made by a venture capital firm, thus imposing a conservative standard for accepting

[7] There is some ambiguity about the interpretation of the bridge stage, since in principle it is possible to have bridge rounds even at an early stage of a company's development. We reran all of the univariate tests dropping the 24 bridge rounds from the sample, but found that this did not affect any of our results.

Table 5
Across-firms involvement

This table reports results from Probit regressions for our base model of investor involvement (Eq. (1)). Dependent variables are RECRUITING, DIRECTORS, FUNDRAISING, and INTERACTION. Independent variables are VENTURE-EXPERIENCE, BUSINESS-EXPERIENCE, SCIENCE-EDUCATION, INDEPENDENT-VC, VC-AGE, VC-SIZE, DOWNSIDE, BOARD, SYNDICATE-LEADER, SYNDICATE-FOLLOWER, COMPANY-AGE, STAGE dummies, and DEAL-YEAR dummies. In all regressions, INDUSTRY CONTROLS are included but not reported. Variables are defined in Table 2. For each independent variable, we report the estimated coefficient and the *t*-ratio (in parenthesis), computed using (Huber-White) heteroskedasticity-robust standard errors, clustered by venture firm. Values significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	Recruiting		Directors		Fundraising		Interaction	
Venture-Experience	−0.015	(*−0.20*)	−0.077	(*−0.29*)	−0.330	(*−1.35*)	0.100	(*0.24*)
Business-Experience	1.059***	(*4.39*)	0.916***	(*3.74*)	1.191***	(*4.28*)	0.673**	(*1.98*)
Science-Education	0.340	(*1.05*)	−0.094	(*−0.26*)	−0.154	(*−0.46*)	−1.395***	(*−2.96*)
Independent-VC	0.562**	(*2.39*)	0.694***	(*2.80*)	0.494**	(*1.96*)	0.492	(*1.60*)
VC-Age	0.118	(*0.74*)	0.086	(*0.57*)	0.394**	(*2.43*)	−0.913***	(*−2.57*)
VC-Size	0.018	(*0.25*)	0.089	(*1.16*)	0.015	(*0.20*)	−0.077	(*−0.95*)
Downside	0.264	(*1.56*)	0.133	(*0.77*)	−0.196	(*−1.23*)	0.318	(*1.39*)
Board	0.863***	(*4.39*)	1.138***	(*5.22*)	0.655***	(*3.04*)	0.551**	(*2.38*)
Syndicate-Leader	0.069	(*0.41*)	0.001	(*0.00*)	0.128	(*0.64*)	0.047	(*0.21*)
Syndicate-Follower	−0.298*	(*−1.90*)	−0.336*	(*−1.84*)	−0.256	(*−1.47*)	−0.078	(*−0.43*)
Company-Age	0.031	(*0.83*)	−0.003	(*−0.09*)	−0.007	(*−0.19*)	−0.038	(*−1.10*)
Stage-Start-up	−0.456***	(*−2.65*)	−0.503**	(*−2.48*)	−0.480**	(*−2.53*)	0.570**	(*2.01*)
Stage-Expansion	−0.500***	(*−2.62*)	−0.395**	(*−1.98*)	−0.506***	(*−2.83*)	0.638**	(*2.02*)
Stage-Bridge	−0.164	(*−0.49*)	−0.005	(*−0.01*)	−0.431	(*−0.90*)	0.680	(*1.08*)
Deal-1999	−0.184	(*−1.27*)	0.174	(*0.71*)	0.147	(*0.89*)	−0.154	(*−0.92*)
Deal-2000	−0.296*	(*−1.93*)	−0.103	(*−0.46*)	−0.048	(*−0.35*)	−0.007	(*−0.05*)
Deal-2001	−0.267	(*−1.44*)	0.084	(*0.34*)	−0.164	(*−0.81*)	−0.231	(*−1.41*)
Industry-Controls	Yes		Yes		Yes		Yes	
Observations	*1,051*		*1,038*		*997*		*954*	
χ^2	*157.39*		*183.89*		*84.49*		*98.94*	
PseudoR^2	*0.241*		*0.269*		*0.189*		*0.234*	
Model p-value	*0.000*		*0.000*		*0.000*		*0.000*	

statistically significant results. Clustering implies the use of heteroskedasticity-robust standard errors.

Table 5 reports the results. The key insight is that human capital is an important driver of the activities performed by venture capitalists. The most important human capital factor is prior business experience, which is consistently positive and statistically significant for all activism variables. The effect also has a large economic impact. Having business experience increases the probability of an investor being active between 21% and 46%.

Venture experience has almost no effect, suggesting that job-specific learning is not a major determinant of the across-firms variation. Note that this does not imply that venture experience is unimportant per se. In Section 7, for example, we identify that venture experience plays an important role within venture capital firms.

Another interesting result is that science education has a negative and significant coefficient in the INTERACTION regression. A reasonable conjecture for this finding is as follows. Consider the trade-off between pre-investment screening activities and post-investment monitoring activities. The negative coefficient could be the result of a strategic trade-off, where venture capital firms with strong science partners pursue a strategy of focusing more on screening rather than monitoring activities.[8]

In terms of the organizational variables, the most important result is that being an independent venture capital firm (INDEPENDENT-VC) consistently has a positive and statistically significant effect. This effect is also economically large, with increases in the probability of investor activism ranging from 18% to 22%. Note that this constitutes a new result in the venture capital literature, which is also consistent with the recent findings of Masulis and Nahata (2007).

In addition we find that VC-SIZE typically has a statistically insignificant coefficient, suggesting that larger venture firms do not behave significantly different from smaller ones. VC-AGE matters mostly for fundraising, where the coefficient is positive and significant, and for the interaction variable, where it is negative. One possible interpretation is that older firms have more contacts with other venture capital firms, making them relatively more effective at fundraising (see Hochberg, Ljungqvist, and Lu, 2007). They might thus spend less time talking to the entrepreneurs, but more time talking about them to other investors.

In terms of contractual variables, the most important result is that BOARD consistently has a positive and

[8] While our data do not allow us to prove this conjecture directly, we provide two additional pieces of indirect evidence to support it. First, the within-firm analysis of Section 7 shows that partners with science backgrounds are less likely to be put in charge of monitoring portfolio companies. Second, industry observers typically argue that screening activities are more important in a market downturn than in a market upturn. Section 8 discusses a robustness check, where we found that the negative coefficient of science education is mainly driven by the "bust" years (2000 and 2001), suggesting that the negative coefficient might be related to a greater emphasis on screening activities.

statistically significant effect. This result is very intuitive, since board participation gives the investor a formal responsibility that might include some of the activities measured by our dependent variables. It also reinforces the point that the results that we obtain for the human capital variables concern real effects that go beyond an investor's formal role of sitting on the board of directors. Downside protection does not have a statistically significant effect. Given our previous theoretical discussion, this is not surprising. The LEADER variable is positive but always insignificant, implying that syndicate leaders have comparable level of activism to those of investors who invest by themselves. The FOLLOWER variable is consistently negative, and statistically so for the RECRUITING and DIRECTORS, thus suggesting that followers in a syndicate exhibit lower levels of activism. These results are consistent with theoretical models of syndication.

In terms of company controls, we find that company age is always insignificant. The stage controls, however, are important. Relative to the omitted category of seed investments, we find that start-up and late stage investments receive significantly lower level of investor activism. There are only 24 bridge financing deals, so that the coefficient estimates for this variable are not very consistent and are statistically weak. The year controls are almost always insignificant, the only exception being that compared to the base year of 1998, there was less recruiting in 2000.

5. Selection

A central concern in much of the corporate finance literature is to account for potential selection biases. In our context, the question is whether the observed positive correlation between business experience and investor activity, for example, might also be due to a "selection" effect where companies that desire more active investors are more likely to match with more experienced investors. If this results is non-random it is possible that the independent variables are correlated with the regression error term, leading to biased estimates. Li and Prabhala (2007) provide an overview of the most common remedies used in the corporate finance literature. To convince the reader that our results are robust to selection issues, we examine several methods, and look at whether they deliver consistent results.

