

Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence

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ABSTRACT

This paper examines the impact venture capital can have on the development of new firms. Using a hand-collected data set on Silicon Valley start-ups, we find that venture capital is related to a variety of professionalization measures, such as human resource policies, the adoption of stock option plans, and the hiring of a marketing VP. Venture-capital-backed companies are also more likely and faster to replace the founder with an outside CEO, both in situations that appear adversarial and those mutually agreed to. The evidence suggests that venture capitalists play roles over and beyond those of traditional financial intermediaries.

IN THIS PAPER, WE SET OUT to empirically examine whether venture capitalists play a role in the professionalization of start-up companies. We use a unique hand-collected data set of Silicon Valley start-ups that allows us to observe aspects of the internal organization of firms. We find that venture capitalists play a role at the top of the organization, in terms of replacing the original founders with an outside CEO. Moreover they seem to influence developments further down the organization, in terms of playing a role for the introduction of stock option plans, the hiring of a VP of sales and marketing, and the formulation of human resource policies.

Traditional financial intermediation theory tends to focus on information-based roles of financial intermediaries, dealing with the alleviation of moral hazard or adverse selection (Diamond (1984), Fama (1985), Stiglitz (1985)).

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An informal literature suggests that the role of venture capitalists extends beyond that of traditional financial intermediaries like banks, and that they play a broader role in the professionalization of the companies they finance (Gorman and Sahlman (1989), Bygrave and Timmons (1992)). Zingales (2000) emphasizes that human capital is central to the development of new firms. This paper therefore empirically examines the hypothesis that venture capitalists foster the development of human resources in start-ups. In particular, we ask if there is any evidence that venture-capital-backed start-ups are different from other start-ups in the way that they professionalize their human capital base.

Using a combination of survey data, interview data, commercial databases, and a large variety of publicly available information, we construct a data set of over 170 young high-technology firms in Silicon Valley. Not only do we observe information about the top of the organization, such as the date of arrival of an outside CEO, but we also obtain information on human resource issues deeper down into the organization. Moreover, we obtain the financing history of companies, including if and when they obtain venture capital. One of the strengths of the data set is that it has information on both venture capital and non-venture-capital-backed firms, and it allows us to examine the role of venture capital looking at a variety of tests and a variety of data types, such as survey responses, as well as actual event data.

Theories of financial intermediation emphasize the monitoring role, where financial intermediaries gather information about the firms they finance. The question we are interested in is whether, as financial intermediaries, venture capitalists perform additional roles. Economic theory can provide us with some useful concepts that have been somewhat underexplored in the empirical corporate finance literature. First, there is the notion of support where the investor can take actions that are privately costly, but that benefit the company. Second, there is the notion of control where there is a conflict of interest between the entrepreneur and the investor, and where the investor can take an action that increases the value of the firm, although it may decrease the utility of the entrepreneur.

As a first step in the analysis, we ask if venture capitalists provide support in building up the internal organization. We examine a variety of evidence, such as the recruitment processes, the overall human resource policies, the adoption of stock option plans, and the hiring of a vice president of marketing and sales. For each of these dimensions, we find that companies that obtain venture capital are more likely and/or faster to professionalize along these various dimensions. This provides evidence for a role of venture capital, in terms of providing support for building up the internal organization.

The next step is to look at the very top of the organization, namely at the question of who gets to be the CEO. We find that, in venture-capital-backed companies, a founder is more likely to be replaced by an outsider as CEO. Venture-capital-backed companies are also faster in effectuating such leadership changes. Furthermore, our analysis tries to differentiate between turnovers where the investor takes a supportive versus a controlling role. For

this, we ascertain whether founders remain with the company or leave after the arrival of the outside CEO. We find that venture capital is associated with both types of events, suggesting that venture capitalists can take both supportive and controlling roles.

The final step of the analysis is to understand the interactions between the various roles played by venture capitalists. We find that there are only mild and statistically insignificant interaction effects between the role of venture capitalists at the top and further down the organization. However, there are some important development stage effects. To attract a new CEO, venture capital is particularly important for early stage companies that do not have any signs of success, still important for companies with a product on the market, and no longer important by the time companies have gone public.

We believe this paper addresses new questions that have not received much attention in the literature, namely the role that financial intermediaries play in building new companies, and the process by which resources are put together. Our approach relates the issue of financing to the theory of the firm (see Hart (1995), Bolton and Scharfstein (1999)). Prior evidence on the role of venture capital in start-ups has been largely related to the monitoring function in venture capital (see, e.g., Gompers (1995) and Lerner (1995)). These papers use samples that contain only venture-capital-backed firms. As a consequence, they rely on changes over time and differences within venture-capital-backed firms, as opposed to differences between venture-capital- and non-venture-capital-backed firms. These papers do not consider the support function of venture capital on team building or CEO turnover that we characterize in this paper. Other related papers on venture capital include Kaplan and Strömberg (2000a, 2000b). The first paper examines the structure of venture capital contracts. The second paper looks at investment memoranda to gauge venture capitalists' expectations at the time of funding, and finds that venture capitalists expect to help companies with managerial recruitment. Their findings about the ex ante stage are strongly complementary to our findings of what venture capitalists do ex post.¹ Our paper is also related to the large literature on corporate governance and CEO turnover. The work of Kaplan and Minton (1994), Kang and Shivdasani (1997), and others highlight the importance played by financial institutions (such as banks) in the corporate governance of the firm (see Shleifer and Vishny (1997) for a useful survey). Baker and Gompers (1998) examine governance issues in a sample of companies that are successful and go public. Largely because of the unavailability of data on private companies, the previous literature focuses mostly on larger, more established companies that are publicly listed, or that are in the process of listing or delisting. Interestingly, our results demonstrate that the effects that venture capitalists have on their

¹ Further useful discussions on contracting and functions of venture capital can be found in Sahlman (1990), Bygrave and Timmons (1992), Admati and Pfleiderer (1994), Barry (1994), and Fenn, Liang, and Prowse (1995).

companies are strongest precisely at the earlier stages when companies are not publicly listed.

Overall, the evidence provided in this paper suggests that a closely involved financial intermediary, such as a venture capitalist, can play roles over and above those commonly discussed in the literature. Most theoretical work emphasizes the role of financial intermediaries in overcoming moral hazard and adverse selection problems. In the context of financing start-ups, however, we find that a closely involved investor can have a broader impact on the development of the companies they finance, suggesting that there are value-added inputs that venture capitalists provide that go beyond that suggested by traditional financial intermediation theory. It is our hope that these findings are useful in guiding future theoretical and empirical work in this area.

The remainder of the paper is structured as follows. Section I describes the data. Section II examines the role of venture capitalists further down the organization. Section III looks at the role of venture capital for CEO turnover. Section IV attempts to distinguish between a supporting and controlling role of venture capital. Section V examines the state-contingent nature of venture capital involvement. Section VI examines the robustness of our results, focusing on endogeneity and selection biases. Section VII concludes.

I. The Data

To conduct this study, we use a unique hand-collected data set of start-ups in Silicon Valley culled from a combination of survey data, interviews, and commercial databases as well as publicly available data. The data set is collated from combining two independent research efforts conducted over a period of several years, starting in 1994. The initial sample selection of Silicon Valley firms and data collection was organized by Baron, Burton, and Hannan (1996a, 1996b, 1999), which we supplemented in 1996 and 1997 by an additional financing survey and related data collection.² To generate the initial list of companies, three main data sources were used. The first two databases that listed firms in Silicon Valley were: *Rich's Everyday Sales Prospecting Guide*, published by Rich's Guide, and *Technology Resource Guide to Greater Silicon Valley*, published by CorpTech. A stratified random sample was selected where firms could have a legal age no older than 10 years and had to have more than 10 employees. Moreover, young and large firms were oversampled and foreign firms were excluded. The Silicon Valley business press was used as a third data source to identify very young firms that were

² A more detailed description of the sampling procedures and their rationale can be found in Burton (1996) and in Baron, Burton, and Hannan (1996a, 1996b). These papers are based on a first round of interviews of some 100 companies that were performed in the summer of 1994. A second round of interviews was conducted in the summer of 1995 and follow-up interviews were conducted in the summer of 1996. This paper obviously uses the updated information. Where possible, we also augmented the publicly available information up to the end of our observation period, which we defined to be October 1997.

not even listed in the two databases mentioned above, and supplement the sample. The purpose of doing this was to alleviate concerns that relying exclusively on guidebooks such as Rich's and CorpTech to construct the sample might underrepresent new start-ups, since there is sometimes a considerable time lag before newly created firms appear in these guidebooks. Hence, the sample was supplemented by adding on 22 very young firms identified by tracking the Silicon Valley business press.

