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**Venture-Capital Financing and the
Growth of Startup Firms**

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Venture-Capital Financing and the Growth of Startup Firms

ABSTRACT

Venture capital firms have unique capabilities in terms of dealing with high uncertainty, high degrees of information asymmetry, and providing access to a strategic network. This study examines the association between the presence of venture capital and the growth of startups. It explores whether venture capital leads to growth or, alternatively growth signals the need for venture capital. It also investigates the impact if any of venture capital financing events and the growth of these firms. Finally, it documents the relationship between growth in startup financial valuation and changes in the number of employees over successive rounds of financing.

The growth path of recently formed companies (startups) is important to management theory (Gimeno, Folta, Cooper, & Woo, 1997). Since the original “theory of the growth of the firm” in Penrose (1959), where managerial resources played a pivotal role, several factors have been suggested as affecting growth. Some factors (such as population density or market forces) are external to the organization (Hannan & Freeman, 1989; Porter, 1980), while others are internal (capabilities, culture, or strategy) (Teece, Pisano, & Shuen, 1997; Boeker, 1997; Garnsey, 1998; Zahra, Ireland, & Hitt, 2000; Canals, 2000, chapter 3). Within the field of entrepreneurship, previous research has examined characteristics that are unique to entrepreneurial firms (Shane & Venkataraman, 2000). This study investigates the impact that venture capital investors, the timing of their investments, and past growth have on the growth of start-ups. A proprietary database covering employees in 494 mainly Silicon Valley based startups is used. Data for young firms is scarce and defining growth itself is difficult. Some companies do not generate revenues for long periods of time and profits may take even longer to show up. Growth is measured as the increase in the number of people working for each startup. As a further contribution, we investigate the relationship between this measure of growth and the change in the valuation of startups (as valued by venture capital firms’ at the time of providing new funds).

Existing evidence indicates that startups using venture capital are different from startups using more traditional financing alternatives (Hellman & Puri, 1999a). These authors find that venture-backed startups follow more innovative strategies and take shorter time to introduce their products to the market. Previous research has also found that the presence of venture capital affects the emergence of human resource practices in startups (Baron, Burton, & Hannan, 1996; Hellman and Puri, 1999b). Venture capital has certain characteristics that

set it apart from more traditional capital markets or debt financing alternatives (Gompers and Lerner, 1999, chapter 7). Venture capital firms devote significant management resources to understanding new technologies and markets, finding promising startups in those spaces, providing them with financial resources, and coaching them through the early part of their lives. High information asymmetry (Petersen & Rajan, 1995) and high risk (documented in the organizational ecology literature (Hannan & Freeman, 1989)) typically limit a startup's access to traditional financing sources. In contrast, venture capital firms have the capabilities required to deal with these factors and contribute to the management of startups.

The purpose of this study is to provide insight into the relationship between venture-capital financing decisions and the growth of startups. We address five research questions. First, we explore whether the presence of venture capital is significant in explaining differences in growth rates across startups. Strong evidence is found that companies with venture-capital financing grow faster over time than companies using other sources of financing. Second, we explore past growth as a factor that may potentially affect current growth and relevant to our understanding of venture capital and startup growth. Several factors may affect the growth path of startups—external opportunities as well as internal factors. The array of potential factors is large enough to suggest that “there are few unambiguous findings which could give guidance to entrepreneurs and their advisors” (Cooper & Gascon, 1992, page 316). Ernst & Young reports results from a questionnaire survey of 672 firms entering the “Entrepreneur of the Year Awards Program.” They conclude that past growth is the only reliable leading indicator of future growth (Cox and Camp, 1999). A time-series analysis of headcount growth in both venture-backed and non-venture backed firms supports this past growth—future growth momentum hypothesis. The third research

question probes whether venture capitalists self-select investments in already growing firms or whether growth only arises after venture capitalists bring their financial and managerial resources. We find little evidence of prior growth in startups before they receive an initial round of venture finance.

The fourth question investigates the potential impact that the provision of venture financing may have upon growth in headcount. In particular, it explores headcount growth around the points in time when startups receive new funding. In growing markets where market share and early mover advantages are often important for success, it may be expected that a commodity-type of resource like financial resources does not affect growth. In other words, startups receive venture capital before they need the funds in order not to delay their growth because of lack of liquidity. However, the sizable ramp-up on employee hiring immediately after a new round of venture financing that we find suggests that the timing of new funding rounds delays startup growth. The finding indicates the existence of frictions between the venture capital market and the growth needs of startups. The lack of coordination in the timing of new funding slows down startup growth.

