ELSEVIER

Journal of Economics and Business 60 (2008) 223–255

Journal of Economics & Business

Venture capital as human resource management

Antonio Gledson de Carvalho [a], Charles W. Calomiris [b,c,*], João Amaro de Matos [d]

[a] *Escola de Adminstração de Empresas de São Paulo, Fundação Getulio Vargas, Brazil*
[b] *Columbia Business School, United States*
[c] *National Bureau of Economic Research, United States*
[d] *Faculdade de Economia, Universidade Nova de Lisboa, Portugal*

Received 25 October 2005; received in revised form 10 January 2007; accepted 26 April 2007

Abstract

Venture capitalists actively participate in attracting, identifying, and suggesting managers for their portfolio companies through internal and external human resource networks. We collect and analyze survey data on the operation of this network. Theoretical and empirical analyses show that cross-sectional differences among portfolio companies should be, and are, associated with differences in the intensity with which venture capitalists network. Relevant factors include (1) the value of the information transmitted, (2) the riskiness of the activities of the portfolio companies, (3) the size of the venture capital fund, (4) the degree of difficulty in attracting executives, and (5) the reputation of the venture capitalist for successfully recycling managers.

JEL classification: G24; J41

Keywords: Capital; Human resources; Venture capitalist

1. Introduction

The crucial role of small businesses in creating jobs and spurring innovation gives special importance to the financing of growth companies. The central problem of financing small, growing businesses is to find a way for outsiders to supply equity profitably to entrepreneurs with limited

* Corresponding author. Fax: +1 212 316 9180.
E-mail addresses: gledson@fgvsp.br (A.G. de Carvalho), cc374@columbia.edu (C.W. Calomiris), amatos@fe.unl.pt (J.A. de Matos).

0148-6195/$ – see front matter
doi:10.1016/j.jeconbus.2007.04.009

track records in the financial system. Small, growing businesses often need to invest quickly, long ahead of the expected stream of profits, and in a quantity far greater than their capacity to issue debt. But the risks faced by suppliers of equity can be prohibitive in the face of substantial adverse-selection problems in identifying worthwhile companies in which to invest, and the need to monitor and control the use of funds by entrepreneurs, to ensure that outsiders' funds are employed to the advantage of stockholders rather than entrepreneurs. The combination of back-loaded profits, limited debt capacity, large growth opportunities, and adverse-selection and moral-hazard problems in the equity market make the provision of outside equity as difficult as it is important.

For the past four decades in the United States, venture capital funds (or, more generally, private equity funds)[1] have been an important solution to this problem. Venture capital has been very successful in funding some of the most dynamic American enterprises, including Microsoft, Cisco, Intel, Compaq, Federal Express, Apple Computers, Genentech, and Amazon.com. About 30% of the companies that go public in the United States received venture capital resources (Gompers & Lerner, 1997). These results become even more impressive when we consider that the amount of capital raised by institutional venture capitalists in the United States between 1978 and 1997 has averaged less than US$ 3 billion per year and never exceeded US$ 7 billion until 1997 (that compared with an average US$ 8 trillion GDP and nearly US$ 1 trillion in gross domestic fixed investment).

Most studies of the structure and function of venture capital funds have focused on the structure of private equity funds (their financial design), and their role in solving information and control problems for portfolio companies – i.e., the role of private equity funds in allocating control rights, and in ameliorating adverse selection and moral hazard problems (Admati & Pfleiderer, 1994; Amit, Glosten, & Muller (1990); Chan, 1983; Cornelli & Yosha, 1997; Hellmann, 1998; Marx, 1998; Repullo & Suarez, 2000). In these papers, venture capital is viewed as a *financial* contract designed to give investors the necessary control, remunerate them for the high risk they assume, and solve incentive problems. Sahlman (1990) describes venture capital as an institution shaped to screen projects and provide monitoring [Gompers (1995) and Lerner (1995) present empirical analyses]. By being actively involved within the companies they fund, venture capitalists have access to information and mechanisms that enable them to deal with adverse selection and moral hazard. As a consequence, venture capitalists can provide financing to young businesses that otherwise would not receive external resources (Barry, 1994). These various studies all view venture capital funding from the perspective of the financial problem solved by venture capitalists, namely permitting entrepreneurial companies to access external equity funding.

Does venture capital also bring *non-financial* benefits? There is anecdotal evidence that because venture capitalists frequently specialize in a particular technology or stage of development they can offer strategic, technical, and commercial guidance (Barry, 1994; Byers, 1997; Bygrave & Timmons, 1992; Sahlman, 1990; Sapienza, 1992). However, to date, little research has been devoted to quantifying the non-financial benefits of venture capital.

Notable exceptions are Kortum and Lerner (2000), and Hellmann and Puri (2000) who find evidence that venture capital has a positive impact on innovation. In other research, Hellmann and Puri (2002) show that venture capital influences the internal organization of portfolio companies. In particular, they show that venture-backed companies are faster to bring in outsiders

[1] In this article, venture capital and private equity are used as synonyms, but typically venture capital connotes the financing of new products, while private equity is a broader category including all types of equity investments (traditional venture capital investments, industry consolidation, leveraged buyouts, etc.).

as CEOs, and that this effect is more noticeable at the very early stage.[2] The authors do not explore the theoretical foundations of why private equity finance should bring such advantages.

Our study describes a theoretical framework in which venture capital acts as a human resources management mechanism, accompanied by corroborating empirical evidence. The theoretical foundations of our framework are simple: Good management is important to the success of all companies, but it is essential for the success of young, fast-growing enterprises pursuing risky investment strategies. Managerial resources often are particularly scarce in young, growing companies; the most innovative entrepreneurs are not necessarily endowed with talents as managers. And, as the newly organized firm grows, its human resource needs become greater and more complex. Thus, it is often the case that realizing the potential of an entrepreneurial firm depends on its capacity to recruit high-level managers.

Venture capitalists may have a comparative advantage in recruiting management for portfolio companies by virtue of their "networking" capabilities and access to private information about managerial talent based on their previous experiences with managers. The extent of that comparative advantage may depend on various attributes of the venture capitalist and the portfolio companies. Different financiers may have different skills and resources for solving the human resource problems of portfolio companies. And portfolio companies may differ according to the difficulties they face in identifying and attracting the right managers to the firm.

Very risky firms may find it harder to attract managers who are risk-averse (and who, therefore, may prefer a safe job in an established firm to a risky job in the portfolio company). The ability of the venture capitalist to use his or her network of industry connections to "recycle" good managers whose firms fail (for exogenous reasons) may permit the venture capitalist to attract skilled managers more successfully.

High-risk activities also make the process of screening managers more difficult. The managers of firms in new industries (where risk is higher) will be less well known to the market because of the relative absence of publicly traded securities (and, therefore, public information creation) for that sector. Greater risk also reduces the signal-to-noise ratio with respect to managerial ability. Thus, venture capitalists' access to private information about managerial talent gives them an advantage in recruiting that is increasing in importance with the riskiness of the industry.

We hypothesize that venture capital brings non-financial benefits to new projects because it allows venture capitalists to use their human resource networking capabilities to transfer valuable information acquired in previous investments and to provide an employment "safety net" for managers. Both the risk aversion of managers, and the adverse-selection problem in identifying managerial talent imply that the comparative advantage of venture capitalists as human resource managers will be an increasing function of the riskiness of the portfolio company. That hypothesis finds some support in the studies of Hellmann and Puri (2002) and Hsu (2004). Hellman and Puri find that the role of venture capital in attracting outsider CEOs is stronger for firms in their early stages (when the prospects for senior managers is riskier). Hsu finds that venture capitalists that are regarded as having superior network resources (including management recruiting contacts) are more likely to succeed when bidding for portfolio companies, and that venture capitalists that possess superior network resources are more likely to be engaged in early-stage financing.

The importance of networks for venture capital financing has been exploited in different contexts. Besides Hsu (2004) cited above, we note Sorenson and Stuart (2001) who show the

[2] That is, before the firm has a product on the market or has gone public.

importance of venture capitalists' networks in overcoming geographical barriers that would otherwise limit the deal flow and the possibility for geographical diversification of the portfolio. Also, Gompers, Lerner, and Scharfstein (2005) find evidence to support the view that networks are important in the creation of venture capital-backed companies: employees of established firms become entrepreneurs by working in a network of entrepreneurs and venture capitalists. The different ways in which networks affect venture capital financing are a topic of interest on its own. However, in this article, we focus only on the determinants of the network for human resource management.

Our empirical examination of cross-sectional differences in the extent that venture capitalists act as human resource managers permits us to test this hypothesis, and other potential influences on the comparative advantage of venture capitalists in human resource management, more directly. Our empirical work is based on a nationwide survey of venture capitalists that identifies various characteristics of portfolio companies and venture capitalists, using objective and subjective measures. These characteristics include the riskiness of portfolio companies and the extent of venture capitalists' involvement in human resource management, as well as many other attributes of portfolio companies and venture capitalists that are relevant to the comparative advantage of venture capitalists in human resource management (e.g., the size of the fund, and the subjective value attributed to the venture capitalist's human resource network as a source of information).

The survey results confirm that human resource networking is an important activity. A majority of the venture capitalists confirm that their relationships with their colleagues include acting on their suggestions when hiring managers, and in turn recommending managers to each other. A substantial proportion of venture capitalists affirm that they adopt the strategy of recycling managers in their portfolio companies.

We find that the extent to which venture capitalists act as human resource managers depends positively on various factors, including (1) the subjective risk venture capitalists attribute to their investments and observable attributes of the investments related to riskiness; (2) the value they attach to the information transmitted through their networks; (3) the size of their funds (which should be positively correlated with their networking ability); and (4) the extent to which venture capitalists believe that the companies that they finance would tend to have difficulty recruiting managers. Venture capitalists surveyed also provide evidence that their networking activities are motivated by perceived cost savings in recruiting managers. Venture capitalists report that greater networking results in an improved ability to attract managers due to the reputation venture capitalists acquire for recycling (assisting managers with job placement in the future).

This article is organized as follows: Section 2 discusses the operation of human resource networks within the venture capital industry, and their importance in creating information about managers ex ante, and the potential for recycling managers ex post. There we consider qualitative and quantitative evidence of the importance of networks in transferring valuable information about managers, and managers themselves, across companies. Section 3 summarizes our model of the decision to network (presented in detail in Appendix A). Section 4 describes the survey and relates some of the survey data to the variables in the theoretical framework. Regression analysis of the incentives to network, hypothesized in the model, is presented in Section 5. Section 6 concludes. Description of the sample and discussion of possible sampling biases are in Appendix B.

2. Screening, insurance, and the role of venture capital human resource networks

Companies receiving venture capital funding are typically very risky. More importantly, these companies are characterized by a high degree of asymmetric information. Managers frequently

have more accurate information about the prospects of the firm than they may be willing to reveal. This information asymmetry makes project governance extremely important. Among the mechanisms venture capitalists adopt to deal with this problem are close monitoring and staging of the investment (Gompers, 1995; Lerner, 1995; Sahlman, 1990).