Our sample consists of 173 start-up companies that are located in California's Silicon Valley. To collect the data, surveys that included a wide range of questions about historic and current aspects of the companies were sent to different key people in the firms. Further, trained MBA and Ph.D. students conducted semistructured interviews with key informants from the sample companies. An effort was made to interview the founders, the current CEO, and the human resource manager for each company. This data was then augmented with any information provided by the company (such as a business plan). Additionally, publicly available information about each of the firms in the study was gathered from on-line data sources such as LEXIS-NEXIS, Dialog, Business Connection, and ABI INFORM. Further, for firms that had gone public, annual reports and 10-K or IPO prospectuses (where available) were also collected and used to augment the data. To obtain financing data, from October 1996 to October 1997 we sent out a survey addressed to the most senior member of the company in charge of finance. The survey asked for a complete financing history of the company since the time of founding. The information was augmented with data available from two commercial databases, Venture Economics and Venture One, largely for the purpose of ascertaining which firms in our sample received venture capital.³ We performed additional cross-checks on the data using the interview transcripts, researching public sources, and placing calls to the companies to resolve remaining ambiguities. We also continued to augment the data coming in from the companies, again using public information as well as the interview and survey material. Considerable emphasis was put on measuring the timing of events such as the date of founding, the timing of all financing rounds, or the date of CEO turnover.

In what follows below we describe the main variables and the way they are defined and collated. Table I shows the descriptive statistics.

Turnover is a dummy variable that takes the value 1 if a firm hired an outside CEO and 0 otherwise. An outsider is any person that is not one of the original founders. If one founder replaces another founder as CEO, he or she is not considered an outsider. We obtain this data from the interviews, surveys, and from publicly available data. *Time-to-turnover* measures the time from the birth of the company to the date of arrival of the first outside

³ See Lerner (1995) for a discussion of the Venture Economics database and Gompers and Lerner (2000) for a discussion of the Venture One database. We found 107 of the sample companies in Venture One and 95 were found in Venture Economics. Sixty-six companies (38 percent) replied to our financing survey.

Table I
Descriptive Statistics

This table provides descriptive statistics of variables used in the paper. *Turnover* is a dummy variable that takes the value 1 if a firm hired an outside CEO and 0 otherwise. *VC* is a dummy variable that takes the value 1 if a firm has received venture capital and 0 otherwise. *VC(T)* is a dummy variable that takes the value 1 if the company obtained venture capital before the date of the first CEO turnover and 0 otherwise. *Recruit(SA)*, *recruit(AM)*, and *recruit(SM)* are dummy variables that take the value 1 if a firm reported to use business and professional contacts to recruit sales and marketing personnel (SA), administrative and managerial personnel (AM), or senior managers (SM), respectively, and 0 otherwise. *HRpolicy* is a dummy variable that takes the value 1 if a firm reported their venture capitalists or other financiers influential in shaping human resource management and 0 otherwise. *Computer*, *telecom*, and *medical* are dummy variables that take the value 1 if the firm is in the computer, telecommunications, or medical-related industries, respectively, and 0 otherwise. *Other* is a dummy variable for other industries. *Sample-age* is the age of the company at the time of sampling. *LNage* is the natural logarithm of the age of the company at the end of the sample period, in October 1997.

	Number of Observations	Mean Full Sample	Mean VC Sample	Mean Non-VC Sample
<i>Turnover</i>	170	0.5352941	0.6153846	0.3584906
<i>VC</i>	170	0.6882353	1	0
<i>VC(T)</i>	170	0.6470588	0.9401709	0
<i>Recruit(SA)</i>	99	0.7676768	0.8133333	0.6250000
<i>Recruit(AM)</i>	100	0.7100000	0.8000000	0.4400000
<i>Recruit(SM)</i>	100	0.7600000	0.8133333	0.6000000
<i>HRpolicy</i>	92	0.4347826	0.5362319	0.1304348
<i>Computer</i>	170	0.4882353	0.4700855	0.5283019
<i>Telecom</i>	170	0.2000000	0.2393162	0.1132075
<i>Medical</i>	170	0.1411765	0.1709402	0.0754717
<i>Other</i>	170	0.1705882	0.1196581	0.2830189
<i>Sample-age</i>	170	6.707927	6.65238	6.830548
<i>LNage</i>	170	2.255077	2.251118	2.263818

CEO. We succeeded in obtaining reliable data for all but three companies, so that our base sample consists of 170 companies.

VC is a dummy variable that takes the value 1 if a firm has received venture capital and 0 otherwise. From the interviews, surveys, and commercial databases, we identify which firms are financed by venture capitalists and the timing of such financing. Venture capitalists are professional investors who specialize in the financing of young private companies. We also create other venture-capital-related variables based on the timing of the venture capital. *Time-to-VC* measures the time from the birth of the company to the date of obtaining venture capital for the first time. *VC(T)* is a dummy variable that takes the value 1 if the company obtained venture capital before the date of the first CEO turnover. And *VC(t)* is a time-varying dummy variable that takes the value 0 as long as a firm has no venture capital, and 1 thereafter.

Recruit(SA), *recruit(AM)*, and *recruit(SM)* are dummy variables that take the value 1 if a firm reported the use of business and professional contacts

to recruit sales and marketing personnel (SA), administrative and managerial personnel (AM), or senior managers (SM), respectively, and 0 otherwise. We obtain these variables from a survey that was sent to the most senior person in charge of human resources.

HRpolicy is a dummy variable that takes the value 1 if a firm reported “venture capitalists or other financiers” to be “influential in shaping human resource management”; 0 otherwise. We obtain this variable from a survey that was sent to the most senior person in charge of human resources, which asked them about their recruitment and selection practices.

Time-to-sales-VP measures the time from the birth of the company to the first date of appointing a vice president of sales and marketing. We obtain this data from survey responses, interviews, and publicly available information.

Time-to-option-plan measures the time from the birth of the company to the date of implementing a stock option plan. We obtain this variable from a survey that was sent to the most senior person in charge of human resources, which asked them about compensation eligibility.

State is a variable that describes three distinct stages in which a company may be. The company may have gone public and we call this state *IPO*. The company may have a product but not have gone public. We call this state *product*. Or the company may neither have a product nor have gone public, and we call this state *nothing-to-show*. We evaluate the state at the time of a turnover or else at the end of the sample period. We obtain information on whether a firm has a product on the market and the timing of doing so from a targeted survey question to the company. We augment this information with publicly available data on the company’s product, using in particular the earliest mention of a product in Rich’s guide or other public sources. The IPO dates are obtained from publicly available sources such as a company’s prospectus, and from Securities Data Company’s (SDC) New Issues database.

Computer, *telecom*, and *medical* are dummy variables that take the value 1 if the firm is in the computer, telecommunications, or medical-related industries, respectively, and 0 otherwise. *Other* is a dummy variable which takes the value 1 if the firm is in another industry (mostly semiconductors) and 0 otherwise.

LNage is the logarithm of the age of the company in October 1997 measured from the birth date of the company. The date of legal incorporation is often taken as the birth date for companies and would appear to be a natural choice. However, for entrepreneurial firms this is far from obvious. In particular, in our sample, over half of the companies had some other significant event that preceded the date of incorporation, such as the beginning of normal business operations or the hiring of a first employee. Moreover, there does not appear to be any clear sequence of events that these companies follow in this initial period of creation. In this paper, we therefore take a conservative approach and use the earliest date recorded in any of our data sources corresponding to the earliest evidence of firm activity as the date of birth. Also, *sample-age* is the age of the company at the time of sampling, measured from the date of birth of the company.

II. Venture Capital and Team Building

As companies develop from being start-ups to becoming large complex organizations, attracting highly talented employees becomes a key challenge. The development of human resource functions, broadly defined, thus becomes an important aspect of professionalization, especially in high-technology sectors where human capital is critical. The question we ask is whether venture capitalists take any role in the professionalization of the firms. In traditional financial arrangements, investors concern themselves mostly with the financial aspects of the firm, but leave matters of internal organization to the entrepreneurs. The notion of venture capitalists being closely involved investors suggests that they may even go as far as helping companies with their internal organization, including their human resource management.

To address this question we look at a variety of evidence. We use both survey data on firms' perception of venture capitalist's influence as well as data on events relating to the venture capitalists' influence on the achievement of professionalization milestones. These approaches complement each other in terms of using very different kinds of data to address the role of venture capital in multiple dimensions. In this section, we will examine how venture capital is related to the kind of recruitment processes that firms undertake, how firms view venture capital's contribution to the human resource development process, and how venture capital affects the timing of a key professionalization events in the company such as the introduction of a stock option plan or the hiring of a vice president of marketing and sales.

The process of building up the internal organization, and, in particular, the employee base of a company, begins with the recruitment process. We first ask whether venture-capital-backed firms use different processes to hire various kinds of employees. We use evidence from the human resource surveys that ask firms what contacts they use in their recruitment process. We identify those firms that report the use of business and professional contacts for the recruitment of various positions. This could include (but is not limited to) the use of professional agencies but would rule out, say, simply recruiting from employees' own contacts. Using business and professional contacts reveals whether a firm has reached a certain level of professionalization in terms of how it interacts with its business environment. It also reveals something about the commercial as opposed to purely technical orientation of the firm. Obviously, investors themselves are also part of this network of business and professional contacts, but the survey question aims at the overall process that the firm is using for recruitment.