The fifth question addresses links between the growth in the valuation of startups and our main measure of growth—headcount growth. Each new round of financing by a venture capital firm requires the start up be revaluated. We examine the amounts of these revaluations and find that they have a significant positive relationship with changes in employee growth of the startup.

Our sample includes venture-backed as well as non-venture backed startups within the same industries, primarily technology industries. This sample is used to test the hypotheses developed in the next section.

THEORY

The Role of Venture Capital Funding

Venture capital firms have some unique characteristics (Gompers & Lerner, 1999, chapter 7). Venture capitalists aim to rapidly grow businesses such that they earn a high rate of return from their investment. They raise money through venture funds that have a finite life. Gomper and Lerner (1999) state that “almost all venture and buyout funds are designed to be “self-liquidating,” that is, to dissolve after ten or twelve years” (p.19). In order to reach the high investment returns required by the risk of their investment (30% per year is one benchmark) over a relatively short time-period, at least a subset of the startup companies in a venture fund need to have rapid growth at the operations level. In most cases, the liquidity events relied upon are either an initial public offering (IPO) or a trade sale. It is unlikely that either type of liquidity event for small companies will be able to attract the large considerations that translate in high venture fund returns. Venture capital firms have an interest in their startups growing fast. But our sample needs to meet two conditions to identify this pattern: (a) the venture capital funds represented in our sample are able to grow their startups, and (b) the growth must happen in a broad enough range of their startup portfolio.

Multiple rationales exist for expecting venture-backed companies to have higher than average growth rates. Venture capitalists typically augment the skill set of the existing management team in a more proactive way than other financing methods (such as bank loans). From a governance perspective (Shleifer & Vishny, 1997), they take an active board role structuring the compensation of top managers (Kaplan and Stromberg, 1999) and periodically monitoring the evolution of the firm. They also bring a network of contacts with experienced infrastructure providers (such accounting firms, law firms, and public relations firms) and

potential professional managers. These contacts facilitate access to external resources that mitigate the resource dependencies that startups experience (Pfeffer & Salancik, 1978). Venture capitalists' knowledge of the industry and their business network also includes potential business partners for their startups. This strategic network (Gulati, Nohria, & Zaheer, 2000) includes other startups as well as established companies and simplifies the search process for business partners—reducing both search costs and time.

Venture capitalists themselves bring a reputation effect over and above a skill augmentation role for a startup. They receive many business plans and often invest in less than 1% of those plans. Their due diligence process, even for ventures passing early screenings, requires detailed analysis of the management team, their technology, products and the viability of their business plan (Gorman and Sahlman, 1989; Fried and Hisrich, 1995). Successfully passing a venture capitalist screen and receiving funding (often in multiple rounds) is a powerful signal to multiple parties, both inside and outside the startup. It endows the startup with a higher reputation that reduces uncertainty and, accordingly reduces transaction costs (Williamson, 1979). The combination of this skill augmentation and reputation signaling can result in a venture-backed startup having an advantage in attracting high quality employees, in gaining new customers, and in negotiating alliances and joint ventures with key players.

Venture-capital backed startups may also have lower agency costs. As mentioned in the previous paragraph, the reputation that the venture capitalist brings to the startup provides a positive signal to the labor market that reduces adverse selection (Eisenhardt, 1988). In addition, venture capitalists typically provide stock options to a broader set of employees than do owner-managed or debt-financed firms. Distributing ownership claims among these larger

set of employees can be an effective means of reducing moral hazard problems that arise in settings where ownership is separated from control (Jensen & Meckling, 1976).

Hypothesis 1: Venture-backed startups grow faster than non-venture backed firms.

The Momentum Hypothesis

Both the organizations and economics literatures provide rationales for past growth increasing the likelihood of future growth (the growth momentum hypothesis). The literature on organization demographics highlights that newer and smaller firms are less likely to survive (Carroll and Hannan, 2000). Industry statistics (Dun & Bradstreet, 1998) also support the twin liabilities of newness and smallness. While startups cannot do much in terms of their age, they can avoid the liability of smallness through fast growth. Past growth enables a firm to increase the likelihood of future survival. Thus, firms benefit from a sustained growth pattern. The momentum implicit in this continuous growth pattern can be grounded in different sources of advantage. Some of them are external to the organization and related to the density and institutional characteristics of the market niche where the startup is competing (Hannan and Freeman, 1989). The growth of a new firm may be based on choosing the right niche where it can succeed. The organizational literature also indicates that forces internal to the organization may drive sustained growth. Internal capabilities (Teece, Pisano, & Shuen, 1997) can provide new firms with the conditions needed to grow and succeed.