To increase the likelihood of success and improve their information about the quality of projects, venture capitalists frequently become actively involved in the operation of their portfolio companies. For example, they sit on the board of directors, hire[3] and recruit managers, help establish business strategies, provide industry knowledge, structure deals with suppliers and customers, and act as confidants to managers (Sahlman, 1990). Because many of the firms suitable to receive venture capital funds are young companies lacking experience in human resources management, venture capitalists often become involved in selecting, recruiting and properly remunerating key employees.[4]

This involvement of venture capitalists within portfolio companies provides venture capitalists with expertise in selecting, recruiting, and properly remunerating managers, as well as in timing the development of the firms as organizations (e.g., deciding when the time is right to add a professional CEO or CFO). Furthermore, this involvement gives venture capitalists non-public information about the abilities and qualifications of the managers in the companies they fund.

Even though venture capitalists fund companies with potential to become publicly traded, more often than not, their investments end when their portfolio companies are either liquidated, merge, or are acquired by larger corporations. For example, Venture Economics (1988) reports that 34.5% of venture capital investments resulted in losses (result based on a sample of 383 companies funded by 13 venture capital partnerships between 1969 and 1985). Black and Gilson (1998) present data from 1984 to 1996 showing that a significant number of venture capital investments exit through acquisitions. In these cases, the portfolio company generally becomes a division of the acquiring corporation and does not need a senior management team. Therefore, in many cases, senior managers leave their companies when they are sold or liquidated (this is not necessarily so if the firm goes public). The limited viability of senior managers in companies funded with venture capital means that many portfolio company managers often are available for repeat hire by venture capitalists.

Venture capitalists bring to a project the expertise they develop in selecting, recruiting, and remunerating managers, and in timing the development of the companies as organizations. The nature of the involvement of venture capitalists within their portfolio companies provides them with the necessary means to acquire non-public information about suppliers, customers, and the management team of the companies they fund, and that information can be reused. For instance, when they exit an investment, they have the possibility of recycling competent managers by rehiring them to manage other companies in their portfolio.[5]

[3] For example, Baker and Gompers (1999) found that only 55% of the CEOs of venture capital-backed companies going public are founders. Hellmann and Puri (2000) found that 61% of companies funded with venture capital experienced a turnover.

[4] The adjective "properly" refers to the design of contracts that gives the managers the right incentives, aligning his or her interests with those of the investors.

[5] An example of this is given by Kleiner and Perkins, in Institutional Investor (June 1996), pp. 95–96: "The keiretsu conceit aside, the Kleiner partners' role in Silicon Valley may in some ways be closer to that of the Hollywood moguls of the '30s and '40s, whose success was built on their ability to lock up stars, directors and writers. Kleiner Perkins has similarly amassed a pool of talent. 'If you're well regarded as a manager in their stable, you're going to be used over the years,' says Frank Ingari, whom Doerr tapped to run networking software company Shiva Corp. in 1993." "One way Doerr

Not only does venture capitalists' involvement improve managerial quality through screening, the recycling of managers across portfolio companies reduces hiring costs via an "insurance effect." Managers in small growing firms are exposed to a high risk of failure. As mentioned before, senior managers find themselves in a vulnerable situation when the firm does not go public. The fact that venture capitalists can offer another chance in another portfolio company reduces the firm-specific risk that managers bear when joining portfolio companies. This insurance effect may explain Hellmann and Puri's (2002) finding that venture-backed companies are faster to bring in outsiders as CEOs.

Both the screening and insurance effects depend on the possibility of consecutively employing managers in distinct portfolio companies. The possibility of the same venture capitalist redeploying the same manager is somewhat restricted since few venture capital funds are large enough to match job openings with the availability of managers. However, one factor that broadens the ability to reuse non-public information about managers is the close relationship among venture capitalists, which is an outgrowth of the syndication of investments.

Syndication of investments is commonly used to improve screening, achieve better monitoring, broader their sources of funds, and diversify their portfolio (Lerner, 1994). The possibilities for syndication depend on both the connections a venture capitalist has, and on his or her reputation among other venture capitalists. Syndication creates strong bonds among venture capitalists and, therefore, allows reliable information to flow among them. The fact that reliable information can flow among venture capitalists gives them an unusual role as certifiers of senior managers' abilities (in the context of small, growing firms' financing), and allows them to operate an informal network to locate and relocate skilled managers.

3. The decision to network

Here we discuss the model presented formally in Appendix A. The venture capitalist conducts a cost–benefit analysis to determine whether to use a network of venture capitalists when hiring managers or use a headhunter to find managerial talent. The degree or probability of project success increases with the quality of the management. The venture capitalist establishes a desired profile for the manager. This profile includes verifiable characteristics such as experience, industry knowledge, etc. It also includes some non-verifiable characteristics. For instance, very few managers can certify their ability to lead young, fast-growing firms into becoming large, well-structured organizations. Successful managers in large corporations may lack that skill. These non-verifiable characteristics define the managers' type. The model assumes that beforehand neither venture capitalists nor managers know managers' types.

The cost of locating a manager depends on the means used. The cost of hiring a search firm is assumed to be the same for all venture capitalists. To locate managers through the network, the venture capitalist needs to establish relations with other venture capitalists. The cost of networking is equivalent to the monetary value of the time that the venture capitalist has to spend establishing connections. Once the venture capitalist is networked, he or she has access to suggestions coming

hardwires his network is by placing Kleiner CEOs on the boards of other corporate members of the keiretsu. . . The CEO of video game maker Crystal Dynamics, Randy Komisar, one of a number of Go veterans now running Kleiner companies, sits on the boards of two Kleiner-associated companies, Total Entertainment Network and MN Interactive. CEO John Kernan of Lightspan Partnership sits on the board of fellow educational software company Academic Systems. . . The network has been buttressed by the 'CEO-in-residence' program which brings temporarily out-of-work top executives into Kleiner and Perkins to review business plans, to do a little strategic thinking and help with recruiting. . .".

from his or her network colleagues. The cost of networking when hiring varies across venture capitalists depending on the potential for networking that each venture capitalist has, which in turn can be related to factors like the size of the venture capital fund, the number of partners, how much the venture capitalist syndicates investments, etc.

The outcome of the project will become public information and influence the future salary that the manager expects to obtain in his or her next job. If the firm fails, the manager's future salary will be lower than in case of success. Managers are risk-averse and venture capitalists are risk neutral (or, equivalently, venture capitalists hold a sufficiently diversified portfolio of investments such that they maximize expected value).

In addition to using the network for hiring, venture capitalists who network can assist managers with job placement by suggesting managers to other venture capitalists.[6] A possible future referral works as an option that managers acquire when they are hired. If the project fails, with a given probability, the assistance can increase the future salary of the manager. In the model, if the firm succeeds, this assistance is irrelevant to the future salary of the manager. By suggesting managers venture capitalists incur a specific cost. This cost is equivalent to the monetary value of the effort and time that the venture capitalist has to spend contacting other venture capitalists to find a match for the managers. This cost varies inversely with venture capitalists' network connections.

In the model, the decision to network involves two aspects: suggesting managers and acting on suggestions when hiring a manager. The decisions to use the network for hiring and for suggesting are separate but related. First, the venture capitalist decides whether or not to participate in the network when hiring managers. If the venture capitalist chooses to use the network for hiring, then he or she has the option also to provide suggestions to the network. The decision to use the network for hiring does not imply that the venture capitalist must use the network for suggesting, but it does make suggesting possible. In turn, the option to suggest managers does affect the decision to use the network for hiring purposes in the first instance, because those who actively suggest managers have an advantage when recruiting managers: managers would accept a monetary salary below their reservation salary because the recommendation increases their expected future salary.

In the model, the benefit that venture capitalists create from suggesting managers is captured by them entirely in the form of lower compensation paid to the managers. When the venture capitalist suggests managers through a network, the manager's reservation salary is diminished by a given amount (reflecting the reduction in risk faced by the manager). That amount represents the gain that the venture capitalist receives by suggesting managers. The venture capitalist will suggest managers whenever that gain is larger than the costs of suggesting.

The gain received by the venture capitalist from networking increases with the riskiness of the portfolio company. Assistance with job placement has value to managers only if the firms they manage fail. Thus, the higher the chances of failure, the higher will be the value that managers attribute to the assistance, and thus, the higher the discount on the reservation salary that they are willing to accept. Venture capitalists stand to gain more from suggesting managers involved in risky projects.

[6] Only those who locate managers through the network have the option of actively suggesting managers. This dependence allows us to incorporate into the model the idea that venture capitalists who suggest managers have an advantage when recruiting managers because suggesting managers reduces the firm-specific risks to which managers are exposed (the *insurance effect*).

In the model, the benefits from taking suggestions from the network when hiring managers can be decomposed into three factors.[7] A first factor reflects the value to the venture capitalist of networking's effect on higher managerial quality. Firms in which differences in managerial quality have greater consequences for firm performance will benefit more from locating highly skilled management, and will rely more on networks to do so to the extent that networks improve the accuracy of the screening process for hiring managers. With respect to this first factor, in the model, the benefits from improved managerial screening depend positively upon three physical parameters: (1) the relative profitability of a successful project outcome – i.e., the riskiness of the project, (2) the effect of managerial quality on the probability of a successful outcome, and (3) the value of networking for identifying skilled managers. In the model, these three parameters appear in a multiplicative way such that the strength of each effect depends on the size of the other two parameters.

The second factor is the insurance effect. This is the benefit captured by the venture capitalist by being able to offer to recycle managers via the network, which takes the form of a reduction in the manager's reservation level for compensation. The value of the insurance effect depends positively on (1) the riskiness of the project and (2) the credibility of the commitment from the venture capitalist to recycle. Note that the insurance effect, therefore, provides a second rationale for a positive relationship between risk and the decision by venture capitalists to participate in networks.

The third factor reflects cost savings to the venture capitalist from the difference between the physical cost of networking and the physical cost of headhunting. It is plausible to assume that using a headhunter has a constant marginal cost that is the same for all venture capitalists. In contrast, the cost of networking should decline with the size of the venture capital fund. Two conjectures relate the size of the venture fund to the costs of networking. First, large funds are managed by many venture capitalists. Therefore, the incidence of suggestions coming from partners or persons associated with them is more frequent. Secondly, other venture capitalists may have an interest in developing good relations with venture capitalists managing large funds. This may occur because of the interest that venture capitalists have in prospective syndications (Lerner, 1994).[8] Moreover, well-established venture capitalists are opinion makers in the industry. Therefore, the flow of reliable suggestions to venture capitalists managing large funds can be more intense.

In summary, when one combines the effects of these three factors, the model predicts that a venture capitalist's reliance on networking when *hiring* managers is positively related to several characteristics of the portfolio company or the venture capitalist: (1) project risk, (2) the effect of managerial quality on the probability of a successful outcome, (3) the value of networking for identifying skilled managers, (4) the credibility of the venture capitalist's commitment to recycle managers, and (5) the size of the venture capitalist. Note that project risk affects the benefits

[7] The benefits associated with human resource networking all are derived from the increase in expected cash flows available to the venture capitalists through reductions in the compensation that venture capitalists must pay managers. We cannot observe these benefits directly, nor differences in benefits associated with the different aspects of networking we identify here (suggesting and taking suggestions) and therefore, in our empirical work discussed below, we test empirical implications related to venture capitalists' observable attempts to capture these benefits. One recent study (Hochberg, Ljungqvist, & Lu, 2004) associated greater networking in general (not just human resource networking) with a superior frequency of "good" exits from the venture capital stage (IPO or trade sale).