5.1. Instrumental variables approach

The classical solution to the selection bias is based on instrumental variable (IV henceforth) regressions. Some recent examples in the corporate finance literature include Berger, Miller, Peterson, Rajan, and Stein (2005), Faulkender and Petersen (2005), and Hellmann, Lindsey, and Puri (2008).[9] In our case the appropriate instrumental variable must be independent of the outcome equation but should be related to the venture capitalists' business experience. A common choice of instruments is to use measures of the local availability of the selected characteristic—business experience in our context. Consider two different markets, one with many experienced investors, the other with few. A company's actual choice of investor may be endogenous, but the local availability of experienced investors is exogenous. Moreover, once a company is matched with its investor, the local availability of experienced investors becomes irrelevant, since all that matters is the experience of the investor who was actually chosen. Hence it is reasonable to use local availability of investor experience as an instrument for the selection equation.[10] This approach closely mirrors the analysis of Berger, Miller, Peterson, Rajan, and Stein (2005), who instrument an individual bank's size with the median size of banks in the local market.

We therefore estimate an IV Probit regression where the main regression is the same as in (1), except that BUSINESS-EXPERIENCE is now instrumented by LOCAL-BUSINESS-EXPERIENCE. This is defined as a fraction, where the denominator measures the number of deals in our data set that are made in the company's country, and where the numerator measures how many of these deals were made by a venture capital firm that has at least one partner with prior business experience. For this calculation we exclude the observation itself from both the numerator and denominator, so as not to use an observation as its own instrument.

Panel A of Table 6 shows the results. We note that accounting for potential endogeneity does not change the statistical significance of business experience. In fact, adding the selection equation hardly affects the main model at all. Interestingly, the estimates of the coefficient of correlation between the error term of the structural equation and the error term of the reduced form equation for the endogenous variable are not significantly different from zero, suggesting that selection does not interfere much with the outcome equations. The only exception is for the INTERACTION regression, where there is some evidence of selection. However, the effect of BUSINESS-EXPERIENCE still remains intact after controlling for selection. We also note that LOCAL-BUSINESS-EXPERIENCE is highly significant and has the expected positive sign, validating that it is a relevant instrument.

A strength of IV regressions is that they are relatively simple and widely used. A weakness is that they require a fairly narrow specification of how endogenous selection takes place. In particular, they assume that companies select investors based on a single characteristic, business

[9] The IV approach is closely related to the selection-treatment model of Heckman (1979), which in the corporate finance literature has been used, among others, by Baker and Hubbard (2003), Bris, Welch, and Zhu (2006), Campa and Kedia (2002), Hellmann and Puri (2002), and Villalonga and Amit (2006). In unreported regressions we verified that all of our IV results also hold in the Heckman selection-treatment model.

[10] As with any exclusion restriction, it is always possible to find some hypothetical reason why the outcome may still depend on the proposed instrument. In our case, one could conceive externalities where the experience of excluded investors still matters after the deal is done. However, there is no evidence or industry-held belief that such externalities exist, suggesting that the exclusion restriction is reasonable.

Table 6
Selection

This table reports results from our model of investor involvement (Eq. (1)). Dependent variables are RECRUITING, DIRECTORS, FUNDRAISING, and INTERACTION. Independent variables are VENTURE-EXPERIENCE, BUSINESS-EXPERIENCE, SCIENCE-EDUCATION, INDEPENDENT-VC, VC-AGE, VC-SIZE, DOWNSIDE, BOARD, SYNDICATE-LEADER, SYNDICATE-FOLLOWER, COMPANY-AGE, STAGE dummies, and DEAL-YEAR dummies. In all regressions, INDUSTRY CONTROLS are included but not reported. Variables are defined in Table 2. Panels A, B, and C report results from models described in Section 5: an the instrumental variable (IV) model, the Ackerberg-Botticini (A-B) model, and the Sørensen-Heckman (S-H) model. For each independent variable, we report the estimated coefficient and the *t*-ratio (in parenthesis), computed using (Huber-White) heteroskedasticity-robust standard errors, clustered by venture firm. Values significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	Recruiting		Directors		Fundraising		Interaction	
Panel A: IV Regressions								
Venture-Experience	−0.058	(*−0.22*)	−0.084	(*−0.31*)	−0.360	(*−1.46*)	0.141	(*0.46*)
Business-Experience	1.213*	(*1.86*)	1.164*	(*1.77*)	1.742**	(*2.35*)	2.739***	(*6.75*)
Science-Education	0.314	(*0.91*)	−0.133	(*−0.35*)	−0.244	(*−0.72*)	−1.612***	(*−3.94*)
Independent-VC	0.572**	(*2.39*)	0.710***	(*2.73*)	0.529**	(*2.04*)	0.319	(*1.35*)
VC-Age	0.134	(*0.74*)	0.108	(*0.67*)	0.459***	(*2.58*)	−0.199	(*−1.04*)
VC-Size	0.018	(*0.25*)	0.089	(*1.18*)	0.018	(*0.26*)	−0.045	(*−0.57*)
Downside	0.275	(*1.56*)	0.149	(*0.84*)	−0.149	(*−0.85*)	0.297	(*1.58*)
Board	0.849***	(*4.36*)	1.109***	(*4.65*)	0.597***	(*2.78*)	0.039	(*0.17*)
Syndicate-Leader	0.046	(*0.23*)	−0.036	(*−0.16*)	0.034	(*0.14*)	−0.140	(*−0.77*)
Syndicate-Follower	−0.315*	(*−1.83*)	−0.363*	(*−1.79*)	−0.320	(*−1.64*)	−0.184	(*−1.33*)
Company-Age	0.030	(*0.80*)	−0.005	(*−0.09*)	−0.010	(*−0.20*)	−0.038	(*−0.92*)
Stage-Start-up	−0.447**	(*−2.49*)	−0.488**	(*−2.34*)	−0.436**	(*−2.31*)	0.499**	(*2.17*)
Stage-Expansion	−0.484**	(*−2.42*)	−0.371*	(*−1.69*)	−0.432**	(*−2.18*)	0.541*	(*1.94*)
Stage-Bridge	−0.167	(*−0.50*)	−0.010	(*−0.02*)	−0.425	(*−0.87*)	0.175	(*0.35*)
Deal-1999	−0.174	(*−1.26*)	0.188	(*0.78*)	0.189	(*1.16*)	−0.012	(*−0.09*)
Deal-2000	−0.285*	(*−1.86*)	−0.087	(*−0.39*)	0.006	(*0.03*)	0.047	(*0.35*)
Deal-2001	−0.256	(*−1.40*)	0.100	(*0.41*)	−0.113	(*−0.57*)	−0.181	(*−1.18*)
Industry-Controls	Yes		Yes		Yes		Yes	
Identification in the selection equation								
Local-Business-Exp.	0.887***	(*4.91*)	0.889**	(*4.78*)	0.994***	(*4.59*)	0.706***	(*4.05*)
ρ	−0.051	(*−0.25*)	−0.082	(*−0.41*)	−0.195	(*−0.82*)	−0.969***	(*−3.45*)
Observations	*1,051*		*1,038*		*997*		*954*	
χ^2	*157.52*		*179.45*		*91.14*		*319.11*	
Model p-value	*0.000*		*0.000*		*0.000*		*0.000*	
Panel B: Ackerberg–Botticini Approach								
Venture-Experience	−0.142	(*−1.47*)	−0.032	(*−0.32*)	−0.071	(*−0.68*)	0.214**	(*2.34*)
Business-Experience	0.307***	(*3.45*)	0.226**	(*2.58*)	0.430***	(*3.75*)	0.132***	(*2.90*)
Science-Education	0.076	(*0.53*)	0.056	(*0.38*)	−0.055	(*−0.34*)	−0.313*	(*−1.71*)
Independent-VC	0.180**	(*2.01*)	0.190**	(*2.30*)	0.183**	(*1.98*)	0.172**	(*2.55*)
VC-Age	0.025	(*0.46*)	0.059	(*1.14*)	0.141**	(*2.04*)	−0.113**	(*−2.06*)
VC-Size	0.013	(*0.41*)	0.011	(*0.35*)	0.020	(*0.50*)	−0.004	(*−0.13*)
Downside	0.085	(*1.49*)	0.039	(*0.73*)	−0.060	(*−1.08*)	0.089	(*1.27*)
Board	0.255***	(*4.18*)	0.288***	(*4.76*)	0.213***	(*2.66*)	0.136*	(*1.82*)
Syndicate-Leader	0.018	(*0.34*)	0.190	(*0.31*)	0.31	(*0.56*)	−0.007	(*−0.12*)
Syndicate-Follower	−0.093**	(*−2.12*)	−0.092*	(*−1.84*)	−0.080	(*−1.28*)	−0.222	(*−0.37*)
Company-Age	0.007	(*0.69*)	−0.001	(*−0.07*)	0.001	(*0.02*)	−0.002	(*−0.22*)
Stage-Start-up	−0.129**	(*−2.31*)	−0.143**	(*−2.13*)	−0.170**	(*−2.59*)	0.134	(*1.27*)
Stage-Expansion	−0.122*	(*−1.93*)	−0.098	(*−1.39*)	−0.176**	(*−2.57*)	0.112	(*0.96*)
Stage-Bridge	−0.076	(*−0.63*)	−0.020	(*−0.14*)	−0.150	(*−0.80*)	0.145	(*0.94*)