The variables *recruit(SA)*, *recruit(AM)*, and *recruit(SM)* capture whether a firm reported using business and professional contacts for recruiting sales and marketing personnel (SA), administrative and managerial personnel (AM), and senior management (SM), respectively. We examine if the firm's approach to recruiting is related to whether it received venture capital or not, as measured by the VC dummy variable. We first perform χ^2 tests and find significant positive correlations with *p*-values of 5.7 percent, 0.1 percent,

and 3.1 percent, respectively. The χ^2 tests are useful for identifying a correlation between venture capital and the recruitment variables, but they do not control for other factors. We therefore move to a multivariate probit regression framework, where we control for firm characteristics, in particular firm age (*LNage*) and the firm's industry. The results are reported in Table II. We find that the coefficient on *VC* tends to be not only statistically significant, but also economically large. A venture-capital-backed firm is significantly more likely to use business and professional contacts for recruiting sales and marketing personnel, as well as for recruiting administrative and managerial personnel. This is also the case for recruiting senior management, although this coefficient is only marginally significant at 14 percent.

Together these results suggest that obtaining venture capital is related to how firms recruit personnel, and that venture-capital-backed firms make greater use of business and professional contacts for recruiting, especially for recruiting deeper down into the organization. While venture capitalists are part of that network, we would argue that the evidence should be interpreted conservatively, indicating an overall pattern of firm conduct, rather than a specific contribution of venture capital.

To address the contribution of venture capitalists more directly, we use a different part of the human resource survey that asks specifically about the contribution of the investors to the development of human resource policies. The variable *HRpolicy* measures whether a firm reported if investors (venture capitalists or other financiers) were influential in shaping the human resource policies of the company. We examine the relationship of this variable to obtaining venture capital. The χ^2 test shows a positive correlation that is significant at 0.1 percent. Again, we then examine the effect of venture capital in a probit framework that controls for age and industry. We find that venture capital is strongly associated with the financier playing an influential role in the shaping of human resource policies. The marginal increase in the likelihood is 48 percent, which is significant at 1 percent (see Table III). This evidence thus suggests that in the eyes of the entrepreneurs, venture capitalists exert influence on the internal organization of the firm.

The survey evidence of the entrepreneurs' perception is important, but for further confirmation we also want to examine evidence on realizations of what actually happens within the firms. For this we look at the timing of certain milestone events that occur within the organization. We examine if and when companies adopt stock option plans and we look at the first hiring of a vice president of marketing and sales (see also Kaplan and Strömberg (2000b) for the role of venture capital in recruiting). Stock option plans are important for a variety of reasons. They help attract talent to the firm, they provide incentives for the employees within the firm, and they may help to retain employees (see, e.g., Saxenian (1994)). Stock options are also a sign of professionalization, in that they formalize the incentive contract between the owners of the firm and its employees. The data on the hiring of a vice president of sales and marketing are interesting for two related reasons. First, they provide us concrete evidence on a specific aspect of team build-

Table II
Recruitment Practices

These tables present results from probit regressions. The dependent variables are *recruit(SA)*, *recruit(AM)*, and *recruit(SM)*, which are dummy variables that take the value 1 if a firm reported to use business and professional contacts to recruit sales and marketing personnel (SA), administrative and managerial personnel (AM), or senior managers (SM), respectively, and 0 otherwise. The independent variables are *VC*, which is a dummy variable that takes the value 1 if a firm has received venture capital and 0 otherwise; *LNage*, which is the natural logarithm of the company's age; and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. Marginal increase measures the change in probability of the dependent variable to a change in the independent variable implied by the probit coefficients evaluated at the sample mean. *T*-ratios are computed using White's heteroskedasticity-adjusted standard errors. Model *p*-value reports the joint significance of the coefficients of the independent variables. Pseudo- $R^2 = 1 - \log L/\log L_0$, where $\log L$ is the maximized value of the log-likelihood function; $\log L_0$ is the log-likelihood computed only with a constant term.

Independent Variables	Marginal Increase in Probability	Coefficients	<i>T</i> -ratio
Panel A: Dependent Variable: <i>Recruit(SA)</i>			
<i>VC</i>	0.2553321**	0.7683741**	2.238
<i>LNage</i>	0.0289683	0.0980365	0.235
<i>Computer</i>	-0.0687642	-0.2302481	-0.526
<i>Telecom</i>	-0.1962421	-0.5976361	-1.196
<i>Medical</i>	-0.2464134	-0.7245992	-1.394
Constant	NA	0.3248034	0.310
Number of firms = 99	Pseudo- $R^2 = 0.0578$	Model <i>p</i> -value = 0.3211	
Panel B: Dependent Variable: <i>Recruit(AM)</i>			
<i>VC</i>	0.4366999***	1.217822***	3.628
<i>LNage</i>	0.1830012	0.5588965	1.340
<i>Computer</i>	-0.0033167	-0.010125	-0.023
<i>Telecom</i>	-0.2692377	-0.7508911	-1.476
<i>Medical</i>	-0.073619	-0.2160782	-0.395
Constant	NA	-1.360384	-1.324
Number of firms = 100	Pseudo- $R^2 = 0.1409$	Model <i>p</i> -value = 0.0073	
Panel C: Dependent Variable: <i>Recruit(SM)</i>			
<i>VC</i>	0.1470161	0.4673383	1.475
<i>LNage</i>	-0.2855742**	-0.9850359**	-2.241
<i>Computer</i>	-0.0243882	-0.08374	-0.217
<i>Telecom</i>	0.122029	0.4725722	0.933
<i>Medical</i>	0.1560752	0.6494414	1.235
Constant	NA	2.526699**	2.469
Number of firms = 100	Pseudo- $R^2 = 0.1103$	Model <i>p</i> -value = 0.0501	

** or *** mean that the coefficient is significant at the five percent or one percent levels, respectively.

Table III
Human Resource Policies

This table presents results from probit regressions. The dependent variable is *HRpolicy*, which is a dummy variable that takes the value 1 if a firm reported their venture capitalists or other financiers influential in shaping human resource management and 0 otherwise. The independent variables are *VC*, which is a dummy variable that takes the value 1 if a firm has received venture capital and 0 otherwise; *LNage*, which is the natural logarithm of the company's age; and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. Marginal increase measures the change in probability of the dependent variable to a change in the independent variable implied by the probit coefficients evaluated at the sample mean. *T*-ratios are computed using White's heteroskedasticity-adjusted standard errors. Model *p*-value reports the joint significance of the coefficients of the independent variables. Pseudo- $R^2 = 1 - \log L / \log L_0$, where $\log L$ is the maximized value of the log-likelihood function; $\log L_0$ is the log-likelihood computed only with a constant term.

Dependent Variable: <i>HRpolicy</i>			
Independent Variables	Marginal Increase in Probability	Coefficients	<i>T</i> -ratio
<i>VC</i>	0.4770777***	1.533646***	3.633
<i>LNage</i>	-0.2894254	-0.7450183	-1.566
<i>Computer</i>	-0.1444156	-0.3752523	-0.843
<i>Telecom</i>	-0.3212045*	-0.9405605*	-1.868
<i>Medical</i>	-0.3175812*	-0.9387685*	-1.797
Constant	NA	0.8677364	0.713
Number of firms = 92	Pseudo- $R^2 = 0.1703$	Model <i>p</i> -value = 0.0055	

* or *** mean that the coefficient is significant at the 10 percent or 1 percent levels, respectively.

ing. Second, the position of marketing and sales is of particular importance, since it holds responsibility for pushing a commercial orientation in the start-up, which is a significant aspect of professionalization.

The evidence on stock option plans or hiring of a VP concerns the timing of these events. We therefore need to examine our data in a duration framework. A standard way of dealing with duration data is employing a hazard model (see Kalbfleisch and Prentice (1980) and Kiefer (1988)). We can choose from a number of parametric models (such as Weibull) or we can use a semi-parametric model. We choose a Cox proportional hazard model, which is a parsimonious semiparametric model, and a common choice for modeling duration. The duration model also lets us explicitly take into account the fact that venture capital is obtained by different companies at different points in time. For robustness, we reran all our tests using a Weibull model, which is a fully parametric model, and obtained similar results. In the Appendix, we provide a brief explanation of these estimation techniques.

Table IV reports the results from our duration regression where the independent variable is *time-to-option-plan*, which measures the time between the birth of the company and the time the company adopts a stock option.

Table IV
Adoption of Stock Option Plans

This table presents the results from a Cox regression with time-varying covariates. The dependent variable is *time-to-option-plan*, which measures the time from the birth of a company to the date of implementing a stock option plan. The independent variables are $VC(t)$, which is a time-dependent dummy variable that takes the value 0 as long as a firm has not received venture capital and 1 thereafter; and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. If the dependent variable is observed without any realization, it is treated as a censored event. Model *p*-value reports the joint significance of the coefficients of the independent variables.