[8] For instance, this can be related to what Lerner calls *window-dressing*: venture capital funds want to show that they financed successful enterprises in order to promote fund raising. Because of this, the opportunity to join a successful enterprise through syndication is extremely valuable.

of networking positively through two distinct affects: the marginal productivity of managerial screening, and the insurance effect. Also, recall that the insurance effect – which is reflected in characteristics (1) and (4) – on the propensity to use networks for hiring is only relevant for venture capitalists that use the network for recycling managers, as well.

The same five characteristics listed above should predict the use of the network for *recycling* (*suggesting*) managers, as well as for hiring them. In the model, the insurance effect in the *hiring* decision is only operative if the venture capitalist chooses to participate in *suggesting* managers for recycling via the network. Conversely, in the model, suggesting is only physically possible if the venture capitalist has already decided to participate in the network for hiring purposes. This interdependence between the two endogenous networking decisions implies that any exogenous variable that directly influences the probability of deciding in favor of doing one also raises the probability of deciding in favor of the other.

4. Survey data

Data concerning the existence and use of the hiring network among venture capitalists were obtained through two surveys of venture capitalists. The first (referred to as "the survey") was answered by 160 venture capitalists and contains mostly qualitative information. The second (referred to as "the follow-up") contains more quantitative questions, for which we obtained 68 responses. Both samples are presented, and their possible biases are discussed in Appendix B. Creating these two new datasets through surveys permitted us to match the exogenous structure in the model to observable variables.

The survey was sent to 879 venture capitalists throughout the US, randomly taken from "*Pratt's Guide to Venture Capital Sources* (1994)," a publication that lists all the venture capital sources and their managers. Among the 160 respondents, 70 agreed to a phone interview and a follow-up survey, but we could reach only 68 of them. The survey and interviews were done in 1995 and 1996. Through the interviews, we discovered that four respondents to the original survey were persons not directly involved in the investment process. These four responses were deleted, resulting in a final sample of 156 survey responses and 68 follow-up responses. Table 1 describes the variables derived from the survey and follow-up.

As a first step in our analysis, we investigate the perceived importance of human resource management by venture capitalists. In the survey, to assess the importance of recruiting managers, the respondents were asked to rank the three activities performed by venture capitalists that they considered most important. They were given a menu including (1) monitoring performance against goals, (2) helping with management decisions, (3) providing industry knowledge, (4) providing finance, (5) developing business strategy, and (6) recruiting managers. Respondents were also given two blank slots to fill in activities that they deemed important that were not included in this list. A significant proportion (16.7%) listed recruiting managers as the most important activity; 35.5% viewed it as one of the two most important activities, and 54.2% described it as one of the three most important (Table 2).

Survey respondents were also asked to quantify various aspects of their human resource management activities. Table 3 presents data on the number of executives that the venture capitalist has employed more than once or helped with job placement in the previous 5 years. Table 3 also provides data on the number of CEOs replaced in the previous 5 years. The mode and median of the empirical distribution for placement is 2. The mode of the empirical distribution for replacement is 3, and the median is 4. Table 3 clearly shows that some venture capitalists are far more active than others, which may reflect either differences in the total number of portfolio companies across

Table 1
Main variables

Variable	Description	Source
PLACEMENT	Answer to the question: *in the last five years, approximately how many executives have you either employed more than once or helped to be placed after their firms were sold or liquidated*?	SURVEY
REPLACEMENT	Answer to the question: *approximately how many CEOs have you replaced in the last five years*?	SURVEY
DEALS	Answer to the question: *approximately how many deals have you made in the last five years*?	SURVEY
HIRINGS	Answer to the question: *in the last 5 years, approximately how many managers have you hired*?	FOLLOW-UP
AVERAGE PLACEMENT	Ratio between PLACEMENT and DEALS.	SURVEY
AVERAGE REPLACEMENT	Ratio between REPLACEMENT and DEALS.	SURVEY
MANAGERS SUGGESTED TO PARTNERS	Answer to the question: *in the last 5 years, approximately how many possible top managers have you recommended to venture capitalists who work for your firm*?	FOLLOW-UP
MANAGERS SUGGESTED TO NON-PARTNERS	Answer to the question: *in the last 5 years, approximately how many possible top managers have you recommended to venture capitalists who do not work for your firm*?	FOLLOW-UP
MANAGERS HIRED UNDER SUGGESTION OF PARTNERS	Answer to the question: *among the top managers you hired in the last 5 years, approximately how many were recommended by venture capitalists who work for your firm*?	FOLLOW-UP
MANAGERS HIRED UNDER SUGGESTION OF NON-PARTNERS	Answer to the question: *approximately how many of the top managers you hired in the last 5 many were suggested by venture capitalists who do not work for your firm*?	FOLLOW-UP
EARLY	Venture capitalists were asked to rank the three types of financing in which they are most involved. The received a list containing seed, startup, R&D, first-stage, second-stage, mezzanine, bridge financing, LBO, acquisition financing, control-block purchase, industry consolidation, and a blank slot for other unlisted types. The first four of these categories are considered early-stage venture capital. Variable EARLY is the number of early-stage venture capital activities in the venture capitalist's list of top three activities.	SURVEY
RISK	Venture capitalists were asked to answer the question: *in the realm of venture capital, how would you classify most of your investments (use a scale from 1 for low risk to 5 for high risk).*	SURVEY
CAPITAL	Amount of capital that the funds of a venture capitalist has under management.	SURVEY

venture capitalists, or differences in the intensity of human resource management. To provide a clearer indicator of the intensity of human resource management activity, the bottom panel of Table 3 reports placement and replacement activity relative to the size of the venture capital fund (measured by the number of DEALS in the past 5 years).

Table 2
Importance given by venture capitalists to the activity of recruiting managers

Rank	Frequency	Valid percentage
Most important	26	16.7
One of the two most important	55	35.5
One of the three most important	84	54.2
Not among the three most important	71	45.8
Missing	1	
Number of answers	155	

Venture capitalists were asked to rank the three activities performed by venture capitalists that they considered most important. They were given a menu including (1) monitoring performance against goals, (2) helping with management decisions, (3) providing industry knowledge, (4) providing finance, (5) developing business strategy, and (6) recruiting managers, and two blank slots to complete with unlisted activities. Some answers presented a tie. In case two answers were tied in the first place, the second place was taken as blank. If three activities were tied in first, then the second and third places were taken as blank, and so on.

Venture capitalists were asked to express their degree of agreement with the following propositions: (1) "*venture capitalists operate informal networks involved in locating and relocating managers*" (proposition NETWORK); (2) "*it is common for me to suggest likely managers to others in the private equity industry*" (proposition SUGGEST); (3) "*it is common for me to act on suggestions from others in the private equity industry when hiring a top manager for a firm*" (proposition TAKE SUGGESTIONS); and (4) "*once I learn about the good qualifications of a manager, I try to keep him/her working for companies I fund, i.e., I entice him/her to leave a firm when I sell or liquidate it and take a position in another company I fund*" (proposition RECYCLING STRATEGY). The follow-up also asked venture capitalists to state the number of managers that the venture capitalist had hired under recommendation and suggested in the previous 5 years both to/from partners and non-partners. The responses to all of these questions are reported in Table 4, where Panel A summarizes responses to the four questions listed above, and Panel B summarizes responses to the follow-up questions about networking.

Clearly, venture capitalists strongly believe in the existence of a human resource network. A large majority, 77.9%, agreed that they operate informal networks (proposition NETWORK; Table 4, Panel A); only 6.5% disagreed. Fully 56.2% agreed that it is common for them to suggest likely managers to others in the private equity industry; only 19.3% disagreed (proposition SUGGEST; Table 4, Panel A).[9] The results in the follow-up (Table 4, Panel B) confirm this last result from the survey. Only 24.6% had not suggested any manager to partners and 24.6% to non-partners. Finally, the proportion of venture capitalists that had not recommended any manager amounts to 12.7%, while those who had recommended more than four is 52.7%.

Most respondents (62.3%) agreed that it is common for them to act on suggestions when hiring managers (7.1% strongly agreed); only 11% disagreed (proposition TAKE SUGGESTIONS; Table 4, Panel A).[10] The numbers in the follow-up (Table 4, Panel B) are consistent with these results: only 19% of the respondents had not hired any manager under suggestion (30.5% had not hired any manager under suggestion of partners and 52.5%, from non-partners). The proportion

[9] The answer given to this question by the sub-sample of those who answered the follow-up is very similar: 10.3% agree strongly, 52.9% agree, 22.1% are indifferent, and 14.7% disagree.

[10] The answer given to this question by the sub-sample of those who answered the follow-up is very similar: 10.3% agree strongly, 52.9% agree, 32.4% are indifferent, 2.9% disagree, and 1.5% strongly disagree.

Table 3
Venture capitalists' involvement with human resources management

Number of managers	PLACEMENT			REPLACEMENT		
	Frequency	Percentage	Cumulative percentage	Frequency	Percentage	Cumulative percentage
0	35	24.8	24.8	7	4.9	4.9
1 and 1.5	16	11.4	36.2	15	10.5	15.4
2	36	25.5	61.7	18	12.6	28.0
3 and 3.5	27	19.2	80.9	29	20.3	48.3
4	3	2.1	83.0	20	13.9	62.2
5	11	7.8	90.8	20	13.9	76.1
6	2	1.4	92.2	5	3.5	79.6
7	1	0.7	92.9	2	1.4	81.0
8 and 8.5	1	0.7	93.6	6	4.2	85.3
≥ 10	9	6.4	100.0	21	14.7	100.0
Total	141			143		
Number of managers	AVERAGE PLACEMENT			AVERAGE REPLACEMENT		
	Frequency	Percentage	Cumulative percentage	Frequency	Percentage	Cumulative percentage
$0 \leq x \leq 0.1$	59	41.5	41.5	11	7.9	7.9
$0.1 < x \leq 0.2$	34	24.0	65.5	40	28.5	36.4
$0.2 < x \leq 0.3$	21	14.8	80.3	17	12.0	48.6
$0.3 < x \leq 0.4$	7	4.9	85.2	28	20.0	68.6
$0.4 < x \leq 0.5$	8	5.6	90.8	20	14.3	82.9
$0.5 < x \leq 0.6$	3	2.2	93.0	9	6.4	89.3
$0.6 < x \leq 0.8$	4	2.8	95.8	5	3.6	92.9
$0.8 < x$	6	4.2	100.0	10	7.1	100.0
Total	142			140		

PLACEMENT is the number of executives that the venture capitalist has employed more than once or helped with job placement in the previous 5 years and REPLACEMENT describes the number of CEOs replaced in the previous 5 years. The averages of the variables PLACEMENT and REPLACEMENT are divided by the number of deals structured in the previous 5 years. When the answer was in the form of an interval, the midpoint was considered. This is why some answers are non-integer numbers.

of those who hired more than three managers under recommendation is 30.2%. A considerable proportion of venture capitalists (37%) affirm that they adopt a recycling strategy (proposition RECYCLING STRATEGY; Table 4, Panel A).[11]

Summary statistics from our survey and follow-up show that a significant proportion of venture capitalists suggest managers to each other, act on suggestions when hiring senior managers, and have a strategy of recycling managers. It is particularly striking that a large proportion of venture capitalists agree that they operate informal networks involved in locating and relocating managers.