Deal-1999	−0.043	(−1.15)	0.046	(0.75)	0.035	(0.72)	−0.070	(−1.37)
Deal-2000	−0.089**	(−2.15)	−0.026	(−0.48)	−0.015	(−0.23)	−0.012	(−0.28)
Deal-2001	−0.094*	(−1.92)	0.019	(0.32)	−0.048	(−0.72)	−0.055	(−1.22)
Industry-Controls	Yes		Yes		Yes		Yes	
Identification in the selection equation								
Country-Industry and Stage interactions	Yes		Yes		Yes		Yes	
Observations	*1,051*		*1,038*		*997*		*954*	
F-test	*11.52*		*9.17*		*5.93*		*7.62*	
R^2	*0.268*		*0.287*		*0.230*		*0.215*	
Model p-value	*0.000*		*0.000*		*0.000*		*0.000*	
Panel C: Sørensen–Heckman Approach								
Venture-Experience	−0.077	(−1.18)	−0.080	(−1.22)	−0.099	(−1.29)	0.089	(0.79)
Business-Experience	0.295***	(4.23)	0.239***	(3.54)	0.406***	(4.65)	0.174**	(2.17)
Science-Education	0.139	(1.38)	−0.005	(−0.05)	−0.059	(−0.51)	−0.326**	(−2.39)
Independent-VC	0.147**	(2.12)	0.184***	(2.67)	0.178**	(2.13)	0.136	(1.58)
VC-Age	0.076*	(1.76)	0.061	(1.52)	0.127***	(2.61)	−0.148**	(−2.54)
VC-Size	−0.004	(−0.20)	0.019	(0.90)	0.007	(0.29)	−0.022	(−0.94)
Downside	0.080	(1.59)	0.039	(0.79)	−0.057	(−1.12)	0.093	(1.38)
Board	0.270***	(4.54)	0.301***	(5.50)	0.213***	(3.11)	0.171**	(2.29)
Syndicate-Leader	0.030	(0.59)	0.012	(0.21)	0.054	(0.81)	0.006	(0.10)
Syndicate-Follower	−0.091**	(−2.08)	−0.093**	(−1.99)	−0.078	(−1.36)	−0.019	(−0.35)
Company-Age	0.011	(0.98)	−0.002	(−0.17)	−0.001	(−0.10)	−0.006	(−0.73)
Stage-Start-up	−0.140**	(−2.56)	−0.142**	(−2.54)	−0.160*	(−2.53)	0.162*	(1.67)
Stage-Expansion	−0.141**	(−2.45)	−0.096	(−1.51)	−0.159***	(−2.77)	0.152	(1.49)
Stage-Bridge	−0.048	(−0.41)	0.007	(0.05)	−0.143	(−0.78)	0.163	(1.1)
Deal-1999	−0.050	(−0.24)	0.046	(0.77)	0.040	(0.81)	−0.056	(−1.12)
Deal-2000	−0.091**	(−2.17)	−0.036	(−0.67)	−0.010	(−0.17)	−0.009	(−0.20)
Deal-2001	−0.098*	(−1.82)	0.005	(0.08)	−0.041	(−0.65)	−0.057	(−1.19)
Industry-Controls	Yes		Yes		Yes		Yes	
Identification in the selection equation								
Country-pair fixed effects	Yes		Yes		Yes		Yes	
ρ	0.208*	(1.93)	0.138	(1.06)	−0.129	(−0.84)	−0.186	(−0.77)
Observations	*1,038*		*1,051*		*997*		*954*	
Potential deals	*118,228*		*118,224*		*118,223*		*118,210*	

experience in our case. In reality, the process by which companies and investors are matched could be more complex, and involve several investor and company characteristics. We therefore consider two additional approaches that allow for a richer selection model.

5.2. Ackerberg and Botticini approach

In their seminal paper, Ackerberg and Botticini (2002) (A-B henceforth) propose an alternative method for identifying selection effects. They derive a richer identification strategy, where the selection of a principal (investor in our context) and of an agent (company in our context) depends on all their potentially relevant characteristics that may be unobserved, partially observed, or observed with error by the econometrician. Their approach involves estimation of a more general matching equation that describes how principals and agents are matched with each other, which takes into account multiple investor characteristics. A-B also argue that the distribution of local market characteristics is exogenous, and then use a broader set of geography-based instruments. Intuitively, the argument is that whether a particular company is matched with a particular investor depends not only on the local availability of investor types (e.g., availability of experienced investors), but also on the distribution of companies in that local market (e.g., number of companies seeking experienced investors). In this case the matching equation should differ across markets. A-B suggest using market fixed effects—which subsumes the previous approach of using local investor characteristics—as well as fixed effects for each type of company–market interaction.

Our data contain 17 domestic markets, 12 industries and four investment stages, resulting in a large number of interaction terms: $270 = 17 \times 12 - 1 + 17 \times 4 - 1$. We use all these to instrument our six investor characteristics (three human capital variables and three organizational variables, see Tables 2(b) and (c)). Ideally one would like to estimate an IV Probit, which is a non-linear regression model. However, given the large number of instruments and variables to be instrumented, it is not surprising that such a large non-linear system fails to achieve numerical convergence. We therefore examine the equivalent linear probability model.[11] Panel B of Table 6 reports the results. These are very similar to those of Panel A of Table 6, as well as those of the base model reported in Table 5. This is an important result, since the A-B model uses a much larger set of instruments and controls for potential selection effects on all six investor characteristics.

[11] This follows A-B, who demonstrate all their results with a linear probability model, and then show that the non-linear Probit model achieves the same results. In unreported regressions we also re-estimated the base model with a linear probability model. While the coefficient values of the linear model are not directly comparable to those of the non-linear model, we may still compare their statistical significance. Comparing thus the results with those of Table 5 reveals that the linear probability model generates very similar results to the Probit specification. Indeed, the significance levels of the main variables are almost identical in the two models. This reduces any concerns about using the linear probability model for the estimation of our matching models.

5.3. Sørensen-Heckman approach

Our final approach of estimating the selection equation is based on combining insights from the recent work of Sørensen (2007), and the Heckman (1979) sample selection model. We call this the Sørensen-Heckman (S-H henceforth) approach. Sørensen (2007) introduces an alternative perspective on the matching process between companies and investors. He exploits the characteristics of all agents in the market by considering not only the realized matches, but all potential matches, including unrealized ones. Specifically, he defines as the unit of observation the potential match between an individual company and an individual investor. He then estimates a selection model that explains which potential matches are actually formed. This methodology generalizes existing models by allowing for a richer interaction between the choices made by different agents. The matching model controls for the sorting and the selection of the observed investments to obtain unbiased estimates of the outcome equation. Because of assumptions specific to his context, Sørensen uses a Bayesian approach to estimate his system of equations. We prefer the classical approach of estimating a system of two equations. With the distinction between potential and realized matches, our data structure corresponds exactly to the sample selection model of Heckman (1979).