Cox Regression; Dependent Variable: <i>Time-to-option-plan</i>			
Independent Variables	Hazard Ratio	Coefficient	T-ratio
<i>VC(t)</i>	2.060956**	0.72317**	2.468
<i>Computer</i>	1.796011	0.5855683	1.515
<i>Telecom</i>	2.264658*	0.8174239*	1.878
<i>Medical</i>	1.264736	0.2348633	0.515
Number of firms = 95	Model <i>p</i> -value = 0.0318		

* or ** mean that the coefficient is significant at the 10 percent or 5 percent levels, respectively.

The independent variables are industry controls and the time-varying *VC* dummy. The duration model explicitly takes into account the timing of events. Thus, if venture capital is obtained after the stock option plan is adopted, we take the company as not having venture capital prior to the adoption of the stock option. We find that obtaining venture capital is associated with a significant increase in the likelihood of adopting a stock option plan. The hazard ratio is slightly greater than two, indicating that venture-capital-backed firms are more than twice as likely to adopt a stock option plan. This result is significant at 2 percent.

Table V reports the results from our duration regression, where the independent variable is *time-to-sales-VP*, which measures the time from the birth of the company to the first date of appointing a vice president of sales and marketing. The dependent variables are industry controls and the time-varying *VC* dummy. We find that obtaining venture capital is associated with a significant increase in the likelihood of appointing a vice president of sales and marketing. The hazard ratio is 1.79, and this result is significant at 2 percent.

The results from Tables IV and V show that firms that obtain venture capital are more likely (or faster) to professionalize. If we put this evidence together with our previous evidence, a picture emerges where venture capitalists are closely involved investors who influence the professionalization of the internal organization of firms. Our data stems from different sources. We ask for firms' perception of the influence of venture capital but also

Table V
The Hiring of a Vice President of Sales and Marketing

This table presents the results from a Cox regression with time-varying covariates. The dependent variable is *time-to-sales-VP*, which measures the time from the birth of a company to the first date of appointing a Vice President of sales and marketing. The independent variables are $VC(t)$, which is a time-dependent dummy variable that takes the value 0 as long as a firm has not received venture capital and 1 thereafter; and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. If the dependent variable is observed without any realization, it is treated as a censored event. Model *p*-value reports the joint significance of the coefficients of the independent variables.

Cox Regression; Dependent Variable: <i>Time-to-sales-VP</i>			
Independent Variables	Hazard Ratio	Coefficient	T-ratio
<i>VC(t)</i>	1.793032**	0.5839081**	2.399
<i>Computer</i>	1.167236	0.1546387	0.489
<i>Telecom</i>	1.167798	0.1551197	0.401
<i>Medical</i>	1.175999	0.1621181	0.446
Number of firms = 99	Model <i>p</i> -value = 0.1530		

** means that the coefficient is significant at the five percent level.

complement this with event-based data. Each of our individual tests concerns aspects of the internal organization that are quite distinct, and they use very different kinds of data. Yet all of our results show that venture capital is associated with each of these aspects of professionalization. While one may have reservations about the significance of any one of these individual tests, the consistency of this finding across different tests using different kinds of data is quite remarkable.

III. Venture Capital and CEO Turnover

The evidence in the previous section shows that venture capitalists play a role in building the internal organization, and specifically the human resources, of the companies they finance. An important question is whether venture capital affects the leadership at the very top of the organization. Presumably one of the most important positions in any company is the position of CEO. This person has a particularly large role in building up all aspects of the company. To begin with, the founders naturally take the leadership position in their own company. While founders may be very suited for the initial phases, not all founders can make the transition from entrepreneur to manager. It could be that as companies develop, they could benefit from bringing in an outsider for the position of CEO. Bringing in an outside CEO thus constitutes a significant step in the professionalization of a start-up company.

The transition from founder to outside CEO, however, is not always simple. Some founders may be glad to have an experienced outsider take the leadership position in their new firm, so that they can focus on other aspects of their start-up. For other founders, however, there may be an issue with relinquishing control to an outsider. While the entrepreneurs may be interested in the maximization of their own benefits (which includes not only the profitability of the firm, but also the various private benefits), the investors are solely concerned with the maximization of shareholder value. This in turn suggests that founders and investors may disagree on the desirability of appointing an outside CEO. Hellmann (1998) develops a formal model of this conflict of interest that suggests that the allocation of control rights is important. In particular, Hellmann shows that efficient contracts may allocate control to the venture capitalists over the decision to hire an outside CEO. Kaplan and Strömberg (2000a) provide empirical evidence from venture capital contracts indicating that a significant number of control rights are allocated to the venture capitalists.

We examine whether venture capitalists are more likely to bring an outsider into the position of CEO. To address this question, we collect evidence on whether and when a company experienced its first turnover of CEO. The variable *turnover* is a dummy variable that takes the value 1 if a company has experienced the replacement of a founder with an outside CEO and 0 otherwise. In measuring the possible effect of venture capital on turnover, we are careful to verify that the turnover event does not precede the venture capitalists. We therefore use $VC(T)$ as the dependent variable, which is the VC dummy, only altered so that it is 0 if venture capitalists first appear after a turnover event. We first perform a χ^2 test and find a positive correlation between venture capital and turnover that is significant at five percent. We then examine a probit regression that also controls for firm age and industry. From Table VI, Panel A, we see that the replacement of a founder with an outside CEO is more likely for firms that have venture capital, with the coefficient of venture capital being significant at eight percent.

The probit regression does not take into account the timing of the events. We therefore also examine a Cox duration regression. The independent variable is now *time-to-turnover*, which measures the time from the birth of the company to the first date of appointing an outside CEO. The dependent variables are venture capital as a time-varying dependent dummy variable, as well as industry controls. Table VI, Panel B, shows a hazard ratio of 2.32, indicating that firms are more than twice as likely to have a turnover event once they have venture capital. This is significant at one percent. The duration regression thus shows that obtaining venture capital is associated with a higher rate at which firms bring in an outside CEO. Another way of expressing this is to note that the likelihood rate is inversely related to the expected duration. With venture capital, the expected time it takes a firm to bring in an outside CEO is reduced.

The analysis in this section suggests that obtaining venture capital is associated with a higher likelihood of appointing an outsider to the position of CEO. Both the probit and the duration model suggest that the advent of a

Table VI
The Hiring of an Outside CEO

Panel A presents the results from a probit regression. The dependent variable is *turnover*, which is a dummy variable that takes the value 1 if a firm hired an outside CEO and 0 otherwise. The independent variables are *VC*, which is a dummy variable that takes the value 1 if a firm has received venture capital and 0 otherwise; *LNage*, which is the natural logarithm of the company's age; and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. Marginal increase measures the change in probability of the dependent variable to a change in the independent variable implied by the probit coefficients evaluated at the sample mean. *T*-ratios are computed using White's heteroskedasticity-adjusted standard errors. Model *p*-value reports the joint significance of the coefficients of the independent variables. Pseudo- $R^2 = 1 - \log L/\log L_0$, where $\log L$ is the maximized value of the log-likelihood function; $\log L_0$ is the log-likelihood computed only with a constant term.

Panel B presents the results from a Cox regression with time-varying covariates. The dependent variable is *time-to-turnover*, which measures the time from the birth of the company to the date of arrival of the first outside CEO. The independent variables are *VC(t)*, which is a time-dependent dummy variable that takes the value 0 as long as a firm has not received venture capital and 1 thereafter, and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. If the dependent variable is observed without any realization, it is treated as a censored event.

Panel A: Probit Regression; Dependent Variable: <i>Turnover</i>			
Independent Variables	Marginal Increase in Probability	Coefficients	<i>T</i> -ratio
<i>VC(T)</i>	0.1503328*	0.3793667*	1.780
<i>LNage</i>	0.3336875***	0.8401538***	2.770
<i>Computer</i>	0.0464849	0.1171207	0.421
<i>Telecom</i>	0.0565826	0.1432936	0.439
<i>Medical</i>	0.2057749	0.5439469	1.467
Number of firms = 170	Pseudo- $R^2 = 0.0623$	Model <i>p</i> -value = 0.0157	
Panel B: Cox Regression; Dependent Variable: <i>Time-to-turnover</i>			
Independent Variables	Hazard Ratio	Coefficient	<i>T</i> -ratio
<i>VC(t)</i>	2.317916***	0.8406685***	3.395
<i>Computer</i>	1.164512	0.152302	0.495
<i>Telecom</i>	1.099037	0.094434	0.284
<i>Medical</i>	1.488202	0.3975686	1.105
Number of firms = 170	Model <i>p</i> -value = 0.0047		

* or *** mean that the coefficient is significant at the 10 percent or 1 percent levels, respectively.

venture capitalist significantly increase the chances that the firm will go beyond its original founder to lead the firm. This evidence thus suggests that venture capitalists play an important role in the professionalization of top leadership.