Survey responses also provide evidence on the motives of venture capitalists in using human resource networks. We hypothesize that an important element that may explain the motivation

[11] Through telephonic interviews, several venture capitalists recognized that the small number of deals does not allow them to implement this strategy, although they would be willing to do it.

Table 4
Evidence on the existence of the network

Proposition	Wording	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Number of answers
Panel A: Qualitative data (in percentage)							
NETWORK	Venture capitalists operate informal networks involved in locating and relocating competent managers.	19.5	58.4	15.6	5.2	1.3	155 (100)
SUGGEST	It is common for me to suggest likely managers to others in the private equity business.	6.5	49.7	24.5	18.7	0.6	155 (100)
TAKE SUGGESTIONS	It is common for me to act on suggestions from others in the private equity industry when hiring a top manager for a firm.	7.1	55.2	26.7	9.7	1.3	154 (100)
RECYCLING STRATEGY	Once I learn about the good qualifications of a manager, I try to keep him/her working for companies I fund, i.e., I entice him/her to leave a firm when I sell or liquidate it and take a position in another company I fund.	8.4	28.6	27.3	23.7	13.0	156 (100)

Number of managers	Managers suggested to			Managers suggested by		
	Partners	Non-partners	Both	Partners	Non-partners	Both
Panel B: Quantitative data (in percentage)						
0	24.6	24.6	12.7	30.5	52.5	19.0
1	8.7	15.7	3.6	28.8	21.3	22.4
2	17.5	17.5	9.1	15.2	18.0	17.2
3	12.2	12.2	12.7	8.9	3.2	12.1
4	5.2	1.7	9.1	6.8	1.6	10.3
≥5	31.5	28.0	52.7	10.2	3.2	19.0
Total	57 (100)	57 (100)	55 (100)	59 (100)	61 (100)	58 (100)

that venture capitalists have in networking is the relatively high value that they attribute to the information that they obtain from each other. More specifically, we hypothesize that venture capitalists have (or at least think they have) information about managers that search firms do not.

To address that hypothesis, venture capitalists were asked to express their degree of agreement with the following propositions: (1) "*the success of the firms I fund depends mostly on their top managers*" (proposition MANAGERIAL IMPACT); (2) "*as a venture capitalist I learn substantially more about the managers of the companies I fund than what can be revealed to outsiders by their track records*" (proposition INSIDE INFORMATION); and (3) "*to manage a firm funded with venture capital requires different skills from those needed to manage a company funded with other sources of capital*" (proposition SPECIAL SKILLS).

The level of agreement with these propositions is presented in Table 5, Panel A. The overwhelming majority (93.5%) of respondents agreed that, through their relations with managers, they learn substantially more about the managers than what can be revealed to outsiders by the managers' records (proposition INSIDE INFORMATION). An even higher level of agreement (95.5%) is attained for the proposition MANAGERIAL IMPACT. Finally, 58.7% agree that to manage for venture capital investors requires special skills (proposition SPECIAL SKILLS). Together, these responses support the hypothesis that information about managerial skills is important and not readily available.

Next, in Table 5, Panel B, we examine venture capitalists' views of the challenges they face in recruiting managers, and the extent to which the operation of a human resource network can help to reduce the costs of hiring skilled managers. We asked respondents to express their degree of agreement with various propositions related to their activities as human resources recruiters. These propositions are as follows: (1) "*it can be difficult to entice a manager to leave a stable position in a well established company and take a chance in a new firm with risky prospects*" (proposition DIFFICULT HIRE); (2) "*if it were not for their confidence in my personal commitments to them, some of the top managers of the companies I fund might not have accepted the job offer they received*" (proposition PERSONAL COMMITMENTS); and (3) "*having a reputation of helping good managers with job placement, in the event that the companies for which they work are liquidated, helps entice other managers to work for other companies I fund*" (proposition REPUTATION).

The data in Table 5, Panel B, indicate that venture capitalists make personal commitments to managers, and rely on their personal reputations for helping managers to find replacement jobs, as a means of enticing managers to come to their portfolio companies, which managers may be reluctant to do because of the riskiness of those portfolio companies. The majority of respondents (54.5% agree that it can be difficult to entice managers to a risky portfolio company, while 25% disagree. 68.7% of respondents emphasize the importance of their personal commitment to managers in getting them to accept a job, while 9.8% disagree. Forty-four percent agree that their reputations for assisting in recycling managers help entice managers to their portfolio companies, while 15.1% disagree.

5. Explaining differences in venture capitalists' reliance on human resource networking

The summary statistics described thus far demonstrate that venture capitalists tend to agree that (1) human resource networking is an important activity, (2) information about managerial quality is important, (3) venture capitalists obtain unique information about their managers, and (4) participating in a human resource network is important for attracting skilled managers. Interestingly, however, the results in Tables 2–5 also show that there is a considerable amount of variation in

Table 5
Challenges in recruiting managers and the value of the network (in percentage)

Proposition	Wording	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Number of answers
Panel A: Value and uniqueness of the information							
MANAGERIAL IMPACT	The success of the type of firms I fund depends mostly on their top managers.	71.1	24.4	3.2	1.3	0.0	156 (100)
INSIDE INFORMATION	As a venture capitalist I learn substantially more about the managers of the companies I fund than what can be revealed to outsiders by their track records.	49.7	43.8	5.2	1.3	0.0	153 (100)
SPECIAL SKILLS	To manage a firm funded with venture capital requires different skills from those needed to manage a company funded with other sources of capital.	14.8	43.9	18.7	20.0	2.6	155 (100)
Panel B: Venture capitalist's challenges in recruiting managers							
DIFFICULT HIRE	It can be difficult to entice a top manager to leave a stable position in a well established company and take a chance in a new firm with risky prospects.	12.2	42.3	20.5	21.8	3.2	156 (100)
PERSONAL COMMITMENTS	If it were not for their confidence in my personal commitment to them, some of the top managers of the companies I fund might not have accepted the job offer they received.	20.3	48.4	21.5	7.8	2.0	153 (100)
REPUTATION	Having a reputation of helping good managers with job placement, in the event that the companies for which they work are liquidated, helps entice other managers to work for other firms I fund.	7.2	36.8	40.9	10.5	4.6	152 (100)

the opinions venture capitalists express about the importance of participating in human resource networks, and the importance of those networks for attracting skilled managers. In Section 3, we discussed our model (formally presented in Appendix A) that suggests explanations for that variation in opinion and practice. Specifically, the model suggests that cross-sectional variation in the perceived importance of networks, or in the desire to participate in them, should be linked to factors identified in the model. This section explores the extent to which cross-sectional differences in the use of networks can be explained by observable characteristics of venture capitalists, as predicted by the model.

In what follows, we use respondents' answers to the propositions SUGGEST and TAKE SUGGESTIONS (both from the survey), the number of managers hired under suggestion from non-partners (from the follow-up), and the number of managers recommended to non-partners (from the follow-up) as alternative endogenous variables to measure the extent of the reliance by venture capitalists on networks. TAKE SUGGESTIONS and the number of managers hired under suggestion are alternative measures of the propensity to network when hiring. SUGGEST and the number of managers recommended are alternative measures of the propensity to supply managers to the network. In the model, these are separate decisions. The model suggests factors that should explain variation in the reliance on networks for both *hiring* and *suggesting*. We measure explanatory factors using observable variables based on responses to propositions in the survey and follow-up, and then test to see whether these observable explanatory variables can explain cross-sectional variation in our measures of reliance on networks.

According to our model, there should be a positive association between the propensity to rely on networks, for both hiring and suggesting, and the following characteristics: (1) project risk, (2) the effect of managerial quality on the probability of a successful outcome, (3) the value of networking for identifying skilled managers, (4) the credibility of the venture capitalist's commitment to recycle, and (5) the size of the venture capitalist.

5.1. Measuring the determinants of using networks

Project risk: We employ three alternative measures of project risk: RISK (Table 1), EARLY (Table 1), and DIFFICULT HIRE (Table 5, Panel B). RISK is a subjective measure of risk by the venture capitalist. It is the response to the question: *"In the realm of venture capital, how would you classify most of your investments (use a scale from 1 for low risk to 5 for high risk)*?"

EARLY is an indicator for whether early-stage venture capital is an important area of the venture capitalist's business. Specifically, we asked the venture capitalists to list the three types of financing with which they are primarily involved. The possible categories included seed, startup, R&D, first-stage, second-stage, mezzanine, LBO, acquisition financing, control block purchase, industry consolidation, and a blank slot for other unlisted types.[12] The first four of these categories are considered early-stage venture capital. EARLY is the number of early-stage venture capital activities that were listed in the venture capitalist's list of top three activities. For example, for a venture capitalist that listed R&D, first-stage, and second-stage as his three top categories of activity, EARLY would have a value of 2. As expected, RISK is strongly correlated with EARLY (the correlation coefficient is 0.67). As shown in Table 6, responses measured by the variables RISK and EARLY are reasonably well distributed over the potential range of responses, indicating substantial heterogeneity in our sample.

[12] This classification of the industry was taken from *Venture Economics* (1994).

Table 6
Characteristics of venture capitalist in the sample

	EARLY			RISK		
	Frequency	Percentage	Cumulative percentage	Frequency	Percentage	Cumulative percentage
0	45	28.8	28.8			
1	20	12.8	41.6	7	4.5	4.5
2 and 2.5	41	26.3	67.9	28	18.2	22.7
3 and 3.5	50	32.1	100.0	37	24.1	46.8
4 and 4.5				49	31.8	78.6
5				33	21.4	100.0
Total	156			154		
	HIRINGS			DEALS		
	Frequency	Percentage	Cumulative percentage	Frequency	Percentage	Cumulative percentage
$0 \leq x \leq 3$	8	12.9	12,9	5	3.5	3.5
$3 < x \leq 6$	23	37.1	50.0	22	15.3	18.8
$6 < x \leq 9$	4	6.5	56.5	18	12.5	31.3
$9 < x \leq 12$	14	22.5	79.0	39	27.0	58.3
$12 < x \leq 15$	7	11.2	90.2	10	7.0	65.3
$16 < x \leq 20$	3	4.9	95.1	21	14.6	79.9
$21 < x \leq 25$	0	0	95.1	10	6.9	86.8
$25 < x$	3	4.9	100	19	13.2	100.0
Total	62			144		

EARLY takes the value of 0, 1, 2, or 3, which corresponds to the number of early-stage financing listed among the three main types of financing performed by a venture capitalist. RISK corresponds to a subjective assessment of the riskiness of the venture capitalist's investments on a scale from 1 for low risk to 5 for high risk. EXPERIENCE is the number of years in the venture capital industry. Deals represent the number of deals made in the previous 5 years. These variables are precisely described in Table 1.

DIFFICULT HIRE (Table 5, Panel B) is a measure of risk that is especially relevant for capturing the insurance effect, but it is also useful more broadly as a gauge of the riskiness of the activities of the venture capitalist.

Managerial impact: We capture the effect of managerial quality on the probability of a successful outcome with the variable MANAGERIAL IMPACT (Table 5, Panel A).