To implement the S-H model, we first construct the sample of all possible company-investor matches. After eliminating those potential matches where the company was raising money before the investor was in operation, as well as matches with missing information, we have 118,228 potential matches. For the selection equation, we build on the identification strategy of Sørensen, who argues that the distribution of companies and investors in the various markets is exogenous. We could characterize these exogenous market characteristics by simply including country fixed effects; since these contain any effects of local business experience, they already capture the identification strategy of the IV model. However, the S-H model allows for an even more powerful identification strategy, since it can account for the distribution of investors by using the joint distributions of the company's and investor's countries through country-pair fixed effects. To this purpose we define a dummy variable for each pair of company and investor country. In addition to these market characteristics, matching may also depend on company and investor characteristics themselves. We therefore include our six investor characteristics and three company characteristics (age, stage, and sector) in the selection equation. Panel C of Table 6 reports the results. Once again we find that accounting for selection does not change the significance of all the main explanatory variables. Given that the S-H model uses a very general structure to account for the matching process, this is an important finding. It confirms that our analysis of selection effects is not sensitive to the econometric details of how selection is being accounted for.

As a further robustness check, we consider our assumption of market segmentation. While the majority of deals are domestic, our data also include some companies that were financed by foreign investors. We therefore reran the S-H model, dropping all foreign deals, and find that all the main results continue to hold. Taken together, the results of Table 6 thus provide persuasive evidence that the main results of Table 5 are not driven by selection.[12]

6. Exit performance

The analysis so far focuses on the determinants of investor activism. This is an important question by itself, but it also ties into the bigger question of how activism affects performance outcomes. Prior work establishes that venture capital backed companies achieve superior performance (Hellmann and Puri, 2000, 2002), and proposes investor activism as a likely explanation. In this paper we measure investor activism directly. Therefore, we can ask to what extent greater activism is associated with better performance outcomes. This involves two research challenges: measurement and identification.

The first challenge is performance measurement. It is well known that venture capital firms are reluctant to disclose their returns and that there is no publicly available source of return data. The venture capital literature therefore relies on 'exits'—IPOs or acquisitions—as a measure of performance (Gompers and Lerner, 2000; Brander, Amit, and Antweiler, 2002). This is an imperfect measure of performance, to the extent that it doesn't account for investment costs or ownership stakes. However, the few studies that look at proprietary returns data (Cochrane, 2005; Kaplan and Schoar, 2005) confirm that most of the returns come from these exit events. The exits easiest to measure are IPOs. However, Brander, Egan, and Hellmann (2005) show, in the North American context, that IPOs constitute only 25% of exits by number (60% by value), the rest being acquisitions. The approach we adopt in this paper is to collect data on both IPOs and acquisitions. Our main dependent variable is EXIT, which takes the value 1 if a company goes public or is acquired; 0 otherwise.

The second research challenge is identification. Investor activism may not be random, and the analysis in Section 4 already identifies some determinants of activism. A simple regression of investor activism on exit performance may therefore fail to account for endogenous effects. In this context, endogeneity concerns reverse causality, whereby unobserved performance-related company characteristics induce investors to become more (or less) active. For example, the company may face operational problems, unobservable to the econometrician, that decrease company performance. These problems may also trigger more investor activism, because the company needs more help from investors. We control for such effects by estimating the following system of two equations that determines both investor activism and exit performance:

$$\begin{aligned} Y_c &= \alpha_Y + H_i\beta_H + R_i\beta_R + N_c\beta_N + X_c\beta_X + \varepsilon_c, \\ E_c &= \alpha_E + Y_c\gamma_c + N_c\gamma_N + X_c\gamma_X + \eta_c, \end{aligned} \tag{2}$$

where variables are defined as in Section 4, and E_c measures the exit performance (EXIT) for company c. The important assumption is that the error terms ε_c and η_c may be correlated, due to unobservable firm characteristics such as the operational problems in the example above. As before, we cluster standard errors by venture capital firm.

The main variable of interest for the performance equation is investor activism. The performance equation also includes the contractual and company characteristics, recognizing that companies in different industries or different stages may have different success probabilities. The equation for investor activism is the same as Eq. (1). The key identification assumption is that investor characteristics affect activism, but not performance. This follows from the literature on investor activism, which argues that company managers determine performance, but that investors contribute *through* their monitoring, support, and control activities (Becht, Bolton, and Röell, 2003). The effect of investors on performance is thus an indirect effect that goes through their activities. This indirect effect is precisely what is captured by the above system of equations.

Panel A of Table 7 reports the results of a simple Probit regression for exit performance. All our measures of activism are insignificant. This may be due to the fact that the simple regression model cannot account for issues of reverse causality.

Panel B of Table 7 estimates the system of the two equations specified in (2), using an IV Probit model. The results confirm that controlling for endogeneity is important. We find that investor activism has a positive and significant effect on exit performance in three out of four models. In these models the estimate of ρ, which measures the correlation of the error terms across the two equations, is negative and significant. This means that there is negative reverse causality, i.e., investor activism occurs more frequently with companies that have performance challenges. However, once we control for this, we find that investor activism has a positive effect on performance. These results apply to the RECRUITMENT, DIRECTORS, and FUNDRAISING variables. The exception is INTERACTION, where the effect on performance remains statistically insignificant even after controlling for endogeneity. We interpret this result as saying that communication by itself does not increase performance. Such improvements arise only from activities where investors actually garner additional resources (managers, board members, financing) for the company.

Panels A and B of Table 7 focus on the system of two equations (2) for investor activism and exit performance.

[12] In unreported regressions we also consider an additional permutation of the selection equation for the S-H model, which mimics the identification strategy of the A-B model. In the selection equation we include company-level, country-industry, and country-stage interactions. The results of this specification are very similar to those reported in Panel C of Table 6, confirming that the results are robust to various ways of specifying the selection equation.

Table 7
Exit

This table reports results from model of exit (Eq. (2)). The dependent variable is EXIT. In each column of the exit equation the independent variables are one measure of investor activism (RECRUITING, DIRECTORS, FUNDRAISING, and INTERACTION, respectively), DOWNSIDE, BOARD, SYNDICATE-LEADER, SYNDICATE-FOLLOWER, COMPANY-AGE, STAGE dummies, and DEAL-YEAR dummies. In the selection equations independent variables are VENTURE-EXPERIENCE, BUSINESS-EXPERIENCE, SCIENCE-EDUCATION, INDEPENDENT-VC, VC-AGE, VC-SIZE, DOWNSIDE, BOARD, SYNDICATE-LEADER, SYNDICATE-FOLLOWER, COMPANY-AGE, STAGE dummies, and DEAL-YEAR dummies. In all regressions, INDUSTRY CONTROLS are included but not reported. Variables are defined in Table 2. Panel A reports estimates from the Probit model, Panel B reports estimates from the IV model, and Panel C reports estimates the IV-cum-Mills model discussed in Section 6. For each independent variable, we report the estimated coefficient and the *t*-ratio (in parenthesis), computed using (Huber-White) heteroskedasticity-robust standard errors, clustered by venture firm. Values significant at the 1%, 5%, and 10% level are identified by ***, **, *.