IV. Support Versus Control in CEO Turnovers

The results from the previous section suggest that venture capitalists play a significant role in bringing outsiders into the position of the CEO. An interesting question arises: How we should interpret this evidence? Different founders may have different attitudes toward bringing in an outside CEO. Some founders may want to focus their attention on other aspects of the business and may be glad to relinquish management control to a professional CEO. In this case, they may seek help from their investors in finding and convincing a new CEO to come on board. The venture capitalists can lend support to the process, which would point towards a cordial role for venture capitalists. Other founders, however, may not be inclined to relinquish management control. In this case, there may be a role for the venture capitalists to take a control action, replacing the founder with an outsider in the position of CEO. This points towards an adversarial role for the venture capitalist.

While the concepts of support and control are not directly observable, one may attempt to find an empirical proxy. We consider what happens to the founders after the arrival of the new CEO. If the founder were willing to relinquish management control, we would expect a smooth transition, where the founder continues to be involved with the start-up after the arrival of the new CEO. The founder may want to focus on a variety of roles, such as taking leadership on the technological side (e.g., becoming the Chief Technology Officer), focusing on business development (e.g., becoming the VP of corporate development), or simply playing a role on the board of directors. But if the venture capitalists need to take a control action to induce an involuntary turnover, we would expect a separation between the founder and the start-up.⁴

We therefore gathered additional evidence on whether the founder continues to be involved with the start-up after the arrival of the outside CEO. We speak of an “accommodating” turnover if the founder retains some position in the start-up and a “separating” turnover if the founder leaves from all positions in the company. Accommodating turnovers point toward a situation where the founders are willing to work with an outside CEO and the investors play a supporting role, in terms of facilitating the transition. Separating turnovers, however, point more toward a situation where the arrival of the new CEO implies the departure of the founder, and where the investors play a controlling role.

Out of a total of 91 turnovers observed over the entire sample, we find that in 38 cases (i.e., in a little over 40 percent), the founders remained involved in their companies. Clearly both types of turnover are important.

⁴ We are careful about the fact that just leaving the company is not synonymous with a “separating” turnover. If a founder voluntarily leaves to pursue other interests, it is common practice that the founder resigns from all management positions, but retains a seat on the board of directors. This signals the amicable nature of the departure and we therefore think of it as an “accommodating” turnover. It is only when we observe no ties at all with the company that we consider a turnover “separating.”

The question is, then, whether venture capitalists are associated with a particular type of turnover event. Table VII looks at a breakdown of the effect of venture capital on turnover into accommodating and separating turnovers. Panels A and B of Table VII consider separating turnovers by excluding all those turnover events where the founder stayed with the start-up. And Panels C and D consider accommodating turnovers, by excluding all those turnover events where the founder left.⁵ The results are very similar across the two subsamples and the full sample. The evidence suggests that venture capitalists play an important role for both types of turnover.

V. The State-contingent Nature of Venture Capital Involvement

So far we have seen evidence that suggests that venture capitalists get involved with the professionalization of start-up firms, and that there can be different facets to this involvement. On the one hand, venture capitalists frequently concern themselves with inducing leadership changes at the top of the organization. On the other hand, they are involved in team building and professionalization further down in the organization. Presumably venture capitalists would want to play all of these roles in the companies they finance, but we may ask if there are interrelationships between those roles, and in what development stages these roles matter most.

We first ask about the interrelationships between the venture capitalists' roles. To examine this issue, we divide our sample into two subsamples: firms that experience a CEO turnover and those that do not. We then rerun our regressions from Section II for those two subsamples. Panels A–C of Table VIII show the results for the two subsamples where the dependent variables are *recruit(SA)*, *recruit(AM)*, and *recruit(SM)*, respectively. Table VIII, Panel D shows the results for the turnover and no turnover sample when the dependent variable is *HRpolicy*. Table VIII, Panels E and F, show the results for the two subsamples where the dependent variable is *time-to-option-plan* and *time-to-sales-VP*, respectively. In each case, the difference between the VC coefficients in the two subsamples is statistically not significant. We may thus conclude that venture capitalists play similar roles across the two subsamples. This implies that there are no strong interactions between the roles at the top and further down the organization.

However, the data also suggest some mild differences between the two subsamples. In general, we find that the venture capital variable tends to be somewhat larger and somewhat more significant in the sample where no turnover occurred. It is possible that venture capitalists do not have the time to fix things both at the top and further down in the organization. Another potential reason may be that in order to reach further down in the organization, the venture capitalist needs to work with the CEO. If there are problems working with the founder on professionalizing the company, then

⁵ Because there are fewer observations, there is a slight loss of power in the probit regressions. The coefficients, however, remain very similar. And the results in the duration model remain statistically significant even for these smaller samples.

Table VII
Separating versus Accommodating CEO Turnovers

Panel A presents the results from a probit regression for separating turnovers, that is, the subsample of firms excluding turnovers where the founder stays with the company after the hiring of the new CEO. The dependent variable is *separating turnover*, which is a dummy variable that takes the value 1 if a firm hired an outside CEO and the founder left from all positions in the company and 0 otherwise. The independent variables are *VC*, which is a dummy variable that takes the value 1 if a firm has received venture capital and 0 otherwise; *LNage*, which is the natural logarithm of the company's age; and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. Marginal increase measures the change in probability of the dependent variable to a change in the independent variable implied by the probit coefficients evaluated at the sample mean. *T*-ratios are computed using White's heteroskedasticity-adjusted standard errors. Model *p*-value reports the joint significance of the coefficients of the independent variables. Pseudo- $R^2 = 1 - \log L / \log L_0$, where $\log L$ is the maximized value of the log-likelihood function; $\log L_0$ is the log-likelihood computed only with a constant term.

Panel B presents the results from a Cox regression with time-varying covariates for separating turnovers. The dependent variable is *time-to-separating-turnover*, which measures the time from the birth of the company to the date of arrival of the first outside CEO. The independent variables are *VC(t)*, which is a time-dependent dummy variable that takes the value 0 as long as a firm has not received venture capital and 1 thereafter; and *computer*, *telecom*, and *medical*, which are dummy variables that take the value 1 if the firm is in the computer, telecommunication, or medical industries, respectively, and 0 otherwise. If the dependent variable is observed without any realization, it is treated as a censored event.

Panel C presents the results from a probit regression for accommodating turnovers, that is, the subsample of firms excluding turnovers where the founder does not remain with the company after the hiring of the new CEO. The dependent variable is *accommodating-turnover*, which is a dummy variable that takes the value 1 if a firm hired an outside CEO and the founding CEO remained with the company in some position and 0 otherwise. Other factors are as in Panel A.

Panel D presents the results from a Cox regression with time-varying covariates for accommodating turnovers. The dependent variable is *time-to-accommodating turnover*, which measures the time from the birth of the company to the date of arrival of the first outside CEO. Other factors are as in Panel B.

Panel A: Probit Regression; Dependent Variable: *Separating-turnover*

Independent Variables	Marginal Increase in Probability	Coefficients	<i>T</i> -ratio
<i>VC(T)</i>	0.1417989	0.3755078	1.529
<i>LNage</i>	0.3678022	0.956066***	2.728
<i>Computer</i>	-0.0360922	-0.093886	-0.304
<i>Telecom</i>	0.0070556	0.018314	0.051
<i>Medical</i>	0.110693	0.2819777	0.646
Number of firms = 132	Pseudo- $R^2 = 0.0621$	Model <i>p</i> -value = 0.0524	

Panel B: Cox Regression; Dependent Variable: *Time-to-separating-turnover*

Independent Variables	Hazard Ratio	Coefficient	T-ratio
<i>VC(t)</i>	2.421437***	0.8843611***	2.789
<i>Computer</i>	0.8456732	-0.1676223	-0.450
<i>Telecom</i>	0.9173724	-0.0862418	-0.214
<i>Medical</i>	1.050463	0.0492313	0.110
Number of firms = 132	Model <i>p</i> -value = 0.0748		

Panel C: Probit Regression; Dependent Variable: *Accommodating-turnover*

Independent Variables	Marginal Increase in Probability	Coefficients	T-ratio
<i>VC(T)</i>	0.1375467	0.4015431	1.464
<i>LNage</i>	0.2161565	0.6120532	1.536
<i>Computer</i>	0.1661263	0.4751503	1.186
<i>Telecom</i>	0.144969	0.3915009	0.830
<i>Medical</i>	0.3756906**	0.9884206**	2.033
Number of firms = 117	Pseudo- <i>R</i> ² = 0.0759	Model <i>p</i> -value = 0.0453	

Panel D: Cox Regression; Dependent Variable: *Time-to-accommodating-turnover*

Independent Variables	Hazard Ratio	Coefficient	T-ratio
<i>VC(t)</i>	2.670197***	0.9821523***	2.528
<i>Computer</i>	2.007404	0.6968424	1.137
<i>Telecom</i>	1.756776	0.5634801	0.834
<i>Medical</i>	3.749152**	1.32153**	1.987
Number of firms = 117	Model <i>p</i> -value = 0.0026		

** or *** mean that the coefficient is significant at the 5 percent or 1 percent levels, respectively.

Table VIII
The Interaction of Team-building and CEO Turnover

Panels A–C report regressions that are identical to those presented in Table II, Panels A–C, except that the regressions are run in two subsamples: The sample of companies that experienced a turnover, and those that did not experience a turnover. Panels D, E, and F reports regressions that are identical to the one presented in Tables III, IV, and V respectively, with the caveat—the regressions are run in two subsamples: The sample of companies that experienced a turnover, and those that did not experience a turnover.