Network's value: The value of networking for identifying skilled managers is captured by SPECIAL SKILLS (Table 5, Panel A). To the extent that the skills of managers are unusual, it should be harder to locate skilled managers, and therefore, the potential contribution of networking should be relatively greater.

Recycling credibility: We capture the credibility of the venture capitalist's commitment to suggest/recycle with the variable REPUTATION (Table 5, Panel B). This variable measures the extent to which the venture capitalist believes that having a reputation for credible recycling is important, which should be closely related to the extent to which the venture capitalist has invested in such a reputation. Reputation is relevant directly for the value of the suggesting service offered by the venture capitalist, and indirectly, through the insurance effect, for the value of participating in the hiring network.

Size: Size is measured by CAPITAL (Table 1), which is defined as the amount of capital that the venture capital fund currently has under management.

5.2. Regressions

Recall that we consider four measures of the decision to network, two that capture the use of networks for hiring managers, and two that capture the use of networks for suggesting/recycling managers. Two of these four endogenous variables (one for hiring and one for suggesting) are measured as ordered variables (that is, they are expressions of the degree of agreement or disagreement with certain propositions). The other two endogenous variables are integer measures of the number of managers hired and suggested. We employ ordered probit analysis to explain variation in the ordered variables, and Poisson regression analysis to explain variation in the integer variables. In all four sets of regressions, we use the same set of seven explanatory variables, namely RISK, EARLY, DIFFICULT HIRE, MANAGERIAL IMPACT, SPECIAL SKILLS, REPUTATION, and CAPITAL. In the Poisson regressions, we also include the number of deals by the venture capitalist in the past 5 years (variable DEALS; Table 1) and the number of senior managers hired by the venture capitalist in the past 5 years (variable HIRINGS; Table 1) as scaling control variables.

Tables 7 and 8 present an empirical analysis of the incentive to hire under suggestions, using our two alternative measures of the network hiring propensity. Table 7 presents ordered probit regressions where the dependent variable is the extent of agreement with the proposition TAKE SUGGESTIONS.[13] Table 8 contains Poisson regressions where the dependent variable is the number of managers hired under suggestion from non-partners in the previous 5 years.

The explanatory variables are consistently positive (with the exception of CAPITAL in Table 8, possibly reflecting the influence in Table 8 of the presence of the closely related variables, DEALS and HIRINGS), as predicted in the model, and are often statistically significant. We alternate our three measures of risk in the various specifications in Tables 7 and 8, and as expected, they tend to detract from one another's explanatory power.

The measured effects of SPECIAL SKILLS and MANAGERIAL IMPACT are positive but not highly statistically significant. In the case of MANAGERIAL IMPACT, this may reflect the lack of cross-sectional variation in our sample for this variable (see Table 5). Furthermore, although we allow SPECIAL SKILLS and MANAGERIAL IMPACT to enter separately in many specifications in Tables 7 and 8, in our model, the two variables should enter interactively; that is, the importance of each should depend on the importance of the other. Thus, in Tables 7 and 8, we also report results where we substitute a new variable, INFORMATION VALUE (defined as the product of SPECIAL SKILLS and MANAGERIAL IMPACT) for SPECIAL SKILLS and MANAGERIAL IMPACT. In Table 7, INFORMATION VALUE enters significantly.

The empirical analysis of the decision to suggest managers appears in Tables 9 and 10, which employs the same explanatory variables as Tables 7 and 8. Table 9 presents ordered probit regressions where the dependent variable is the degree of agreement with the proposition SUGGEST. Table 10 contains Poisson regressions where the dependent variable is the number of managers suggested to non-partners in the previous 5 years.

The variables EARLY, RISK, and REPUTATION appear with positive and statistically significant coefficients. In the survey sample, the other variables fail to show statistical significance in accordance with the model. In the follow-up sample, DIFFICULT HIRE is positive and statistically significant. In the follow-up sample, SPECIAL SKILLS and MANAGERIAL IMPACT, or alternatively their product, INFORMATION VALUE, enter negatively and statistically signifi-

[13] In Tables 7–10, we report pseudo-R^2 for our Poisson and ordered probit regressions. Note that psuedo-R^2 are not bounded between zero and one; the usefulness of these measures is primarily in comparing the levels of pseudo-R^2 across similar regression specifications.

Table 7
Empirical determinants of the decision to network: taking suggestions

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
SPECIAL SKILLS	0.10 (1.12)	0.13 (1.48)	0.13 (1.56)	0.11 (1.18)				
MANAGERIAL IMPACT	0.24 (1.59)	0.19 (1.30)	0.19 (1.30)	0.25 (1.63)				
INFORMATION VALUE					0.03* (1.88)	0.03* (1.95)	0.03** (2.10)	0.03* (1.84)
REPUTATION	0.23** (2.23)	0.10** (2.54)	0.24** (2.41)	0.24** (2.29)	0.22** (2.13)	0.26** (2.47)	0.24** (2.35)	0.23** (2.19)
DIFFICULT HIRE	0.22** (2.36)			0.25*** (2.64)	0.20** (2.24)			0.24** (2.52)
RISK		0.14* (1.73)		0.15 (1.27)		0.14* (1.73)		0.14 (1.24)
EARLY			0.12 (1.60)	0.03 (0.30)			0.12 (1.60)	0.04 (0.33)
log CAPITAL	0.16** (2.25)	0.11 (1.59)	0.14* (1.93)	0.16** (2.06)	0.16** (2.24)	0.12 (1.61)	0.14* (1.95)	0.16** (2.06)
N	144	142	144	142	144	142	144	142
Pseudo-R^2	0.05	0.04	0.04	0.07	0.05	0.04	0.04	0.07
log likelihood	−151.85	−150.18	−153.38	−146.52	−152.01	−150.18	−153.25	−146.84
Wald χ^2	18.58	15.61	15.52	22.92	18.26	15.60	15.79	22.27

*, **, and *** indicate statistical significance levels of 10, 5, and 1%, respectively (two tailed). The dependent variable is agreement with the proposition TAKE SUGGESTIONS: *it is common for me to act on suggestions from others in the private equity industry when hiring a top manager for a firm*. Independent variables are described in Tables 1 and 5. Variable INFORMATION VALUE is the product of variables SPECIAL SKILLS and MANAGERIAL IMPACT. Estimates come from ordered probit analysis. In parentheses are the regression coefficients' *z*-values.

Table 8
Empirical determinants of the number of managers hired under suggestion of non-partners

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
SPECIAL SKILLS	0.25 (1.35)	0.31 (1.63)	0.24 (1.35)	0.25 (1.32)				
MANAGERIAL IMPACT	0.00 (0.00)	−0.02 (0.12)	0.05 (0.28)	0.04 (0.21)				
INFORMATION VALUE					0.30 (1.03)	0.03 (1.18)	0.03 (1.21)	0.03 (1.14)
REPUTATION	0.09 (0.54)	0.21 (1.25)	0.24 (1.45)	0.16 (0.85)	0.11 (0.67)	0.23 (1.43)	0.25 (1.56)	0.17 (0.94)
DIFFICULT HIRE	0.30** (2.21)			0.12 (0.72)	0.31** (2.35)			0.13 (0.82)
RISK		0.05 (0.32)		−0.34 (1.45)		0.08 (0.53)		−0.32 (1.40)
EARLY			0.34*** (2.65)	0.47** (2.45)			0.35*** (2.76)	0.47** (2.48)
log CAPITAL	−0.14 (1.28)	−0.14 (1.21)	−0.17 (1.51)	−0.22* (1.66)	−0.14 (1.28)	−0.14 (1.19)	−0.17 (1.51)	−0.21* (1.64)
DEALS	−0.00 (0.30)	−0.00 (0.16)	−0.00 (0.26)	−0.00 (0.05)	−0.00 (0.39)	−0.00 (0.23)	−0.00 (0.29)	−0.00 (0.10)
HIRINGS	0.08*** (4.62)	0.06*** (3.71)	0.06*** (3.53)	0.07*** (3.71)	0.07*** (4.60)	0.06*** (3.60)	0.05*** (3.49)	0.07*** (3.69)
CONSTANT	−2.50** (1.98)	−1.96 (1.37)	−2.35* (1.87)	−1.39 (0.87)	−2.09** (2.17)	−1.63 (1.43)	−1.81** (1.96)	−0.95 (0.71)
N	56	55	56	55	56	55	56	55
Pseudo-R^2	0.15	0.11	0.16	0.18	0.14	0.10	0.16	0.18
log likelihood	−74.09	−76.14	−72.87	−0.70	−74.54	−76.88	−73.25	−70.56
Wald χ^2	26.30	20.20	28.74	31.37	25.39	18.72	27.97	30.64

*, **, and *** indicate statistical significance levels of 10, 5, and 1%, respectively (two tailed). The dependent variable is the number of managers hired under suggestion of non-partners in the previous 5 years. Independent variables are described in Tables 1 and 5. Variable INFORMATION VALUE is the product of variables SPECIAL SKILLS and MANAGERIAL IMPACT. Estimates come from Poisson regressions. In parentheses are the regression coefficients' z-values.

Table 9
Empirical determinants of the decision to network: suggesting managers

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
SPECIAL SKILLS	0.00 (0.09)	0.01 (0.20)	0.03 (0.41)	0.00 (0.00)				
MANAGERIAL IMPACT	−0.03 (0.25)	−0.08 (0.54)	−0.06 (0.40)	−0.06 (0.37)				
INFORMATION VALUE					0.00 (0.10)	0.00 (0.04)	0.00 (0.29)	−0.00 (0.07)
REPUTATION	0.49*** (4.53)	0.47*** (4.33)	0.50*** (4.65)	0.46*** (4.16)	0.49*** (4.55)	0.48*** (4.40)	0.50*** (4.71)	0.46*** (4.20)
DIFFICULT HIRE	0.12 (1.31)			0.15 (1.58)	0.12 (1.35)			0.15* (1.64)
RISK		0.22*** (2.73)		0.25** (2.16)		0.22*** (2.72)		0.25** (2.16)
EARLY			0.13* (1.81)	−0.01 (0.13)			0.13* (1.80)	−0.01 (0.13)
log CAPITAL	−0.02 (0.29)	−0.01 (0.23)	−0.03 (0.43)	0.01 (0.08)	−0.02 (0.28)	−0.01 (0.22)	−0.02 (0.42)	0.01 (0.09)
N	144	142	144	142	144	142	144	142
Pseudo-R^2	0.07	0.08	0.07	0.09	0.07	0.08	0.07	0.09
log likelihood	−159.96	−155.62	−159.17	−154.37	−159.99	−155.79	−159.29	−154.44
Wald χ^2	25.99	29.84	27.56	32.33	25.93	29.50	27.33	32.20

*, **, and *** indicate statistical significance levels of 10, 5, and 1%, respectively (two tailed). The dependent variable is agreement with the proposition SUGGESTS: *It is common for me to suggest likely managers to others in the private equity business.* Independent variables are described in Tables 1 and 5. Variable INFORMATION VALUE is the product of variables SPECIAL SKILLS and MANAGERIAL IMPACT. Estimates come from ordered probit analysis. In parentheses are the regression coefficients' z-values.