Panel A: Probit regressions								
Exit equation								
RECRUITING	−0.056	(*−0.44*)						
DIRECTORS			0.116	(*1.00*)				
FUNDRAISING					0.192	(*1.61*)		
INTERACTION							−0.102	(*−0.86*)
Downside	−0.140	(*−1.30*)	−0.155	(*−1.39*)	−0.127	(*−1.09*)	−0.191*	(*−1.71*)
Board	0.377***	(*2.70*)	0.298**	(*2.32*)	0.251*	(*1.91*)	0.268**	(*2.20*)
Syndicate-Leader	0.046	(*0.30*)	0.029	(*0.19*)	0.001	(*0.01*)	0.113	(*0.73*)
Syndicate-Follower	0.065	(0.40)	0.039	(*0.24*)	0.095	(*0.54*)	0.067	(*0.44*)
Company-Age	0.044	(*1.64*)	0.044	(*1.62*)	0.056**	(*2.01*)	0.028	(*0.93*)
Stage-Start-up	−0.034	(*−0.26*)	0.028	(*0.23*)	−0.028	(*−0.22*)	−0.005	(*−0.04*)
Stage-Expansion	0.379**	(*2.41*)	0.415**	(*2.71*)	0.398*	(*2.48*)	0.390**	(*2.30*)
Stage-Bridge	0.780**	(*1.97*)	0.806***	(*2.03*)	0.686*	(*1.70*)	0.763*	(*1.87*)
Deal-1999	−0.168	(*−1.31*)	−0.162	(*−1.24*)	−0.148	(*−1.12*)	−0.107	(*−0.79*)
Deal-2000	−0.104	(*−0.78*)	−0.105	(*−0.79*)	−0.066	(*−0.47*)	−0.057	(*−0.39*)
Deal-2001	−0.435***	(*−2.84*)	−0.431***	(*−2.72*)	−0.420**	(*−2.49*)	−0.412**	(*−2.55*)
Industry-Controls	Yes		Yes		Yes		Yes	
Observations	*1,159*		*1,046*		*1,005*		*962*	
χ^2	*125.80*		*120.40*		*130.29*		*133.77*	
Model p-value	*0.000*		*0.000*		*0.000*		*0.000*	
Panel B: IV model								
Exit equation								
RECRUITING	0.912**	(*2.42*)						
DIRECTORS			1.170***	(*2.62*)				
FUNDRAISING					0.713**	(2.32)		
INTERACTION							0.261	(*0.55*)
Downside	0.234**	(*1.96*)	−0.217*	(*−1.85*)	−0.094	(*−0.80*)	−0.213*	(*−1.80*)
Board	0.017	(*0.08*)	−0.112	(*−0.46*)	0.115	(*0.63*)	0.156	(*0.94*)
Syndicate-Leader	−0.023	(*−0.15*)	−0.022	(*−0.14*)	−0.044	(*−0.24*)	0.132	(*0.87*)
Syndicate-Follower	0.113	(*0.67*)	0.108	(*0.66*)	0.111	(*0.60*)	0.081	(*0.49*)
Company-Age	0.028	(*1.00*)	0.040	(*1.54*)	0.056*	(*1.94*)	0.037	(*1.18*)
Stage-Start-up	0.134	(*0.94*)	0.196	(*1.40*)	0.071	(*0.52*)	−0.062	(*−0.39*)
Stage-Expansion	0.520***	(*3.63*)	0.496***	(*3.82*)	0.491***	(*3.16*)	0.337*	(*1.76*)
Stage-Bridge	0.808*	(*1.92*)	0.746*	(*1.91*)	0.763**	(*2.12*)	0.648**	(*1.60*)
Deal-1999	−0.082	(*−0.61*)	−0.168	(*−1.21*)	−0.139	(*−1.06*)	−0.088	(*−0.65*)

Deal-2000	0.006	(*0.04*)	−0.037	(*−0.25*)	−0.021	(*−0.15*)	−0.074	(*−0.51*)
Deal-2001	−0.276	(*−1.55*)	−0.355*	(*−1.90*)	−0.324*	(*−1.77*)	−0.391**	(*−2.41*)
Industry-Controls	Yes		Yes		Yes		Yes	
Selection equation								
Venture-Experience	−0.063	(*−0.98*)	−0.073	(*−1.15*)	−0.127*	(*−1.80*)	0.052	(*0.51*)
Business-Experience	0.307***	(*4.51*)	0.247***	(*3.42*)	0.396***	(*4.60*)	0.172*	(*1.99*)
Science-Education	0.112	(*1.23*)	−0.012	(*−0.12*)	−0.048	(*−0.43*)	−0.309**	(*−2.47*)
Independent-VC	0.166***	(*2.57*)	0.090***	(*2.70*)	0.169**	(*2.12*)	0.131	(*1.50*)
VC-Age	0.058**	(*1.41*)	0.047**	(*1.20*)	0.130***	(*2.75*)	−0.126**	(*−2.43*)
VC-Size	0.009	(*0.44*)	0.028	(*1.39*)	0.006	(*0.28*)	−0.025	(*−0.96*)
Downside	0.086*	(*1.64*)	0.044	(*0.87*)	−0.062	(*−1.23*)	0.088	(*1.29*)
Board	0.263***	(*4.59*)	0.297***	(*5.52*)	0.214***	(*4.15*)	0.176**	(*2.39*)
Syndicate-Leader	0.025	(*0.46*)	0.009	(*0.15*)	0.050	(*0.76*)	0.002	(*0.03*)
Syndicate-Follower	−0.092**	(*−2.09*)	−0.094**	(*−2.00*)	−0.078	(*−1.36*)	−0.021	(*−0.37*)
Company-Age	0.101	(*0.91*)	−0.002	(*−0.24*)	−0.002	(*−0.15*)	−0.007	(*−0.79*)
Stage-Start-up	−0.142***	(*−2.60*)	−0.143*	(*−217*)	−0.160**	(*−2.54*)	0.164*	(*1.72*)
Stage-Expansion	−0.143**	(*−2.49*)	−0.097	(*−1.51*)	−0.158***	(*−2.68*)	0.159	(*1.56*)
Stage-Bridge	−0.060	(*−0.52*)	−0.001	(*−0.01*)	−0.144	(*−0.80*)	0.170	(*1.16*)
Deal-1999	−0.047	(*−1.18*)	0.048	(*0.78*)	0.038	(*0.77*)	−0.056	(*−1.11*)
Deal-2000	−0.077*	(*−1.82*)	−0.029	(*−0.52*)	−0.021	(*−0.36*)	−0.017	(*−0.39*)
Deal-2001	−0.077	(*−1.50*)	0.016	(*0.27*)	−0.058	(*−0.94*)	−0.071	(*−1.42*)
Industry-Controls	Yes		Yes		Yes		Yes	
ρ	−0.465**	(*−2.36*)	−0.492**	(*−1.99*)	−0.259*	(*−1.78*)	−0.166	(*−0.85*)
Observations	*1,051*		*1,038*		*997*		*954*	
χ^2	*150.09*		*180.68*		*117.79*		*136.76*	
Model p-value	*0.000*		*0.000*		*0.000*		*0.000*	
Panel C: IV-cum-Mills Model								
Exit equation								
RECRUITING	0.909**	(*2.38*)						
DIRECTORS			1.182***	(*2.61*)				
FUNDRAISING					0.695**	(*2.20*)		
INTERACTION							0.209	(*0.47*)
Downside	−0.232*	(*−1.94*)	−0.215*	(*−1.82*)	−0.105	(*−0.88*)	−0.221*	(*−1.87*)
Board	0.018	(*0.08*)	−0.117	(*−0.47*)	0.115	(*0.62*)	0.167	(*1.06*)
Syndicate-Leader	−0.024	(*−0.15*)	−0.022	(*−0.15*)	−0.052	(*−0.29*)	0.126	(*0.81*)
Syndicate-Follower	0.110	(*0.66*)	0.108	(*0.66*)	0.109	(*0.59*)	0.078	(*0.47*)
Company-Age	0.028	(*0.98*)	0.040	(*1.49*)	0.158**	(*2.01*)	0.037	(*1.20*)
Stage-Start-up	0.132	(*0.95*)	0.198	(*1.41*)	0.052	(*0.38*)	−0.060	(*−0.38*)
Stage-Expansion	0.517***	(*3.60*)	0.495***	(*3.85*)	0.472***	(*3.00*)	0.338*	(*1.80*)
Stage-Bridge	0.806*	(*1.92*)	0.745*	(*1.92*)	0.741**	(*2.01*)	0.650	(*1.59*)
Deal-1999	−0.081	(*−0.61*)	−0.167	(*−1.21*)	−0.143	(*−1.10*)	−0.097	(*−0.72*)
Deal-2000	0.006	(*0.04*)	−0.030	(*−0.20*)	−0.046	(*−0.33*)	−0.096	(*−0.65*)
Deal-2001	−0.275	(*−1.49*)	−0.345*	(*−1.78*)	−0.361**	(*−1.98*)	−0.424***	(*−2.58*)
Inverse Mills ratio	−0.004	(*−0.04*)	−0.026	(*−0.26*)	0.107	(*1.09*)	0.095	(*1.00*)