Independent Variables	If <i>Turnover</i> = 1		If <i>Turnover</i> = 0	
	Coefficient	<i>T</i> -ratio	Coefficient	<i>T</i> -ratio
Panel A: Probit Regression; Dependent Variable: <i>Recruit(SA)</i>				
<i>VC</i>	0.7888307	1.530	1.126228**	2.040
<i>LNage</i>	0.3765616	0.677	−0.2494935	−0.353
<i>Computer</i>	0.0557878	0.098	−0.6133305	−0.854
<i>Telecom</i>	0.0615289	0.101	−1.633219*	−1.916
<i>Medical</i>	−0.4010684	−0.658	−0.8711714	−1.047
Constant	−0.8229447	−0.560	1.560968	0.823
Number of firms	58		41	
Pseudo- <i>R</i> ²	0.0488		0.1862	
Model <i>p</i> -value	0.6506		0.2309	
Panel B: Probit Regression; Dependent Variable: <i>Recruit(AM)</i>				
<i>VC</i>	1.082398**	2.154	1.928223***	3.266
<i>LNage</i>	0.7272306	1.317	0.6991546	1.046
<i>Computer</i>	0.6879628	1.215	−0.9699655	−1.255
<i>Telecom</i>	−0.1905132	−0.326	−1.530711*	−1.691
<i>Medical</i>	0.3404197	0.533	−0.8229691	−0.980
Constant	−2.266388	−1.562	−1.262842	−0.707
Number of firms	59		41	
Pseudo- <i>R</i> ²	0.1090		0.3057	
Model <i>p</i> -value	0.2139		0.0111	
Panel C: Probit Regression; Dependent Variable: <i>Recruit(SM)</i>				
<i>VC(T)</i>	0.0889817	0.187	1.117654**	2.160
<i>LNage</i>	−0.4718662	−0.944	−1.762467**	−2.190
<i>Computer</i>	−0.0971634	−0.174	−0.9243682*	−1.740
<i>Telecom</i>	0.1947836	0.311	◦	◦
<i>Medical</i>	0.7652766	1.071	−0.1568579	−0.223
Constant	1.674619	1.279	4.567973**	2.484
Number of firms	59		41	
Pseudo- <i>R</i> ²	0.0560		0.2577	
Model <i>p</i> -value	0.6732		0.0092	

continued

Table VIII—Continued

Independent Variables	If Turnover = 1		If Turnover = 0	
	Coefficient	T-ratio	Coefficient	T-ratio
Panel D: Probit Regression; Dependent Variable: <i>HRpolicy</i>				
<i>VC</i>	1.407048*	1.851	1.544036***	2.877
<i>LNage</i>	-1.269377**	-2.031	-0.40047	-0.612
<i>Computer</i>	-1.255746**	-2.084	0.1366377	0.222
<i>Telecom</i>	-1.493856**	-2.341	-0.8016821	-1.060
<i>Medical</i>	-1.388619**	-2.193	-1.155917	-1.293
Constant	2.842274*	1.751	-0.1776248	-0.106
Number of firms	50		42	
Pseudo- R^2	0.1672		0.2490	
Model p -value	0.0507		0.0308	
Panel E: Cox Regression; Dependent Variable: <i>Time-to-option-plan</i>				
<i>VC(t)</i>	0.5558378	1.429	1.069102**	2.230
<i>Computer</i>	-0.2730287	-0.589	1.646073**	2.360
<i>Telecom</i>	-0.2024297	-0.399	2.756569***	3.717
<i>Medical</i>	-0.3692889	-0.682	0.7241106	0.816
Number of firms	57		38	
Model p -value	0.5246		0.0001	
Panel F: Cox Regression; Dependent Variable: <i>Time-to-sales-VP</i>				
<i>VC(t)</i>	0.6608867**	2.302	0.6812879	1.545
<i>Computer</i>	0.4171708	1.087	-0.3671893	-1.064
<i>Telecom</i>	0.3453134	0.796	-0.4343757	-0.591
<i>Medical</i>	0.2986724	0.723	-0.3646467	-1.073
Number of firms	66		33	
Model p -value	0.1937		0.4089	

° To run the probit, we had to drop the *telecom* dummy variable, since it predicted success perfectly. We reran the regression dropping all the *telecom* observations with similar results. *, **, or *** mean that the coefficient is significant at the 10 percent, 5 percent, or 1 percent levels, respectively.

the venture capitalist brings in a new CEO.⁶ But in either case, the differences are not pronounced, suggesting that venture capitalists provide a fairly consistent role across companies, helping develop human resources. This is

⁶ To further examine this interpretation, we also reran the regressions of Table VIII, conditioning the subsamples on whether there was a separating turnover. We again found similar results, which is consistent with the notion that there are some conflicts between founders and venture capitalists. Note also that this interpretation is consistent with the notion that venture capitalists professionalize companies by making them less dependent on their founders. What matters is not so much whether the founder is replaced, but whether (s)he is replaceable. See also Rajan and Zingales (1999) and Zingales (2000).

consistent with the ex ante evidence in Kaplan and Strömberg (2000b) that venture capitalists expect to play a role in developing the managerial team.

Next we ask at what stages venture capitalists focus on founder replacements. For instance, is it possible for a company to attract an outside CEO if it has yet to prove its viability? While it may be important for a company to get an outside CEO in the earlier stages of development, it may also be harder for the company to attract a CEO before reaching key milestones, such as having a product on the market or even going public.

To examine how turnovers are related to the underlying state of the company, we unfortunately do not have the benefit of any reliable performance data. Since we sample private companies, there are no stock prices, and we do not have balance sheet or profit-and-loss statements for our sample companies. To measure the state that a company is in, we therefore have to use a very coarse yet fairly intuitive measure. In particular, we identify three distinct stages in the development of the company. A first important milestone in the development of a start-up is to bring a product to market (see also Hellmann and Puri (2000)). Prior to having a product on the market, there is considerable uncertainty about the viability of a company's business plan. As such, we can think of a company without a product on the market as being in a more fragile position than those with a product on the market. A second important milestone is when a company goes public. To go public, a company has to meet many criteria that provide some assurances about its viability and quality. We thus distinguish between three states. If a firm has gone public, we call the state *IPO*; if it has a product on the market, we call the state *product*; and if the firm has neither a product on the market, nor has it gone public, we call the state *nothing-to-show*. We evaluate the state of the company at the time of the first turnover or otherwise at the end of the sample period.

We divide our sample into three subsamples and ask whether the rate of turnover is similar across these subsamples. We find that the rates are very similar with the difference not being statistically significant. This, however, does not yet reveal anything about whether venture capitalists behave distinctly in those different states. For that, we rerun the results from Section III to examine when the effect of venture capital on turnover is particularly important. Table IX shows the results from both the Probit and the Cox regressions for the respective subsamples. Both of these two estimation models show the same pattern. The effect of venture capital is strongest for companies that have nothing to show yet, is still strong for companies with a product on the market, and it becomes insignificant for companies that have already gone public. These results suggest that there is some state-contingency to the exercise of control by venture capitalists. If the company is already well on track and the founders can point to having achieved some milestones, venture capitalists are not more likely than other investors to replace the founders with an outside CEO. But in those states where the company does not have much to show, venture capitalists play a significant role in attracting professional CEOs.

Table IX
The State-contingent Effects in CEO Turnover

Panels A and B report regressions that are identical to the one presented in Table VI, Panels A and B respectively, except that the regressions are run in three subsamples: the sample of companies that experienced clear sign of success, such as an IPO; the sample of firms that have some sign of progress, such as a product on the market; and those who have no concrete evidence of progress, that is, neither IPO nor product.