Table 10
Empirical determinants of the number of managers suggested to non-partners

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
SPECIAL SKILLS	−0.28*** (3.02)	−0.14* (1.67)	−0.16* (1.87)	−0.27*** (2.91)				
MANAGERIAL IMPACT	−0.30*** (3.73)	−0.36*** (4.32)	−0.34*** (4.05)	−0.32*** (3.73)				
INFORMATION VALUE					−0.07*** (5.25)	−0.06*** (4.60)	−0.06*** (4.64)	−0.08*** (5.13)
REPUTATION	0.23** (2.24)	0.27*** (2.62)	0.30*** (2.87)	0.20* (1.91)	0.25** (2.45)	0.30*** (2.86)	0.31*** (3.05)	0.23** (2.20)
DIFFICULT HIRE	0.40*** (4.77)			0.44*** (4.81)	0.41*** (5.08)			0.45*** (5.03)
RISK		0.10 (1.26)		0.25* (1.84)		0.12 (1.53)		0.25* (1.86)
EARLY			0.10 (1.52)	−0.15 (1.33)			0.12* (1.90)	−0.14 (1.29)
log CAPITAL	0.01 (0.28)	−0.02 (0.45)	−0.06 (1.24)	0.11 (1.44)	−0.00 (0.02)	−0.05 (0.83)	−0.09 (1.61)	0.08 (1.20)
DEALS	−0.01 (1.29)	−0.00 (0.21)	−0.00 (0.46)	−0.01 (1.10)	−0.01 (1.52)	−0.00 (0.30)	−0.00 (0.52)	−0.02 (1.39)
HIRINGS	0.03*** (3.17)	0.01 (1.29)	0.01 (1.48)	0.03*** (2.79)	0.03*** (3.08)	0.00 (0.85)	0.01 (1.10)	0.03*** (2.68)
CONSTANT	1.18* (1.91)	2.06*** (2.97)	2.38*** (4.05)	0.09 (0.11)	0.05 (0.11)	0.98* (1.64)	1.37*** (2.86)	−1.06 (1.30)
N	50	49	50	49	50	49	50	49
Pseudo-R^2	0.19	0.12	0.13	0.20	0.20	0.12	0.13	0.20
log likelihood	−137.43	−147.23	−148.22	−134.74	−136.39	−147.74	−148.14	−133.84
Wald χ^2	68.68	41.97	47.10	66.95	70.77	40.95	47.27	68.75

*, **, and *** indicate statistical significance levels of 10, 5, and 1%, respectively (two tailed). The dependent variable is the number of managers suggested to non-partners in the previous 5 years. Independent variables are described in Tables 1 and 5. Variable INFORMATION VALUE is the product of variables SPECIAL SKILLS and MANAGERIAL IMPACT. Estimates come from Poisson regressions. In parentheses are the regression coefficients' z-values.

cant, contrary to the predictions of the model. This indicates that the more venture capitalists value unique managerial talent, the less they are willing to suggest managers to the network. In other words, while INFORMATION VALUE has a positive effect on the desire by venture capitalists to use the network for the purposes of hiring, it seems to have the opposite effect on their desire to suggest (rather than try to retain) talented managers. While this result is contrary to our model, it is not surprising. The model does not consider the fact that venture capitalists may wish to reuse managers themselves; incorporating that feature into the model, we conjecture, could explain the incentives of venture capitalists not to suggest managers when those managers possess unique and important talents (which make venture capitalists want to keep those managers for themselves).

6. Conclusion

A significant part of a firm's value depends upon the skills, knowledge and experience of its senior managers. Along with their investment activities, venture capitalists become actively involved within their portfolio companies and acquire non-public information about managerial quality. Venture capitalists have the opportunity to share that information via their participation in a network for hiring skilled managers.

In this study, we examine evidence of the perceived importance of that network in the minds and actions of venture capitalists, and the determinants of their decisions to employ the network for human resource management. We compare that evidence with the predictions of our model of venture capital networking.

In theory, reliance on the network benefits venture capitalists by raising their portfolio companies' productivity, reducing prospective managers' risks and compensation, and reducing the costs of locating senior managers. Through a nationwide survey, we obtained evidence that venture capitalists operate an informal network involved in locating and relocating managers: 77.9% of the respondents agreed with the proposition that venture capitalists operate networks for locating and relocating managers. A majority of the venture capitalists affirm that it is common for them to hire managers under suggestions from their colleagues (62.3%) and to suggest managers (56.2%). Furthermore, 37% affirm that they adopt the strategy of recycling managers.

Interestingly, there is substantial heterogeneity in the intensity with which venture capitalists participate in human resource networks. Econometric analysis of cross-sectional variation gives support to the theoretical reasoning that the intensity with which venture capitalists locate managers through the network is positively influenced by the following factors: (1) the value of the information transmitted though the network (the importance of managerial skill for the portfolio company); (2) the risk of venture capital investments; (3) the size of the venture capital fund; (4) the degree of difficulty in enticing executives to manage companies funded with venture capital; and (5) the reputation of the venture capitalist for successfully recycling managers via the network.

Theoretical and empirical arguments provided in this article support the view that venture capitalists add value by bringing to their portfolio companies the capacity to attract superior management. This indicates that human resources management is one of the keys to understanding the success of the venture capital industry.

Acknowledgements

The authors thank Ivan Bull, Charles Kahn, Stanley Golder, Joshua Lerner, Sherrill Shaffer, Kenneth Kopecky, and two anonymous referees for helpful comments, and are especially grateful

to the venture capitalists who participated in their survey. Carvalho acknowledges financial support from FAPESP (Projeto 03/08825-7) and CNPq (Processo 477572/2003-0). Amaro de Matos acknowledges support from an FCT research grant and INOVA research center.

Appendix A. The model

This model assumes that the venture capitalist has access to a project. In order to undertake it, the venture capitalist needs to hire a manager. We assume that each manager is characterized by his/her type θ. There are two types of managers: good (θ^{G}) and bad (θ^{B}). Neither managers nor venture capitalists know ex ante the managers' type. We also assume that there are two possible outcomes for the project: success and failure. Let V be the value of the project. In case of success $V = S$ and in case of failure $V = F$, with $F < 0 < S$.

Let P_X^Y denote the conditional probability that the event X occurs given that event Y occurred. Assuming that the probability of success depends on the quality of the manager, we take accordingly $P_S^B < P_S^G$.

Managers can be chosen from different sources. Let ω denote the possible sources. In this model we assume that there are only two possible ways of locating managers: through search firms ω^H at a cost C^H, and through the network ω^N at a cost C^N. While C^H is the same for all venture capitalists, C^N varies according to venture capitalists' network connections. P_G^N and P_G^H are the respective probabilities of locating good managers via either the network or via search firms. The relation between P_G^N and P_G^H depends on the belief that each venture capitalist has about the quality of the information transmitted through the network.

Consistent with the fact that managers do not know ex ante their own type, we assume that managers have a reservation salary, R, independent of their types. The manager's future salary in his/her next job depends on whether the project succeeds. The future salary is W, in case of success, and M, in case of failure. In case of failure, venture capitalists who network can assist the manager with job placement. With probability π, this assistance increases the manager's future wealth to $M + I$.[14] This assistance is assumed to be ineffective if the project succeeds. Finally, we assume that the manager's future salary is higher in case of success than in case of failure, i.e., $W > M + I$. This assumption guarantees an incentive for the manager to succeed.

By suggesting managers, venture capitalists incur a cost, C^D, which varies according to venture capitalists' network connections.

Finally, we assume that managers are risk-averse with utility function υ and venture capitalists are risk neutral.[15]

The incentive to network is modeled as the difference between the payoffs received by the venture capitalist when the network is used and the payoff when a headhunter is hired. In our model,

[14] The increase in future wealth can either be due to higher salary in the next job or employment search cost reduction.

[15] The assumption of risk neturality for venture capitalists simplifies the analysis by reducing the venture capitalist's utility from investing in the firm to the expected value of the investment. It is also a realistic assumption. Risk neutrality is tantamount to assuming that venture capitalists value deals based on expected value (in a market sense), not their own particular expected utility. Our model's assumption of risk neutrality realistically reflects the fact that venture capitalists maintain funds, which invest in multiple projects. In that case, even though venture capitalists may be risk-averse, much of the risk they face in a particular investment can be diversified, which implies that their objective will converge to the maximization of expected value (as assumed here) as the number of portfolio companies increases. In the limit, therefore, as venture capitalists diversify their portfolio, they will behave as if they are risk-neutral with respect to individual investments. The same is not true for the managers of portfolio companies because they are highly exposed to firm-specific risk.

the venture capitalist first decides whether or not to participate in the network by hiring suggested managers. If the venture capitalist networks by hiring suggested managers, he/she can then choose between suggesting managers or not. Venture capitalists who actively suggest managers have an advantage when recruiting managers: managers would accept a lower salary, $R-D$, because in case of failure their future wealth will be increased by the venture capitalists' recommendation. The discount D constitutes the venture capitalist' benefit from suggesting managers. Summing up, the manager's present and future salary together sum up to $R+W$, if the firm succeeds and the venture capitalist does not assist managers; $R-D+W$, if the project succeeds and the venture capitalist assists managers; $R+M$, if the firm fails and the venture capitalist does not assist managers with job placement; $R-D+M+I$, if the project fails and the assistance of the venture capitalist is effective; and $R-D+M$, if the project fails and the assistance of the venture capitalist is ineffective.

Therefore, the manager's expected utility when the venture capitalist actively suggests managers is given by

$$E_{\mathrm{N}}(\upsilon) = (1-P_{\mathrm{S}})\,[\pi\upsilon(R-D+M+I)+(1-\pi)\upsilon(R-D+M)]+P_{\mathrm{S}}\upsilon(R-D+W), \tag{1}$$

reflecting the fact that the reservation salary is reduced by D and increased by I when the project fails (with probability π). On the other hand, when the venture capitalist does not suggest managers, the manager's expected utility is given by

$$E_{\mathrm{H}}(\upsilon) = (1-P_{\mathrm{S}})\upsilon(R+M)+P_{\mathrm{S}}\upsilon(R+W). \tag{2}$$

The amount D representing the gain that the venture capitalist has by suggesting managers is implicitly defined by the indifference of managers:

$$E_{\mathrm{N}}(\upsilon) = E_{\mathrm{H}}(\upsilon). \tag{3}$$

Note that condition (3) implicitly defines the equilibrium (optimal) value of D: the venture capitalist will suggest managers whenever the gain from this activity is larger than the cost associated with it, i.e., $D > C^{\mathrm{D}}$. Accordingly, the incentive to suggest managers is given by

$$D - C^{\mathrm{D}}. \tag{4}$$

Next we determine how the incentive to suggest managers varies as a function of the probability of failure, $(1-P_{\mathrm{S}})$, and the value of the assistance, I.