Table 7. (*continued*)

Industry-Controls	Yes		Yes		Yes		Yes	
Selection equation								
Venture-Experience	−0.079	(*−1.57*)	−0.087	(*−1.43*)	−0.113	(*−1.59*)	0.065	(*0.62*)
Business-Experience	0.270***	(*4.72*)	0.241***	(*3.38*)	0.403***	(*4.68*)	0.173**	(*2.02*)
Science-Education	0.127	(*1.39*)	−0.004	(*−0.04*)	−0.052	(*−0.47*)	−0.314**	(*−2.48*)
Independent-VC	0.152**	(*2.40*)	0.181***	(*2.66*)	0.176**	(*2.20*)	0.140	(*1.66*)
VC-Age	0.069	(*1.70*)	0.055	(*1.38*)	0.124**	(*2.60*)	−0.144**	(*−2.49*)
VC-Size	0.002	(*0.10*)	0.025	(*1.26*)	0.008	(*0.39*)	−0.022	(*−0.94*)
Downside	0.079	(*1.57*)	0.039	(*0.78*)	−0.057	(*−1.14*)	0.093	(*1.38*)
Board	0.270***	(*4.72*)	0.302***	(*5.62*)	0.211***	(*3.10*)	0.173**	(*2.34*)
Syndicate-Leader	0.024	(*0.46*)	0.008	(*0.14*)	0.053	(*0.78*)	0.004	(*0.06*)
Syndicate-Follower	−0.093**	(*−2.09*)	−0.094**	(*−2.02*)	−0.079	(*−1.38*)	−0.194	(*0.35*)
Company-Age	0.010	(*0.94*)	−0.002	(*−0.22*)	−0.002	(*−0.17*)	−0.007	(*−0.81*)
Stage-Start-up	−0.142***	(*−2.63*)	−0.142**	(*−2.18*)	−0.160**	(*−2.53*)	0.164*	(*1.74*)
Stage-Expansion	−0.143**	(*−2.50*)	−0.096	(*−1.51*)	−0.158***	(*−2.69*)	0.159	(*1.57*)
Stage-Bridge	−0.059	(*−0.51*)	−0.001	(*−0.01*)	−0.144	(*−0.80*)	0.171	(*1.18*)
Deal-1999	−0.048	(*−1.24*)	0.046	(*0.76*)	0.039	(*0.79*)	−0.055	(*−1.10*)
Deal-2000	−0.089**	(*−2.26*)	−0.039	(*−0.72*)	−0.011	(−0.19)	−0.006	(*−0.15*)
Deal-2001	−0.093*	(*−1.79*)	0.003	(*0.04*)	−0.043	(−0.70)	−0.056	(*−1.23*)
Inverse Mills ratio	0.067	(*1.55*)	0.055	(*1.22*)	−0.054	(−1.04)	−0.052	(*−0.86*)
Industry-Controls	Yes		Yes		Yes		Yes	
ρ	−0.465**	(−2.36)	−0.499**	(−1.99)	−0.248	(−1.49)	−0.141	(−0.78)
Observations	*1,051*		*1,038*		*997*		*954*	
χ^2	*152.30*		*184.08*		*125.46*		*163.58*	
Model p-value	*0.000*		*0.000*		*0.000*		*0.000*	

In Section 5, we also considered the possibility of selection effects for how investors and companies are matched in the first place. While we did not find strong evidence for such selection effects, we may still want to examine whether the results for the relationship between activism and exit might be affected by any such selection effects. The estimation of models with both selection effects and systems of endogenous equations poses some econometric challenges. Woodridge (2002) discusses these challenges and suggests the following procedure (see page 568). In a first step, use a selection equation to estimate an inverse Mills ratio. This is the standard measure of selection bias in Heckman-type selection models. In the second step, include the estimated inverse Mills ratio as an independent variable into all of the equations of the endogenous system. Woodridge then explains that the null hypothesis of no selection effects can be tested using standard *t*-tests for the coefficients of the inverse Mills ratio.

We implement this approach as follows. Of the three selection models in Section 5, the S-H model is the only one to have the appropriate binary structure for the selection equation. It also contains a very comprehensive specification of a selection equation. Thus, we use the S-H model to estimate the inverse Mills ratio. We then include this estimate into both equations of (2). Panel C of Table 7 reports the results from this approach, which we call the 'IV–cum–Mills' approach.

Comparing Panels B and C we immediately note that most coefficients are very similar. This suggests that the inclusion of selection effects does not appear to interfere with the basic relationship between activism and exit performance. Next, we note that the Mills ratios are always insignificant in both the exit and the activism equations. Thus, for all the regression models, we cannot reject the null hypothesis of no selection effects.

We subject these findings to a series of robustness checks. We start by considering a narrower measure of performance, based only on IPOs, but excluding acquisitions. In unreported regressions we reran the analysis of Table 7 with IPOs as the dependent variable, and found that our results for activism are not affected. We then verify that the results of Panel A are not due to the simple Probit structure, and examine two alternative specifications. First, we consider a Cox duration model to measure time-to-exit. We find that recruiting managers, hiring directors, and helping with fundraising all have an insignificant effect on time-to-exit, while the interaction variable comes out negative and significant. This last result is consistent with venture capitalists spending more time with companies that are not on a clear path to a fast exit. Second, we consider an alternative specification based on propensity scores. This approach has been used in the corporate finance literature by Bottazzi and Da Rin (2002), Drucker and Puri (2006), and Villalonga (2004). As emphasized by Li and Prabhala (2007), this provides a richer way of controlling for observable characteristics, although it does not account for correlation with unobservables. In unreported regressions we found that the propensity scoring method yields very similar results to the simple Probit model.

Concerning the interpretation of our main result, one may ask the following question. If the structure of venture capital firms affects activism and ultimately company performance, what prevents these firms from always adopting the most successful structure? For example, why doesn't every venture capital firm simply hire some partners with prior business experience? It is important to note that our analysis does not invite such a conclusion. Our results do not imply that anybody with prior business experience would make a good venture capitalist. They only show that people who become venture capitalists and had prior business experience are more active investors, which in turn improves company performance. These results can be interpreted as an equilibrium outcome of an economy where there is a limited supply of talented venture capitalists with prior business experience.

7. Within-firm analysis

7.1. Which partners are most active?

Our results so far show the importance of human capital for investor activism *across* venture capital firms. But does human capital also play a role *within* venture capital firms? Our data allow us to push the analysis one step further in this direction. In our survey, we gathered additional data on which partner(s) is in charge of which company, obtaining information for about 80% of our observations. There are two issues we explore with these data.

The first issue is how human capital affects variation in activism within the same firm. This is a different question than what we asked before. In Section 4 we were concerned with how differences in the average human capital profiles affected activism across firms. In this section we deliberately ignore all differences across firms, and focus only on within-firm variation, asking whether human capital can explain differences in the level of activism a company receives, compared to other companies financed by the same venture firm. Therefore, the within-firm analysis does not replicate the across-firms analysis, but adds some additional insights.