Independent Variables	<i>IPO State</i>		<i>Product State</i>		<i>Nothing-to-show State</i>	
	Coefficient	<i>T</i> -ratio	Coefficient	<i>T</i> -ratio	Coefficient	<i>T</i> -ratio
Panel A: Probit Regression; Dependent Variable: <i>Turnover</i>						
<i>VC(T)</i>	-0.459174	-0.579	0.5471696**	1.923	2.308881***	3.362
<i>LNage</i>	1.051509	1.475	1.430092***	3.329	1.338967	1.513
<i>Computer</i>	-0.939615	-1.164	0.4613404	1.284	0.9386687	1.199
<i>Telecom</i>	-0.4654517	-0.598	0.824938*	1.697	-1.54289*	-1.740
<i>Medical</i>	-0.0422916	-0.050	0.6905522	1.157	1.318186	1.386
Constant	-1.661827	-0.831	-3.801519***	-3.568	-3.891526*	-1.820
Number of firms	45		96		29	
Pseudo- <i>R</i> ²	0.2433		0.1464		0.3877	
Model <i>p</i> -value	0.1136		0.0038		0.0040	
Panel B: Cox Regression; Dependent Variable: <i>Time-to-turnover</i>						
<i>VC(T)</i>	0.3406719	0.416	1.064003	3.448***	2.588803***	4.095
<i>Computer</i>	-0.8007438	-1.095	0.4468177	1.191	1.319213*	1.831
<i>Telecom</i>	-0.0765131	-0.096	0.7163346	1.587	-0.9661981	-0.779
<i>Medical</i>	0.0294689	0.045	0.5817608	1.063	2.651634***	2.983
Number of firms	45		96		29	
Model <i>p</i> -value	0.6481		0.0022		0.0003	

* or *** mean that the coefficient is significant at 10 percent or 1 percent levels, respectively.

We also reran those regressions for accommodating and separating turnovers, and obtained very similar results. Separating turnovers of companies with few signs of success might be a manifestation of a company in trouble. In this case, the evidence suggests that venture capitalists are particularly good at imposing control if the firm is in a difficult state.⁷ And the result on accommodating turnovers in companies with few signs of success suggests that venture capitalists may allow companies to attract a new CEO in a fragile state when other companies have greater difficulty in accessing outside CEOs.

This last result also highlights the importance of our overall approach of looking at nonpublic companies. In fact, we find that the effect of venture capital is much more pronounced when companies are still private. Hence,

⁷ This effect is along the lines of the theory of contingent control by Aghion and Bolton (1992).

looking only at companies when they are public can obscure some of the important contributions that investors can have on the companies they finance.

VI. Robustness Checks and Alternative Explanations

In this section, we discuss some robustness checks as well as some alternative explanations of our results.

A concern with the data is potential survivorship bias, since companies are not sampled at birth. A number of arguments, however, suggest that this survivorship bias is relatively minor. First, in terms of sampling design, a particular effort was made to include many young companies, precisely to reduce any survivorship bias. As a consequence, our sample captures firms at a much earlier stage than most other databases. Further, unlike many other studies in finance relating to venture capital, ours is able to sample companies independent of their financial choices. In fact, our sampling criterion is essentially based on the existence of the company, and not on any endogenous financial measure. In particular, our sampling criteria is not affected in any way by the firm getting venture capital. Second, a number of companies fail within our sample and we estimate a probit to see if the probability of failing is systematically related to any known characteristic. We find that neither the presence of venture capital, age of the firm, turnover, nor industry effects are statistically significant in predicting exit from the sample. The within-sample behavior thus suggests that survivorship issues are unlikely to have a major effect on our results. Another potential issue could be that the companies in our sample are unusually successful, as 82 out of 170 companies go public in our dataset. This is a little higher than the average IPO rate of venture capital investments, which (based on Venture Economics) is around 30 percent for the industries and time period we consider. We therefore reran our regressions on the subsample of companies that did not go public. We found that the effect of venture capital was qualitatively similar and sometimes quantitatively even stronger.⁸

A second concern with the survey evidence might be that of response bias. Not all firms responded to our survey questions, raising the question of whether there is any systematic bias in our responses that might affect some of our results. Our main survey question asks firms whether investors (venture capitalists or other financiers) were influential in shaping the human resource policies of the firm. Our results here are robust if we include only those firms where we know there is an external investor. We also do selectivity adjustments to correct for potential response bias (see Greene (1997)). We implement selectivity adjustments in the following manner. First, we estimate a probit where the dependent variable is 1 if we obtained a re-

⁸ Related to this, we also examined the issue that our results might be affected by the fact that a few companies in our sample do not obtain any external financing. All the results in the paper are qualitatively similar if we limit our sample to include only those firms where we know that there is an external investor.

sponse from the firm on our survey question and 0 otherwise. The independent variables include *VC*, *turnover*, *LNage*, and industry controls. We use the estimates of the coefficients in the probit equation to form the expected value of the residuals, conditional on obtaining a response. This is the inverse Mills ratio. In the second step, we rerun the regression in Table III where the dependent variable is *HRpolicy*, but now additionally include the inverse Mills ratio obtained from the first step regression. We find that even after taking this selectivity correction into account, the coefficient on *VC* is positive and significant, suggesting that our results are not being driven by response bias.⁹

A natural question to ask about our results is whether selection might play a role. There are two kinds of selection that might occur. The first kind of selection, which is entirely consistent with our results, arises in an equilibrium where entrepreneurs choose their investors on the basis of the support they expect to receive. In such an equilibrium, venture capitalists provide a greater level of support, and firms pick venture capital expecting to receive such support in equilibrium. Selection of this kind would only reinforce the positive role of venture capital that we identify.

A somewhat different question, however, is whether the observed effect on professionalization is *only* due to the selection of companies venture capitalists finance, and the actual presence of the venture capitalist per se has no effect at all. There are two main ways to deal with this type of selection bias. One can deal with it econometrically in a regression framework. Alternatively, one can deal with it through the experiment design, by having a number of different tests and data and checking the consistency of all the results with alternate explanations.

We deal with selection bias econometrically in two ways. The first way is through selectivity methods. We can account for the possibility that obtaining venture capital is based on observable characteristics by doing a Heckman correction. This involves regressing whether the firm obtains venture capital or not on known characteristics such as age and industry. We use the estimates of the probit to form estimates of the inverse Mills ratio. We substitute the *VC* dummy variable with the inverse Mills ratio in the probit regressions of turnover, teambuilding, etc. Our results are qualitatively similar, suggesting that selection on observables is not driving our results. Alternatively, if one examines the probit regression of venture capital, the firm's industry is the only significant variable. Roughly half of our sample is in the computer industry. Hence a clean way to account for such selection is to rerun all our regressions in the computer industry. Again, our results are qualitatively similar.

A second way of dealing with the issue of alternative explanations, such as selection, is through the experiment design, by creating a number of tests

⁹ We also perform similar selectivity bias adjustments for the survey questions that deal with recruitment from business and professional contacts. The results are again quite similar, suggesting that our survey results are not being driven by response bias.

with different kinds of data and checking the consistency with various explanations. Any alternate explanation, including one based on selection, would have to explain all our results. It is unclear how some of the results, such as the state-contingent nature of CEO turnovers, and the substitutability between CEO replacement versus team building could be explained on the basis of selection alone. Further, one of the advantages of this paper is that it uses different kinds of data to get at the same set of issues. For example, the result on the recruitment process could be affected by selection: It might be that venture capitalists prefer to invest in companies that also have a professional recruitment process. But the selection argument does not apply to the results on human resource policies, since the survey question explicitly asked for the influence that investors have. For the CEO turnover results (as well as the other timing events), the issue of selection is somewhat different. One of the strengths of the duration analysis is that it explicitly takes timing into account. In all our duration models, venture capital pre-dates the occurrence of the events. The only way that selection effects would enter here is through expectations of future events. But if anything, this kind of selection should affect our results in the opposite way. If there were an anticipation of a future replacement of the founder with an outside CEO, then we would expect those entrepreneurs who are most at risk to be less likely to select venture capital. The point that selection alone cannot account for the observed pattern is further corroborated by the fact that we continue to find a strong venture capital effect when we examine only those turnovers where there is a separation of the founders from their own firms.¹⁰

VII. Conclusion

In this paper, we examine the hypothesis that venture capitalists play a role beyond the traditional roles of financial intermediaries. We provide evidence for the role of venture capital in the professionalization of start-up companies. Obtaining venture capital is related to a variety of organizational milestones, such as the formulation of human resource policies, the adoption of stock option plans, or the hiring of a VP of sales and marketing. Firms with venture capital are also more likely and faster to replace the founder with an outsider in the position of the CEO. Interestingly, however, founders often remain with the company, even after the CEO transition. The effect of venture capital is also particularly pronounced in the early stages of a company's development.

¹⁰ Another related concern may be that there could be some interrelated contracting, where the acceptance of a new CEO is conditional on obtaining venture capital, or vice versa. In this case, we would expect the new CEO to appear around the time venture capital is obtained. Out of a total of 91 companies that had a turnover event, only three occurred in a six-month window around the date of obtaining venture capital and six in a one-year window. This suggests that the results are not due to conditional contracts, where the turnover event is an automatic consequence of obtaining venture capital.