The economics literature is giving increasing attention to industry conditions under which past growth promotes future growth. Demand-side increasing returns (DSIR) industries are those where companies grow quickly by exploiting a “virtuous circle” in which the early adoption of products/services helps build momentum for future adoption of those products/services (Saloner, Shepard, & Podolny, 2000). Explanations for DSIR include the

benefits of using compatible products (as exemplified in the increasing adoption of VHS tapes over beta tapes) and network benefits/externalities (as exemplified in the adoption of mobile phones). Technology products/services are frequently cited as being often subject to DSIR.

Support for the growth momentum hypothesis also comes from practitioners' surveys. Cox and Camp (1999) report that past growth is the most reliable indicator of future growth. A potential explanation for this observation is rooted in the diversity of elements that affect growth. Growth may come from an attractive product market positioning (Porter, 1980) in a favorable environment with low density and demand-side increasing returns. It may also come from the resource endowment of the firm or capabilities including physical systems, management systems, skills and knowledge or values (Leonard-Barton, 1992). Moreover, past success may increase organizational confidence, effort, and fuel future success, working as a self-fulfilling hypothesis. All these factors may be uncorrelated, but they all converge into this time-dependent relationship of growth over time that we call the momentum hypothesis.

Hypothesis 2: The growth of a startup in period $T-1$ is positively related to growth in period T .

Initial Growth and Attracting Venture Funding

Hypothesis 1 posits that venture capital firms bring both management skills and a reputation/signaling contribution that accelerates the growth of a startup. The underlying assumption is that the presence of venture capital not only funds the financing needs of the startup but also signals to external parties (such as prospective employees, prospective customers, or potential partners) the quality of the firm. These two elements facilitate its growth. However, there is an additional possible rationale for differential growth that also

relies on a signaling argument. In this case, venture capitalists self select companies that have already exhibited relatively high growth (venture capital screening criteria are discussed in Zacharakis and Meyer (1998, 2000)). This rationale presumes that venture capitalists' screening process flags companies with higher growth in the same way that it identifies innovative firms (Hellman and Puri, 1999a). The initial growth of the startup before it receives venture funds signals to the venture capital firms its attractiveness as an investment alternative. This initial growth can be financed through one or more of multiple sources, including existing management, seed/angel investors, or debt capital. In this setting, growth is prior to the presence of venture capital.

This argument elaborates the signaling story underlying Hypothesis 1. Hypothesis 1, relates firm growth with the presence of venture capital. However, it does not distinguish whether (a) it is the presence of venture funds that signals to external parties and facilitates growth, or (b) it is growth that signals and makes a startup more attractive to a venture capital fund. The next hypothesis relates the initial growth of the firm with receiving venture capital funds.

Hypothesis 3: Venture capital firms fund startups that have higher prior growth rates.

Timing of Financing and Firm's Growth

Much of the traditional theory of finance, such as the irrelevancy of capital structure and of dividends, assumes minimal institutional frictions between the capital market and other markets (such as the product and labor markets)—see the classic exposition in Fama and Miller (1972). While the existence of information asymmetry among firms and suppliers of financial resources may affect the structure of contracts (Shleifer and Vishny, 1997) as well as whether a market exists (Akerlof, 1970), it does not affect the timing of funding. Financial

resources because of their nature as a commodity are timely and are not identified as potential constraints to the growth of the firm. All parties involved in these transactions share common goals in terms of optimizing the growth path of the firm.

In the context of venture capital, the successive rounds of financing should ideally be timed in such a way as not to halt the growth of the firm and to take full advantage of the potential of the firm. This behavior is especially in a market where fast movers have a competitive edge over their slower competitors (Saloner, Shepard, & Podolny, 2000). If growth maximizes company value, then financing should happen in a timely seamless fashion without disrupting the growth path of the firm. The supply of new capital should be coordinated and happen in such a way that it is available when growth requires new funding.