Proposition 1. *The incentive to suggest managers increases with the risk of the project, $1-P_{\mathrm{S}}$.*

Proof. From (1), $\mathrm{d}[E_{\mathrm{N}}(\upsilon)-E_{\mathrm{H}}(\upsilon)]=0$. Thus,

$$\mathrm{d}[E_{\mathrm{N}}(\upsilon)-E_{\mathrm{H}}(\upsilon)] = \frac{\partial[E_{\mathrm{N}}(\upsilon)-E_{\mathrm{H}}(\upsilon)]}{\partial P_{\mathrm{S}}}\mathrm{d}P_{\mathrm{S}} + \frac{\partial[E_{\mathrm{N}}(\upsilon)-E_{\mathrm{H}}(\upsilon)]}{\partial D}\mathrm{d}D = 0.$$

The first derivative is negative, which is the result of a combination of the need to satisfy condition (3) and the fact that $\upsilon(R+W)>\upsilon(R-D+W)$ imply that $\upsilon(R+W)<\pi\upsilon(R-D+M+I)+(1-\pi)\upsilon(\mathrm{R}-D+M)$. Expression (1) also implies that the second derivative is negative. Therefore,

$$\frac{\mathrm{d}D}{\mathrm{d}P_{\mathrm{S}}} < 0 \Rightarrow \frac{\mathrm{d}D}{\mathrm{d}(1-P_{\mathrm{S}})} > 0.$$

Proposition 2. *The incentive to suggest managers increases with the value of the assistance, I.*

Proof. Similar to the proof above, leading to $dD/dI > 0$.

The intuition of these results is straightforward. The value of the assistance depends on how effective it is. Since the assistance with job placement is effective only when the project fails, the higher the chances of failure, the higher the value managers attribute to the assistance and the higher the discount on the reservation salary that they are willing to accept.

Next, we move to the decision of whether to locate managers through the network. The value of the firm, before subtracting the manager's salary $(D - R)$ and the contributed efforts of the venture capitalist $(C^{D} - C^{N})$, is given by $SP_{S} + (1 - P_{S})F$. The probability of success is given by $P_{S} = P_{S}^{G} P_{G} + (1 - P_{G}) P_{S}^{B}$. Taking into account the substitution of the definition of the probability of success, and subtracting the value of the manager's compensation and the effort cost of the venture capitalist results in the following expressions for the expected payoffs to a venture capitalist from choosing to hire, or not hire, managers through the network, and to suggest, or not suggest, managers via the network:

$$(S - F)[(P_{S}^{G} - P_{S}^{B})P_{G}^{N} + P_{S}^{B}] + F - R + D - C^{D} - C^{N}, \tag{5}$$

if the venture capitalist suggest managers, and

$$(S - F)[(P_{S}^{G} - P_{S}^{B})P_{G}^{N} + P_{S}^{B}] + F - R - C^{N}, \tag{6}$$

if the venture capitalist does not suggest managers. The expected payoff of a venture capitalist who hires through search firms is given by

$$(S - F)[(P_{S}^{G} - P_{S}^{B})P_{G}^{H} + P_{S}^{B}] + F - R - C^{H}. \tag{7}$$

Whenever expression (7) is negative and either (5) or (6) is positive, the project will be funded only by venture capitalists who network.If the venture capitalist suggests managers, the incentive to locate managers through the network is given by the difference between (5) and (7) which equals

$$(S - F)(P_{S}^{G} - P_{S}^{B})(P_{G}^{N} - P_{G}^{H}) - C^{N} + C^{H} + D - C^{D}. \tag{8}$$

If the venture capitalist does not suggest managers, the incentive to locate managers through the network is given by the difference between (6) and (7)

$$(S - F)(P_{S}^{G} - P_{S}^{B})(P_{G}^{N} - P_{G}^{H}) - C^{N} + C^{H}, \tag{9}$$

Expressions (8) and (9) show that the incentive to take suggestions can be decomposed into three factors.

1. The term $(S - F)(P_{S}^{G} - P_{S}^{B})(P_{G}^{N} - P_{G}^{H})$ represents how much the venture capitalist values the improvement in the quality of managers when these latter are located through the network, vis-à-vis headhunters (informational gain). The underlying intuition is that locating a good manager is important only if the difference in the productivity of managers $(P_{S}^{G} - P_{S}^{B})$ and the variation in the return of the project $(S - F)$ are large. If $(S - F)$ or $(P_{S}^{G} - P_{S}^{B})$ is small, there is little value in locating good managers.
2. The term $C^{H} - C^{N}$ is related to how easily the venture capitalist can get suggestions.
3. Finally, the term $D - C^{D}$ stands for the gain that the venture capitalist can obtain by assisting managers with job placement as in Eq. (4).

Analysis of expressions (8) and (9) also leads to the following proposition.

Proposition 3. *Firms that would be funded by venture capitalists who network, and not by those who hire through search firms are more likely to be*

(a) *firms that are very risky (projects where $S - F$ is large); and*
(b) *firms for which the difference in managers' productivity is high.*

Also, expressions (8) and (9) allows to conclude the following proposition.

Proposition 4. *Firms that would be funded by venture capitalists who network, and not by those who hire through search firms are more likely to be funded by venture capitalists who*

(a) *believe that managers coming through the network are significantly more efficient ($P_S^G - P_S^B$ is large); and*
(b) *have low networking costs.*

Appendix B. Sample characteristics and possible biases

This appendix describes the sample and discusses the existence of possible biases.

B.1. Characteristics of the sample

The survey included questions to characterize venture capitalists according to five different aspects: (1) the time they had been in the private equity industry; (2) the three types of finance they are most dedicated to; (3) the subjective risk they assess of their investments; (4) the amount of capital their funds have under management; and (5) the number of deals the respondent had done in the previous 5 years.

Among the respondents, 88.4% have been in the private equity business for more than 5 years and 56.8% for more than 10 years (details in Table B1). With respect to size, 27.2% of the

Table B1
Distribution of the respondents according to the number of years in the venture capital industry (variable EXPERIENCE)

EXPERIENCE	Frequency	Valid percentage	Cumulative percentage
0–5	18	11.6	11.6
6–10	49	31.6	43.2
11–15	49	31.6	74.8
16–20	15	9.7	84.5
21–25	10	6.5	91.0
More than 25	14	9.0	100.0
Missing	1	–	
Total	156	100	

respondents manage funds smaller than US$ 50 million and 47.6% less than US$ 100 million (details in Table B2).

Respondents were asked to list the three main types of financing they are involved with. They were given a menu including seed, startup, R&D, first-stage, second-stage, mezzanine, LBO, acquisition financing, control block purchase, industry consolidation, and a blank slot for other

Table B2
Distribution of the respondents according to the amount of capital under management (variable CAPITAL)

CAPITAL[a]	Frequency	Valid percentage	Cumulative percentage
0–25	15	10.2	10.2
26–50	25	17.0	27.2
51–75	8	5.5	32.7
76–100	22	14.9	47.6
101–150	16	10.9	58.5
151–200	19	12.9	71.4
200–300	16	10.9	82.3
More than 300	26	17.7	100.0
Missing	9	–	
Total	156	100	

[a] In millions of dollars.

Table B3
Distribution of the respondents according to the number of early-stage financing out of the three main types of financing (variable EARLY)

EARLY	Frequency	Valid percentage	Cumulative percentage
3	50	32.1	32.1
2	41	26.3	58.4
1	20	12.8	71.2
0	45	28.8	100.0
Missing	0	–	
Total	156	100	

unlisted types of financing.[16] As there is no clear distinction between the types above, we grouped seed, startup, R&D and first-stage in a broader category named *early-stage*. We then classified each venture capitalist according to the number of early-stage financing out of the three main types (variable, EARLY). Table B3 displays the characteristics of venture capitalists according to the type of financing.

Variable RISK is a subjective assessment of the riskiness of venture capitalistsĭ investments. It was obtained by asking the question "*in the realm of venture capital, how would you classify most of your investments (use a scale from 1 for low risk to 5 for high risk)*?" Table B4 presents the distribution of variable RISK. As one can see, it is relatively well distributed over the interval. As expected, variable RISK is strongly correlated with variable EARLY (the correlation coefficient is 0.67).

Finally, Table B5 presents the distribution of venture capitalists according to the number of deals they had made in the previous 5 years. In some cases, the venture capitalists had structured an unusually high number of deals in 5 years (larger than 30). Such large numbers raised suspicion that the data were related to the whole fund rather than to the individual venture capitalist. On phone interviews, some respondents were asked about these numbers. Some reported that they have assistants and trainees of venture capitalists who help them with their activities, nonetheless, the final decisions are taken by the venture capitalist in charge. In other cases, the respondent

[16] This classification was taken from *Venture Economics* (1994).

Table B4
Distribution of the respondents according to the subjective risk of their investment (variable SUBJECTIVE RISK)

SUBJECTIVE RISK	Frequency	Valid percentage	Cumulative percentage
1	7	4.5	4.5
2	23	15.0	19.5
2.5	5	3.2	22.7
3	34	22.1	44.8
3.5	3	2.0	46.8
4	46	29.8	76.6
4.5	3	2.0	78.6
5	33	21.4	100.0
Missing	2	–	
Total	156	100	

Table B5
Distribution of the respondents according to the numbers of deals made in the previous 5 years (variable DEALS)

DEALS	Frequency	Valid percentage	Cumulative percentage
0–5	30	13.9	13.9
6–10	51	35.4	49.3
11–15	23	16.0	65.3
16–20	21	14.6	79.9
21–25	10	6.9	86.8
26–30	16	11.1	97.9
More than 30	3	2.1	100.0
Missing	12	–	
Total	156	100	

indicated that the answer given referred to the whole fund. In such cases, the answer was either corrected or considered blank.

B.2. Possible sampling biases

Most of the questions in the survey are used to explain the cross-sectional variation of the intensity with which venture capitalists network. Therefore, the average answer given to such questions are not a primary concern. However, this is not the case with the questions related to the intensity with which venture capitalists suggest managers to their colleagues (proposition SUGGEST), acting on suggestions when hiring managers (proposition TAKE SUGGESTIONS), and believing that there exists a network (proposition NETWORK). It is desirable to know the accuracy of the average answer and whether it is biased. After all, if only a small proportion of venture capitalists network, then the network itself is of little relevance. The purpose of this section is to investigate the existence and relevance of possible biases.

An ideal investigation of the existence of biases would require detailed statistics about the population of venture capitalists. However, relevant personal information about individual venture capitalists is scarce. As a consequence, there are limited possibilities for controlling the sample.

The only public information about individual venture capitalists is Venture Economics' *Pratts's Guide to Venture Capital Resources* (hereon refereed to as VE). This publication lists all the venture

capital firms in the United States. For each firm, it lists the managers, whom to contact, the type of financing done by the firm, their focus according to industry and geographical preference, the year in which the venture capital firms were funded, and capital under management. The data on capital under management listed in VE, besides not covering all the firms, seems to be of little benefit. For example, it lists venture capital firms managed by several venture capitalists with as little capital under management as US$ 2 million. Also, a comparison between the amount of capital some identified respondents gave and the amount listed in VE shows that the information about capital under management is not accurate.[17] The remarks above make the data on capital under management listed in VE of little use in detecting possible biases.

Of the information available in VE, the type of financing venture capital firms are engaged in seems to be the only useful piece of information for controlling the sample. The survey examines the habits of venture capitalists as human resources managers. This issue seems to be more fundamental in early-stage financing (seed, startup, R&D, first-stage) since a venture capitalist would hardly think of funding a fast-growing firm without considering the eventual need to hire or replace key employees. Therefore, an overrepresentation of early-stage financiers in the sample would not be surprising. Section B.2.1 investigates the existence of an early-stage bias.