The paper is of interest to the growing literature on the theory of firm, providing evidence on a question that has received surprisingly little attention so far, namely the process by which resources are put together into a new firm. The paper contributes to the large literature on corporate governance, which has tended to focus on large, public companies. In contrast, our analysis shows that the effect of venture capitalists in corporate governance is important particularly when companies are still private. And the paper speaks to the large literature on the role of financial intermediaries. This literature generally documents that financial intermediaries play a monitoring role, gathering information about individual firms. This paper, as well as complementary work by Hellmann and Puri (2000) and Kaplan and Strömberg (2000a, 2000b, 2001), suggests that at least in the context of venture capital, investors can play a much larger role.

The fundamental insight that there is more to venture capital than money and monitoring suggests some new research direction. On a theoretical level, we need to recognize that investors may gather information not merely *about* firms, but also *for* firms. When modeling financial intermediaries, it is important to capture these support functions wherein venture capitalists exert costly effort to give inputs, which increase the value of the firm. On the empirical side, this line of research raises a number of interesting questions. To what extent do other financial intermediaries, especially banks, provide similar support functions? And to what extent does this depend on the economic environment (e.g., whether banks can or cannot hold equity)? This paper hopes to provide a starting point for further theoretical and empirical research on these important questions.

Appendix

A standard procedure for dealing with duration data is to employ a hazard model (see Kalbfleisch and Prentice (1980), Kiefer (1988)). To proceed, we have to specify the exact nature of our hazard model. We can choose from a number of parametric models (such as Weibull) or we can use a semiparametric model. The parametric models are attractive because of their simplicity, but by imposing as much structure as they do, the models can distort the estimated hazard rate. Since fewer restrictions can result in a more accurate representation, we use the Cox proportional hazard model, a common choice among researchers for modeling duration. The formal model is

$$h(t) = h_0(t)\exp\{\beta'X(t)\}. \quad (\text{A1})$$

Cox's partial likelihood estimator does not impose any structure on the baseline hazard, $h_0(t)$, and provides a way of estimating β without requiring estimates of $h_0(t)$. Suppose the complete durations are ordered $t_1 < t_2 < \dots < t_n$. The risk set with respect to any moment of time is the set of firms that have not yet exited just prior to that time. The conditional probability that

observation i exits at time t_i , given that any of the observations in the risk set R_i could have been concluded at duration t_i , is

$$\frac{\exp\{\beta'X_i(t)\}}{\sum_{j \in R_i} \exp\{\beta'X_j(t)\}}. \quad (\text{A2})$$

This conditional probability is independent of the baseline hazard function. The partial log likelihood is

$$\ln L = \sum_{i=1}^n \left[\beta'X_i - \sum_{j \in R_i} \exp\{\beta'X_j\} \right]. \quad (\text{A3})$$

Technically, this is for the simplest case where exactly one firm exits at each distinct time and there are no censored observations. The partial log likelihood can handle censoring easily, which is one of the features of our data. An observation whose spell is censored between duration t_j and t_{j+1} appears in the summation in the denominator of the likelihood function of observation i through j , but not in any others, and does not enter in the numerator. To account for the fact that the same firm can appear repeatedly in the risk pools, we compute standard errors as in Lin and Wei (1989).

Note that the dependent variable can vary over time, a feature that we will use in our estimation. We report both the coefficients and the hazard ratios (i.e., the relative risks). A positive coefficient on x implies a higher x is linked to a higher hazard rate and thus a lower expected duration. For ease of interpretation, we also give the hazard ratios. The hazard ratio tells us how much the hazard (i.e., the instantaneous risk) of the event increases for a unit change in the independent variables. In the case of a dummy variable, this is equal to the ratio of the (instantaneous) probabilities of the two possible states. A coefficient greater than one implies a higher hazard rate and thus a lower expected duration.

REFERENCES

- Admati, Anat, and Paul Pfleiderer, 1994, Robust financial contracting and the role of venture capitalists, *Journal of Finance* 49, 371–402.
- Aghion, Philippe, and Patrick Bolton, 1992, An incomplete contracts approach to financial contracting, *Review of Economic Studies* 59, 473–494.
- Baker, Malcolm, and Paul Gompers, 1998, An analysis of executive compensation, ownership, and control in closely held firms, Mimeo, Harvard Business School.
- Baron, James, Diane Burton, and Michael Hannan, 1996a, The road taken: Origins and evolution of employment systems in emerging companies, *Industrial and Corporate Change*, 239–275.
- Baron, James, Diane Burton, and Michael Hannan, 1996b, Inertia and change in the early years: Employment relations in young, high technology firms, *Industrial and Corporate Change*, 503–535.
- Baron, James, Diane Burton, and Michael Hannan, 1999, Engineering bureaucracy: The genesis of formal policies, positions, and structures in high-technology firms, *Journal of Law, Economics, and Organization* 15, 1–41.

- Barry, Chris, 1994, New directions in research on venture capital finance, *Financial Management* 23, 3–15.
- Bolton, Patrick, and David Scharfstein, 1999, Corporate finance, the theory of the firm and organization, *Journal of Economic Perspectives*, 12(4), 95–114.
- Burton, Diane, 1996, The emergence and evolution of employment systems in high-technology firms, Unpublished Ph.D. dissertation, Department of Sociology, Stanford University.
- Bygrave, William, and Jeffrey Timmons, 1992, *Venture Capital at the Crossroads* (Harvard Business School Press, Cambridge, MA).
- Diamond, Douglas, 1984, Financial intermediation and delegated monitoring, *Review of Economic Studies* LI, 393–414.
- Fama, Eugene, 1985, What's different about banks? *Journal of Monetary Economics* 15, 29–39.
- Fenn, George, Nellie Liang, and Stephen Prowse, 1995, The economics of private equity markets, Staff study 168, Board of Governors of the Federal Reserve System.
- Gompers, Paul, 1995, Optimal investment, monitoring, and the staging of venture capital, *Journal of Finance* 50, 1461–1489.
- Gompers, Paul, and Josh Lerner, 2000, Money chasing deals? The impact of fund inflows on the valuation of private equity investments, *Journal of Financial Economics* 55, 281–325.
- Gorman, Michael, and William Sahlman, 1989, What do venture capitalists do? *Journal of Business Venturing* 4, 231–248.
- Greene, William, 1997, *Econometric Analysis* (Prentice Hall, New Jersey).
- Hart, Oliver, 1995, *Firms, Contracts and Financial Structure*, Oxford University Press, Oxford.
- Hellmann, Thomas, 1998, The allocation of control rights in venture capital contracts, *Rand Journal of Economics* 29, 57–76.
- Hellmann, Thomas, and Manju Puri, 2000, The interaction between product market and financing strategy: the role of venture capital, *Review of Financial Studies* 13, 959–984.
- Kalbfleisch, John D., and Ross L. Prentice, 1980, *The Statistical Analysis of Failure Time Data* (Wiley, New York).
- Kang, Jun-Koo, and Anil Shivdasani, 1997, Corporate restructuring during performance declines in Japan, *Journal of Financial Economics* 46, 29–65.
- Kaplan, Steven, and Bernadette Minton, 1994, Appointments of outsiders to Japanese boards: Determinants and implications for managers, *Journal of Financial Economics* 36, 225–258.
- Kaplan, Steven, and Per Strömberg, 2000a, Financial contracting meets the real world: An empirical study of venture capital contracts, Working paper, University of Chicago.
- Kaplan, Steven, and Per Strömberg, 2000b, How do venture capitalist choose investments? Working paper, University of Chicago.
- Kaplan, Steven, and Per Strömberg, 2001, Venture capitalists as principals: Contracting, screening and monitoring, *American Economic Review*, 91(2), 426–430.
- Kiefer, Nicholas M., 1988, Economic Duration Data and Hazard Functions, *Journal of Economic Literature*, 26, 646–679.
- Lerner, Josh, 1995, Venture capitalists and the oversight of private firms, *Journal of Finance* 50, 301–318.
- Lin, D., and L. Wei, 1989, The robust inference for Cox proportional hazard models, *Journal of American Statistical Association* 84, 1074–1078.
- Rajan, Raghuram, and Luigi Zingales, 1999, The firm as a dedicated hierarchy: A theory of the origin and growth of firms, Mimeo, Graduate School of Business, University of Chicago.
- Sahlman, William, 1990, The structure and governance of venture capital organizations, *Journal of Financial Economics* 27, 473–521.
- Saxenian, Annalee, 1994, *Regional Advantage* (Harvard University Press, Cambridge, MA).
- Shleifer, Andrei, and Robert Vishny, 1997, A survey of corporate governance, *Journal of Finance* 52, 737–783.
- Stiglitz, Joseph, 1985, Credit markets and the control of capital, *Journal of Money, Credit and Banking* 17, 133–152.
- White, Halbert, 1980, A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48, 817–838.
- Zingales, Luigi, 2000, In search of new foundations, *Journal of Finance* 55, 1623–1653.