For the estimation of within-firm effects, we use the following conditional logit model:

$$Y_c = \alpha + H_{ci}\beta_H + N_c\beta_N + X_c\beta_X + FE_i\beta_F + \varepsilon_c, \quad (3)$$

where the variables are the same as in Eq. (1), with two differences. First, we now have a different measure of human capital. H_{ci} is the vector of human capital measures for the partner(s) at firm i in charge of company c (PIC-VENTURE-EXPERIENCE, PIC-BUSINESS-EXPERIENCE, and PIC-SCIENCE-EDUCATION). This differs from our main measure of human capital (H_i in (1)),which is the average across all partners of a venture firm.[13] Second, the vector

[13] We obtain the necessary data from an additional question in our survey, which asked (for each company): *Which partner(s)/senior manager(s) has/had responsibility for monitoring this company?* While typically a single partner is put in charge of a deal, in 15% of the cases more than one partner is put in charge.

or investor characteristics R_i is now superseded by FE_i, a vector of investor fixed effects.

Table 8 reports the results from the conditional logit model. Note that all the observations where there is no within-firm variation are dropped, explaining the lower number of observations. Once again we find that human capital matters: venture experience has a positive and significant effect on all the activism variables. This result reveals that, within firms, venture experience affects the level of activism of the individual partners. However, this effect seems to apply across all venture firms, so that we could not pick it up in the across-firms analysis. The within-firms analysis therefore complements the across-firms approach.[14] Another interesting result is that business experience is no longer significant at the within-firms level. One possible interpretation of this result is that business experience is relatively easily shared among partners in a firm, and therefore does not matter in the within-firm regressions.

7.2. Which partners get put in charge?

The second issue we explore is which partner gets put in charge when a firm makes an investment in a company. Being put in charge gives a partner the primary responsibility for interfacing with the firm. Theoretical models suggest that managers with more skills are given more responsibility (Rosen, 1982; Garicano, 2000). We then ask whether human capital matters for the allocation of tasks within venture capital firms.

Examining this requires a different data construction. Our unit of observation now becomes the potential match between a partner in a venture firm and a company financed by that firm. A match is realized if the specific partner is put in charge of the specific company, and unrealized otherwise. Note that these potential matches between a firm's individual venture partners and its portfolio companies are entirely different from the potential matches we considered in Section 5, which were between all companies and all venture capital firms. Our dependent variable is IN-CHARGE, which takes the value 1 if there is a realized match; 0 otherwise. The independent variables are the same as before, except that human capital is now measured at the individual partner level, whether or not put in charge of a company. We denote these individual-partner-level variables with IP-VENTURE-EXPERIENCE, IP-BUSINESS-EXPERIENCE, and IP-SCIENCE-EDUCATION. Since for every company there are several potential partners, the number of observations increases, relative to the base data set.

To obtain our estimates we use the following conditional logit model:

$$I_p = \alpha + H_p\beta_H + N_c\beta_N + X_c\beta_X + FE_i\beta_F + \varepsilon_p. \quad (4)$$

The index p indicates that a variable varies at the level of the individual venture partner. I_p is the dependent variable (IN-CHARGE), which measures whether or not partner p has been put in charge of company c. H_p is the vector of human capital measures for each individual partner p. The remaining variables are as before.

Table 9 reports the results. Once again, we find that human capital matters. Partners with prior business experience are significantly more likely to be put in charge of an investment. In addition, we find that venture experience also has a positive and statistically significant effect on task-allocation: the longer a partner's experience in venture capital, the more likely that s/he will be put in charge of an investment. The effect of a science education is negative and statistically insignificant. These results complement our previous analysis, showing yet another facet of how human capital affects investor activities.[15]

8. Extensions and robustness checks

A growing literature focuses on the characteristics of corporate (Gompers and Lerner, 2000) and bank-related venture capital firms (Hellmann, Lindsey, and Puri, 2008). So far we have distinguished between independent and so-called 'captive' funds. We now look at what additional insights can be gained by differentiating among the three types of captive venture funds, namely corporate, bank, and public venture funds. Panel A of Table 10 provides separate univariate tests for each of the three captive types, the comparison category being independent venture funds. Banks provide lower levels of activism, with the difference being significant except for fundraising. Corporates also provide lower levels of activism, but the difference is significant only for fundraising. Public venture firms provide lower levels of activism, but the differences are not significant, which may be due to the low number of observations in this category. In terms of exits, we notice no significant differences, except that public venture firms are associated with considerably fewer exits. An unreported Kruskal-Wallis test of the difference of median confirms that the three types of captive firms differ (at 5%) for all variables except fundraising. In terms of other firm characteristics we notice that bank firms tend to be larger. Curiously, none of the public venture firms have partners with science education.

We then ran additional regressions breaking out the captive types in the model of Table 5. We use the independent venture firms as the omitted category and estimate separate coefficients for the three captive types. Panel B shows the results in abbreviated format, focusing only on the three coefficients of interest. The other coefficients not reported in Panel B of Table 10 are very similar to those of Table 5. As expected, all the coefficients of the captives are negative or else insignificant. Banks are less active in hiring directors. Corporate venture firms do the same, and also get less involved with recruiting management. Public venture firms have fewer interactions with the entrepreneurs.

[14] One caveat is that when we estimate the models of Table 8 as linear probability regressions with fixed effects, we find that venture experience continues to be significant in the fundraising and interaction regressions, but becomes insignificant in the recruiting and directors regressions.

[15] We also estimated the models of Table 9 as linear probability regressions with fixed effects, and found analogous results.

Table 8
Within-firm involvement (conditional logit)

This table reports results from a conditional logit model (Eq. (2)). The dependent variables are DIRECTORS, RECRUITING, FUNDRAISING, and INTERACTION. The dependent variables are PIC-VENTURE-EXPERIENCE, PIC-BUSINESS-EXPERIENCE, PIC-SCIENCE-EDUCATION, DOWNSIDE, BOARD, SYNDICATE-LEADER, SYNDICATE-FOLLOWER, COMPANY-AGE, STAGE dummies, and DEAL-YEAR dummies. In all regressions, INDUSTRY CONTROLS are included but not reported. Variables are defined in Table 2. For each independent variable, we report the estimated coefficient and the *t*-ratio (in parenthesis), computed using (Huber-White) heteroskedasticity-robust standard errors, clustered by venture firm. Values significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	Recruiting		Directors		Fundraising		Interaction	
PIC-Venture-Experience	0.620*	(1.71)	0.721*	(1.94)	0.831**	(2.48)	1.435***	(3.01)
PIC-Business-Experience	−0.234	(−0.51)	−0.805	(−1.39)	0.002	(0.01)	−0.611	(−1.04)
PIC-Science-Education	0.178	(0.51)	0.165	(0.41)	0.215	(0.60)	−1.115	(−0.21)
Downside	1.037***	(3.23)	0.732**	(2.01)	0.551*	(1.83)	1.354***	(3.23)
Board	2.311***	(5.89)	2.880***	(5.62)	1.371***	(4.39)	2.447***	(5.74)
Syndicate-Leader	0.147	(0.44)	0.228	(0.63)	0.580∗	(1.65)	0.845	(1.45)
Syndicate-Follower	−0.531	(−1.57)	−0.159	(−0.44)	−0.458	(−1.47)	0.089	(0.22)
Company-Age	0.114	(1.34)	0.122	(1.27)	−0.056	(−0.69)	−0.125	(−1.07)
Stage-Start-up	−0.028	(−0.08)	−0.421	(−1.07)	−0.281	(−0.89)	0.783**	(1.78)
Stage-Expansion	−0.295	(−0.70)	−0.781*	(−1.65)	−0.431	(−1.08)	0.763	(1.49)
Stage-Bridge	0.065	(1.05)	0.352	(0.36)	−0.696	(−0.82)	0.089	(0.06)
Deal-1999	−0.077	(−0.18)	0.991*	(2.02)	0.393	(1.01)	−0.167	(−0.32)
Deal-2000	−0.782*	(−1.92)	−0.084	(−0.18)	−0.378	(−1.01)	0.225	(0.43)
Deal-2001	−0.973	(−2.22)	−0.311	(−0.61)	−0.900**	(−2.13)	0026	(0.05)
Industry-Controls	Yes		Yes		Yes		Yes	
Observations	*659*		*536*		*622*		*421*	
χ^2	*100.468*		*88.54*		*80.88*		*114.30*	
PseudoR^2	*0.196*		*0.211*		*0.158*		*0.315*	
Model p-value	*0.000*		*0.000*		*0.000*		*0.000*	