Several forces may act against such a seamless behavior. Funding events are not only a mere transfer of cash but they are one of the most important control mechanisms that venture capitalists use (Gompers and Lerner, 1999, page 139). This control role may create incentives through the funding process that are not aligned with the expected smooth growth path. Moreover, management can be too optimistic in estimating the length of the funding process and face financial constraints that slow down growth. Attracting the attention of venture firms is still a difficult endeavor. Cash flow problems within a startup can also result in hiring freezes until a new round of financing is closed. On the labor market side, potential employees may be reluctant to commit to a startup that has not secured its latest financing round. A new round of financing may send a positive signal to these prospective employees who are more willing to accept the offer once they see that venture capitalists have funded the company. A startup can also face cash flow problems if management overestimates the magnitude and timing of revenues and under-estimates the magnitude and timing of costs

(Zacharakis and Meyer, 2000). These rationales suggest the potential of sizable institutional frictions between the venture capital market and the product/labor markets of the venture-backed firms that may affect the timely availability of new funds.

Institutional frictions between the venture capital market and the labor market facing a startup and their impact upon the timing of new rounds of financing can have several dysfunctional consequences on growth of the firm. Hiring freezes followed by hiring surges can create problems in maintaining momentum in new product development cycles. They can also create delays in meeting customer deployment schedules and in responding to actions by competitors. Such constraints on management due to financing markets not be synchronized with other markets (such as labor or product) can result in startups not maximizing their opportunities.

Hypothesis 4: The timing of financing events affects the growth path of startups.

Headcount Growth and Changes in Valuation

Headcount related measures are the main indicator of growth examined in this paper. We also examine a market valuation growth indicator (post-money valuation at the time of a financing round) and its relationship to headcount growth. The importance of estimating the value of a firm has drawn significant interest mainly from both the finance and accounting literatures. Traditionally, financial accounting numbers are the main source for valuation (Ohlson, 1999). Non-financial numbers have proved to have incremental information in certain industries like telecommunications or e-commerce where the effect of accounting conservatism may be most relevant (Lev, 1996; Rajgopal, Kotha, & Venkatachalam 2000). The limited research on venture financing round valuation (Houlihan Valuation & VentureOne, 1998) has focused on the changes in valuation over sequential rounds of

financing across industries but has not examined internal drivers of these changes in valuation. One of the drivers of increased valuation is headcount growth. The growth in number of employees may indicate that the business model of the firm is successful and this success is spurring growth. It may also signal that the likelihood of success has increased and risk of failure has decreased. These rationales suggest that headcount growth can be a relevant measure of value for privately-held firms where public information is limited.

Hypothesis 5: Employee growth in startups is associated with positive changes in firm value.

METHODS

Sample Selection

The research sample of 494 startups was obtained from combining a human resource database with two venture capital databases. The human resource database comes from a Professional Employer Organization (PEO) we call HR-PEO. This company is based in the San Francisco bay area. It specializes in providing outsourced human resource services to both venture-capital backed and non-venture-capital backed startup companies. Each member of the workforce in these companies receives their bimonthly pay through HR-PEO who also administers additional HR activities including retirement plans and health insurance plans.

The strategy of HR-PEO is to provide a cost effective full-service solution for the HR needs of small firms and to grow with those firms as long as possible. Its customers include startup firms with diverse funding (such as venture-backed, family-backed, debt-funded or funded from operations). HR-PEO has developed strong relationships in the venture-capital community and has been able to attract a sizeable number of venture-backed start-ups. The result is that the HR-PEO database has a unique mix of firms with similar sizes at the outset

but with different financing structures. One caveat is that the sample is not a random sample of small firms, given that it is restricted to companies that choose to outsource their HR needs.

The full HR-PEO database includes pay data (cash compensation) for 606 entities that were in their payroll system between January 1994 and December 1999. For each of these firms we collected payroll information from January 1994 through May 2000. The monthly headcount of each client company of the HR-PEO is the number of individuals receiving a separate payroll payment for that month. These 606 entities include firms that used HR-PEO's services at any time during this period. Companies that ceased using HR-PEO's services at any time after January 1994 are included in our research. Some of these entities were different divisions of the same company; for example, the Canadian subsidiary of a U.S. company or an office in Denver of a San Francisco-based company that chose to have the office as a separate payroll entity. These divisions were merged in our research. The total number of payroll transactions is 585,497, increasing over time as the PEO company (itself a startup) increased its client base. The number of firms in the sample grows over the six-year period from 52 at the end of 1994 to 327 at the end of 1999. The total number of employees that were in the system at some point during the period is 27,226. HR-PEO uses an industry classification scheme to code the firms in its sample. We restricted the sample to include industries in which there was at least one firm in both the venture-backed and the non-venture-backed sample (empirically, the minimum number of firms in any one industry in either sub-sample is 8). The largest industry excluded was venture capital firms themselves (25 non-venture-backed firms that are customers of HR-PEO). The net result was a database with 494 firms—193 venture-backed firms and 301 non-venture-backed firms. The industry

composition is presented in **Table 1**. The high-tech focus of the predominantly Silicon-Valley based sample of firms is evident in both startup groups.