A second path for investigating the existence of biases uses the data available in the questionnaires. Venture capitalists were offered a summary of the main findings of the survey. They were also asked if they would be willing to answers a follow-up survey on the telephone. We used this information to rank venture capitalists according to the interest they showed in the survey. It is possible that the interest venture capitalists showed is positively related to the intensity with which venture capitalists network. Therefore, this could be a source of bias to the average answer given to the questions related to the existence of the network. This path is pursued in Section B.2.2

B.2.1. Early-stage bias

To gauge a possible overrepresentation of early-stage financiers among the respondents, we compared the characteristics of the (a) venture capitalists listed in VE; (b) those in the mailing lists (879 venture capitalists); and (c) the respondents (156), with respect to the type of financing they are dedicated to. We encountered difficulty in that there is not a list of types of financing for individual venture capitalists, only for firms. This is a problem because even though a firm may be dedicated to a wide range of types of financing, each of its venture capitalists may be specialized in a particular type. Since in the survey, the respondents answered individually, it is meaningless to fully compare the sample with the set of venture capitalists listed in VE. However, it is possible to compare the proportion of respondents that are dedicated to early-stage financing (those who included in their answers at least one early stage as one of the three most frequent) with the proportion of venture capitalists listed under firms that do at least one early-stage type of financing. If the first proportion is greater than the second, we can conclude that early-stage financiers have more incentive to answer the survey. This would generate a bias[18] toward the opinion of early-stage financiers. The reverse of this proposition is not true.

[17] Two possible source for this discrepancy are (1) that some venture capitalist are listed under more than a single firm consequently, the amount of capital they gave is greater than what is listed, and (2) new funds might have been launched since the time the data for publication was collected.

[18] The assumption here is that the respondents who do early-stage financing are listed under firms that do early-stage financing. Therefore, the proportion of respondents who do early-stage financing should not be greater than the proportion of venture capitalists listed in VE under firms that do early-stage financing.

Table B6
Cross-tabulation: proposition SUGGEST and level of interest showed by respondents (values in parentheses are percentages)

INTEREST	SUGGEST			
	Agreement	Indifference	Disagreement	Total
Survey only	34 (57.6)	15 (25.4)	10 (16.9)	58 (38.1)
Asked summary	15 (53.6)	7 (25.0)	6 (21.4)	28 (18.1)
Offered interview	38 (55.9)	16 (23.5)	14 (20.6)	68 (43.9)
Total	87 (56.1)	38 (24.5)	30 (19.4)	155 (100)

Pearson's chi-square: 0.3985 (4 degrees of freedom) (not significant at the 10% level).

VE lists nearly[19] 2615 venture capital managers.[20] Among those, approximately 1934 (73.9%) are from firms that listed at least one early-stage type of financing. In the mailing list, 73.7% of the addresses were listed under firms that do early-stage financing. Among the respondents, 71.2% listed early-stage types of financing. The similarity of these numbers indicates neither that the mailing list was overweight toward early-stage financiers nor that these venture capitalists were especially motivated to answer the survey. Therefore, there is no evidence of overrepresentation of early-stage financiers in this sample.

B.2.2. Bias due to the motivation of the respondents

The interest that different venture capitalists showed toward the survey can also be a source of bias. It is possible that venture capitalists who network or think that the network exists are more interested in the subject and, therefore, more likely to answer the survey. We measured the interest venture capitalists showed in the survey based on whether the respondent asked for a summary of the survey or agreed to participate through telephone interview.

The group of venture capitalists who agreed to a telephone interview is a subset of those who asked for the summary. This permitted the creation of a variable that captures the interest of the respondents on the object of the survey (variable INTEREST). This variable assumes value 1 for those who only answered the survey; 2 for those who asked for a summary of the main findings; and 3 for those who offered a telephone interview. The cross-tabulation of variable INTEREST and propositions SUGGEST, TAKE SUGGESTIONS, and NETWORK is presented in Tables B6–B8. In these tables, the answers "agree" and "totally agree" were collapsed[21] into a single category "agreement." We repeated this procedure for answers "disagree" and "totally disagree" that were collapsed into category "disagreement." One can note that the average answers vary little with respect to variable INTEREST.

Pearson's chi-square statistics in Tables B6–B8 test the independence between the row and column variables. These statistics give no information about the sign of the relation, if it exists.

[19] The term *nearly* was used because of possible counting errors. Some firms have branches in different states. These firms are listed in all states in which they have branches. Nonetheless, they are fully listed in only one state (in the other states there is a reference to the state where the full listing occurs). To avoid the problem of double counting, we counted only managers from firms where the full listing occurs. This does not avoid the double listing due to venture capitalists associated with different funds. However, the number of cases in which this occurs is a very small.

[20] For each firm there is a list of managers and a list of persons to contact. These two lists do not necessarily coincide. Since the survey is concerned with the habits of the people who structure deals, we used the list of managers, ignoring the list of persons to contact.

[21] This was done to make Pearson's chi-square statistics reliable.

Table B7
Cross-tabulation: proposition TAKE SUGGESTIONS and level of interest showed by respondents (values in parentheses are percentages)

INTEREST	TAKE SUGGESTIONS			
	Agreement	Indifference	Disagreement	Total
Survey only	38 (64.4)	12 (20.3)	9 (15.3)	59 (38.3)
Asked summary	15 (53.6)	11 (39.3)	2 (7.1)	28 (18,2)
Offered interview	43 (64.2)	18 (26.9)	6 (9.0)	67 (43.5)
Total	96 (62.3)	41 (26.6)	17 (11.0)	154 (100)

Pearson's chi-square: 4.5833 (4 degrees of freedom) (not significant at the 10% level).

Table B8
Cross-tabulation: proposition NETWORK and level of interest showed by respondents (values in parentheses are percentages)

INTEREST	NETWORK			
	Agreement	Indifference	Disagreement	Total
Survey only	48 (80.0)	9 (15.0)	3 (5.0)	60 (39.0)
Asked summary	21 (77.8)	5 (18.5)	1 (3.7)	27 (17.5)
Offered interview	51 (76.1)	10 (14.9)	6 (9.0)	67 (43.5)
Total	120 (77.9)	24 (14.6)	10 (6.5)	154 (100)

Pearson's chi-square: 0.8446 (4 degrees of freedom) (not significant at the 10% level).

To be reliable, this test requires the expected frequency of each cell to be greater than 1, and that at most 20% of the cells have the expected frequency less than 5. In none of the three tables, the chi-square statistics rejects the null hypotheses that the variables are independent. Only for variable NETWORK, the chi-square statistics are not reliable (see Table B8).

As an alternative procedure to detect a possible effect on the variable INTEREST, we ran a set of ordered probits using the variable INTEREST as the dependent variable. The explanatory variables are propositions SUGGEST, TAKE SUGGESTIONS, and NETWORK, and a constant. Table B9 summarizes the results of these regressions. None of the parameters estimated are significant (the highest *t*-value obtained was 0.686). Therefore, there is no evidence that the

Table B9
Effects on the interest of the respondents

Regressions	(1)	(2)	(3)	(4)
CONSTANT	0.225 (0.80	0.111 (0.36)	0.197 (0.54)	0.102 (0.251)
SUGGEST	0.033 (0.31)			−0.004 (0.03)
TAKE SUGGESTIONS		0.077 (0.69)		0.076 (0.56)
NETWORK			0.038 (0.317)	0.007 (0.05)
Significance level of the regressions	0.74	0.50	0.75	0.93
Number of correct predictions	66	70	68	70

Estimates are from ordered probit analysis. The dependent variable is the degree of interest the respondents showed in the survey. The variable INTEREST assumes value 2 for those who asked a report and offered for the follow-up survey, 1 for those who asked the report and did not offer for the follow-up and 0 for those who only answered the survey. Values in parentheses are *t-statistics*. The sample in these regressions has 153 observations due to some blank answers.

respondents' opinions about the network have any significant impact on the interest they showed in the survey.

In conclusion, the results of Pearson's chi-square statistics and ordered probit analysis in the sample do not yield any evidence that the interest venture capitalists showed in the survey was influenced by the attitude they have toward networking.

References

Admati, A. R., & Pfleiderer, P. (1994). Robust financial contracting and the role of venture capitalists. *Journal of Finance*, (June), 371–402.

Amit, A. R., Glosten, L., & Muller, E. (1990). Entrepreneurial ability, venture investments, and risk sharing. *Management Science*, (October), 1232–1245.

Baker, M., & Gompers, P. (1999). *An analysis of executive compensation, ownership, and control of closely held firms* (Harvard Business School working paper).

Barry, C. B. (1994). New directions in research on venture capital finance. *Financial Management*, (Autumn), 3–15.

Black, B. S., & Gilson, R. J. (1998). Venture capital and the structure of capital markets: Banks versus stock markets. *Journal of Financial Economics*, (March), 243–277.

Byers, B. (1997). Relationship between venture capitalist and entrepreneur. In *Pratt's guide to venture capital resources*. Wellesly Hills, MA: Venture Economics.

Bygrave, W., & Timmons, J. (1992). *Venture capital at the crossroads*. Boston: Harvard Business School Press.

Chan, Y. (1983). On the positive role of financial intermediation in allocations of venture capital in a market with imperfect information. *Journal of Finance*, (December), 1543–1561.

Cornelli, F., & Yosha, O. (1997). *Stage financing and the role of convertible debt* (CERP Discussion Paper No. 1735).

Gompers, P. A. (1995). Optimal investment, monitoring, and the staging of venture capital. *Journal of Finance*, (December), 1461–1489.

Gompers, P. A., & Lerner, J. (1997). Venture capital and the creation of public companies: Do venture capitalists really bring more than money? *Journal of Private Equity*, (Fall), 15–32.

Gompers, P. A., Lerner, J., & Scharfstein, D. S. (2005). Entrepreneurial spawning: Public corporations and the genesis of new ventures, 1986–1999. *Journal of Finance*, *60*(2), 577–614.

Hellmann, T. (1998). The allocation of control rights en venture capital contracts. *RAND Journal of Economics*, *29*, 57–76.

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

Hellmann, T., & Puri, M. (2002). Venture capital and the professionalization of start-up firms: empirical evidence. *Journal of Finance*, (February), 169–197.

Hochberg, Y., Ljungqvist, A., & Lu, Y. (2004). *Who you know matters: Venture capital networks and investment performance* (Working paper). Stern School of Business.

Hsu, D. H. (2004). What do entrepreneurs pay for venture capital affiliation? *Journal of Finance*, *59*, 1805–1844.

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

Lerner, J. (1995). Venture capital and the oversight of the private firms. *Journal of Finance*, *50*, 301–318.

Lerner, J. (1994). The syndication of venture capital investments. *Financial Management*, (Autumn), 16–27.

Marx, L. (1998). Efficient venture capital financing combining debt and equity. *Review of Economic Design*, *3*, 371–387.

Repullo, R., & Suarez, J. (2000). *Venture capital finance: A security design approach* (CEMFI working paper).

Sahlman, W. A. (1990). The structure and governance of venture capital organizations. *Journal of Financial Economics*, (October), 473–521.

Sorenson, O., & Stuart, T. (2001). Syndication networks and the spatial distribution of venture capital investments. *American Journal of Sociology*, *106*(6), 1546–1588.

Venture Economics. (1988). *Venture capital performance: Review of the financial performance of venture capital partnerships*. Needham, MA: Author.

Venture Economics. (1994). *Pratt's guide to venture capital sources*. New York, NY: Author.