Table 9
Within-firm task allocation

This table reports results from Probit regressions (Eq. (3)). The dependent variable is IN-CHARGE. The independent variables are IP-VENTURE-EXPERIENCE, IP-BUSINESS-EXPERIENCE, IP-SCIENCE-EDUCATION, DOWNSIDE, BOARD, SYNDICATE-LEADER, SYNDICATE-FOLLOWER, COMPANY-AGE, STAGE dummies, and DEAL–YEAR dummies. In all regressions, INDUSTRY CONTROLS are included but not reported. Variables are defined in Table 2. Columns (i) and (ii) report the estimated coefficients for two different specifications, and the *t*-ratio (in parenthesis), computed using (Huber-White) heteroskedasticity-robust standard errors, clustered by venture firm. Values significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	(*i*)		(*i*)	
IP-Venture-Experience	0.044***	(5.32)	0.052***	(5.37)
IP-Business-Experience	0.258***	(2.30)	0.346***	(2.76)
IP-Science-Education	−0.181*	(−1.70)	−0.207*	(−1.76)
Downside			−0.064	(−0.50)
Board			−0.009	(−0.07)
Syndicate-Leader			−0.047	(−0.32)
Syndicate-Follower			−0.022	(−0.16)
Company-Age	0.012	(0.39)	0.012	(0.34)
Stage-Start-up	−0.124	(−0.80)	−0.134	(−0.7)
Stage-Expansion	−0.129	(−0.71)	−0.146	(−0.72)
Stage-Bridge	−0.092	(−0.23)	−0.098	(0.72)
Deal-1999	−0.075	(−0.44)	−0.064	(−0.32)
Deal-2000	−0.048	(−0.30)	−0.021	(−0.11)
Deal-2001	−0.029	(−0.17)	−0.016	(−0.08)
Industry-Controls	Yes		Yes	
Observations	*4,056*		*3,372*	
χ^2	*37.65*		*40.02*	
Pseudo R^2	*0.010*		*0.013*	
Model p-value	*0.014*		*0.029*	

Hellmann and Puri (2002) note that when venture capitalists support the professionalization of their companies, they are not only concerned with recruiting chief executive officers (CEOs), but also become involved more deeply with building an entire management team. Our survey therefore asked additional details about the role of venture capitalists in recruiting for specific positions within the company, namely Chief Executive Officer (CEO), Chief Financial Officer (CFO), Vice President of marketing (VP) and Head of Research and Development (R&D). In unreported Probit regressions we find that our results on human capital continue to hold for all of these management positions, suggesting that the role of venture capital activism goes deep into the organization of portfolio companies.

A central finding of this paper is that prior business experience is important for investor activism. The other main types of experience held by venture partners in our data set are finance and accounting. We can thus ask whether this alternative experience also matters for investor activism. In unreported regressions we add the venture firm's prior experience in finance and accounting. We find that this variable is never significant, nor does it alter the importance of business experience.

We examined whether the importance of venture capital firm characteristics varied over the cycle. In unreported regressions we estimated each of the venture capital variables separately for the boom and bust periods (see, also, Section 4.1). Overall we find that cyclical effects do not have an important effect on the relationship between venture firm characteristics and investor

Table 10
Breaking out captive venture firms

This table presents univariate non-parametric tests for the difference of means of the dependent variables and venture firm characteristics, comparing the mean for INDEPENDENT-VC to that of CORPORATE-VC, BANK-VC, and PUBLIC-VC, respectively. Differences significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	Independent-VC	Corporate-VC	Bank-VC	Public-VC
Panel A: Univariate Comparisons				
Recruiting	0.555	0.374	0.358**	0.471
Directors	0.425	0.451	0.237**	0.367
Fundraising	0.551	0.338*	0.485	0.440
Interaction	0.855	0.752	0.716*	0.650
Exit	0.206	0.274	0.179	0.044**
Venture-Experience	1.994	1.746	1.840	1.777
Business-Experience	0.563	0.714	0.568	0.633
Science-Education	0.390	0.443	0.287	0.000***
VC-Age	3.959	3.404	3.761	4.354
VC-Size	3.790	3.708	4.656*	3.813

Panel B: Multivariate Regressions: This table reports results from Probit regressions for our base model of investor involvement (Eq. (1)), reported in Table 5, where we substitute INDEPENDENT-VC with CORPORATE-VC, BANK-VC, and PUBLIC-VC. For each of these three independent variables, we report the estimated coefficient and the *t*-ratio (in parenthesis), computed using (Huber-White) heteroskedasticity-robust standard errors, clustered by venture firm. Values significant at the 1%, 5%, and 10% level are identified by ***, **, *.

	Recruiting	Directors	Fundraising	Interaction
Corporate-VC	−1.240***	−0.698**	−0.401	−0.175
Bank-VC	−0.516	−0.850**	−0.566	−0.508
Public-VC	0.245	−0.097	−0.404	−1.366**

activism. The only variable that is affected by the cycle is INTERACTION. Science education is negative and significant for the bust but not the boom period; independent venture capital firms have a positive and significant effect for the bust but not for the boom period; and venture experience is positive and significant for the boom but not the bust period.

Theory suggests that the size of an investor's equity stake affects the incentives to be involved with a company. Unfortunately, investors consider the size of their stakes sensitive and confidential information, and we were unable to obtain any information on them. However, for about 60% of all companies, we have information on the amount that a venture firm invested in the company. We expect that investing larger amounts of money is correlated with larger ownership stakes. In unreported regressions we find that adding the natural logarithm of the amount invested to our regression does not change our basic results. The coefficient on the amount variable is itself positive and significant for the DIRECTORS and RECRUITING regressions.

Our data cover a total of 17 different countries. In a companion paper we investigate the importance of a country's legal system on venture capital investing (Bottazzi, Da Rin, and Hellmann, 2007). For this paper, we consider two simple extensions. We group countries by legal origin (LaPorta, Lopez-de-Silanes, Shleifer, Vishny, and 1998), using both a company's and an investor's legal system of origin. And we use individual country dummies. In all these regressions we find that our results for activism are not affected by these additional controls.

To construct our INTERACTION variable we pooled weekly and monthly communication, and we pooled quarterly and annual communication. To make full use of the information we have, and be sure that pooling has no effect on our results, we also estimate ordered Probit models with the disaggregated information, where the dependent variable is an ordered categorical variable for annual, quarterly, monthly, or weekly communication. We found that pooling did not affect any of our results.

In the construction of our DOWNSIDE measure we have used the information on the *entire set* of securities used to finance a deal. In our survey we also asked which security was the most important in the deal, i.e., we asked what the *main* security used was. We make use of this additional information and modify our downside measure to include only the main security used. Using this alternative measure, however, does not affect any of our results.

We already discussed that our sample is unusually large, and that it closely matches population characteristics. As with any other hand-collected data, and in spite of a major effort to fill as many gaps as possible, we still end up with some missing observations on some variables. To verify that our data do not suffer from sample selectivity bias we estimate a Heckman sample selection model, using the maximum likelihood approach. None of our regressions appear to be affected by this, suggesting that it is unlikely that our results are affected by sample selection problems.

As a further check on sample selectivity bias, we run our regressions on a sample restricted to those companies for which we have complete information. Using such a sample provides consistency across regressions, but discards potentially useful information. In any case, we find that our results continue to hold in this more restrictive sample.

9. Conclusion

In this paper we use a hand-collected sample of European venture capital deals to examine the determinants and consequences of investor activism. We find that prior business experience is an important predictor of an active investment style. Organizational structure also matters, especially whether a venture capital firm is structured as an independent entity. These results are remarkably robust across a wide variety of specifications, including models which account for endogenous matching of companies and investors. We also establish a positive relationship between investor activism and the success of portfolio companies, a finding which highlights the economic importance of human capital for financial intermediation. The analysis suggests avenues for future research. The financial intermediation literature focuses mostly on the effects of contracts and organization. Our results suggest that human capital considerations might be under-appreciated in this literature.

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