Insert **Table 1** around here

Two existing proprietary databases were used to identify those firms in the HR-PEO database that were venture-finance backed:

- VentureOne (Reuters)
- Venture Source (Venture Economics)

Both are described in Gompers and Lerner (1999, p. 335 and p. 337 respectively). The VentureOne database tracks the evolution of companies that receive venture capital. It includes rounds of financing, dates for those rounds, amount of financing, and, when the company chooses to disclose it, pre and post-money valuation. It also describes for each company the founding date, the background of the management team, and service providers including venture capitalists that financed the company, commercial bank, law firm, and auditors. We identified 169 companies that were in both the HR-PEO and the VentureOne databases. For these companies, information on the founding date, industry, the dates and amounts of the various funding events (rounds of financing), and exit event if it had happened (IPO, acquired, or out of business) were collected. VentureOne ceases tracking companies once they experience an exit event.

The second database to identify venture-backed companies was Venture Source (Venture Economics). This database is similar to VentureOne and also tracks the financing milestones during the life of venture-backed firms. We identified 147 companies in the Venture Source database, 24 of which were in addition to the 169 already identified in VentureOne.

Table 2 provides descriptive statistics on 170 venture-backed firms for which we have the founding date (from VentureOne or Venture Source). **Panel A** reports the rounds of financing. The mean number of financing rounds is 2.75. Firms founded in later years in the 1994-2000 period have received less rounds of financing up to the research cut off date (in part, due to there being less elapsed time from a first round of financing). **Panel B** indicates that the mean time to first round of financing is 4.4 quarters (median: 2 quarters). **Panel C** describes the average amount of financing and average company post-money valuation for different rounds. The first round of venture funding may be preceded by a seed round. This seed round is venture capital funding but the amount is typically small. The post-money valuation is the estimated value of the company given the new amount of venture capital invested and the percentage of the company associated with the this new investment. As expected, later rounds are larger and are associated with larger company valuations. The number of firms in the sample that exited the private stage through IPO, acquisition, or out-of-business as well as the timing of exit is reported in **panel D**. The number of firms ceasing operations likely understates the number of firms exiting due to financial distress. Acquisition rather than ceasing operations is often a preferred exit strategy for a failing company.

Insert **Table 2** around here

An important strength of the research is the use of month-by-month hard data on headcount. This approach complements the more qualitative approach—survey and interview data collection methods—previously used to study human resources and growth paths of startup firms. Combining employee-related growth data with financing information for privately-held venture-backed companies enables us to gain new insight into the impact of financing structure and financial constraints on the growth path of these firms.

Measurement of variables

Growth: Headcount-related growth measures are used to proxy for growth. Headcount is operationally defined as the number of people in a company receiving a payroll payment from its outsourced payroll provider (HR-PEO). Not included in this headcount measure are outside consultants or subcontractors, both of whom are typically paid by the company rather than the PEO. The measure of growth is the change in headcount over a certain period (usually a month). For a sub-sample of the firms, we also use a capital market-based growth measure (post-money valuation—value of the company at the end of a financing round—at successive financing rounds) when examining our Hypothesis 5. Growth measures based on financial-statement information (such as revenues, profits, or total assets) are not systematically available because of the privately-held nature of most firms in the sample.

Rounds of financing from venture capital firms: VentureOne is the primary source on venture-financing round information in our research—date of a round, the amount raised, and the post-money valuation of the company. Venture Source is used for the 24 venture-backed companies found in our database but not in VentureOne. We identified 275 pre-IPO financing events. In addition, twelve firms remained using the PEO service after their IPO liquidity event. This information about a round of financing is voluntarily disclosed (except for IPO). However, data on the incidence and the date of a financing round are almost always available. The amount raised is disclosed in 95.3% of the cases. The post-money valuation amount is disclosed in 80.4% of the cases. Not enough is known about those non-disclosing firms to ascertain whether there is bias due to the voluntary nature of these venture-capital round disclosures.

Age: We include a control for age as a proxy for newness. Because we lack the founding date for all firms in the sample, we measure age since the first date that a company joins the HR-PEO database. We compared this measure of age with the actual age (since the founding of the company) for those firms for which we have both the founding date and the date they entered the HR-PEO system is available, the mean difference is 4.77 quarters and the standard deviation is 5.49 quarters.

Size: We also control for size measured as headcount to control for the potential liability of smallness.

Industry dummies: Finally, we include different intercepts for the various industries identified in our database. These dummy variables are intended to capture any differences that may exist across industries. They also control for the different mix of industries across the venture-backed and non-venture-backed samples. To be consistent in classifying the two groups of firms, we used the HR-PEO's industry coding that is homogenous across both groups and is finer than SIC codes.

RESULTS

Table 3 presents descriptive statistics on both venture-backed and non-venture-backed firms. Venture-backed startups grow faster (in number of employees) and are larger in size than non-venture-backed firms.

Insert **Table 3** around here

Startup Growth: Venture Financing and the Momentum Hypothesis

Hypothesis 1 posits that venture-backed startups grow faster than non-venture-backed startups. **Figure 1** plots the mean size of venture-backed and non-venture backed firms in our sample for those months with at least 35 observations in at least one of the two samples. We

use the date in which companies entered the HR-PEO system as date zero. There is a reduction in the number of observations over time in **Figure 1** for multiple reasons—primarily existing firms having limited time with the HR-PEO due to being recently formed. In the first month, venture-backed companies have a mean size of 9.6 people compared to 6.9 of the non-venture backed firms (significant at 1%). Over time, the difference becomes larger and always significant suggesting that companies receiving venture capital grow faster than their counterparts. By month 30, the mean of venture-backed firms is 42.0 people compared to 17.4 for non-venture backed firms (significant at the 1% level).

Insert **Figure 1** around here

Figure 1 also probes Hypothesis 2 that relates past growth with current growth. The Pearson correlation between past (month_{t-1}) and current growth (month_t) is positive and significant (0.21 for the full sample and 0.33 for the venture-backed sub-sample).

Next we report several further probes of these two hypotheses. First, a logit model is used to estimate the likelihood of a company growing in a certain month (month_t). The dependent variable is a dummy variable that takes value of one if the company grew during the current month (month_t) and 0 otherwise. The independent variables include a dummy variable that takes value of one if the company is venture funded and zero otherwise—to test Hypothesis 1; growth for the company in the previous month (month_{t-1})—to test Hypothesis 2; the natural logarithm of size at the end of the previous month (to control for smallness); and, the natural logarithm of the time that the company has been in the sample (to control for newness). The model also includes control variables for the industries. Hypothesis 1 predicts the coefficient for venture financing to be positive. Hypothesis 2 (momentum) predicts the coefficient on

growth in the previous month to be also positive. This logit model reflects the directional structure of the hypotheses.

Panel A in Table 4 presents the results using the logit model. The positive coefficient on the venture capital variable (0.486 and $t=9.55$) is consistent with venture capital firms investing in faster growing firms (Hypothesis 1). The non-venture-backed firms in our sample combine different financing options. While alternative mechanisms to grow fast may exist (Shane, 1996), venture capital shows a consistent pattern above a mix of alternative financing options. The positive coefficient on the past growth variable (0.119 and $t=9.49$) supports Hypothesis 2 (momentum hypothesis). The incremental effect of size is positive, indicating that holding constant the rest of variables in the model, larger firms are more likely to grow than their smaller counterparts. In contrast, younger firms are less likely to grow.

The second approach to probe Hypotheses 1 and 2 uses a regression analysis that incorporates the magnitude as well as the direction of the headcount growth. The independent variables are identical to those used in the logit model presented above. Regressing a lagged dependent variable presents some technical issues (Greene, 2000, page 534; Kennedy, 1997, page 147). To obtain consistent coefficients we use a generalized instrumental variable estimation for the lagged dependent variable to eliminate the correlation problem between the independent variable and the residuals. We run an auxiliary regression of lagged growth on size and age lagged one period. To take into account the autocorrelation in the residual terms, we use an AR(1) model for the residuals and use the Prais-Winsten estimator (Greene, 2000, page 546).

Insert **Table 4** around here

Panel B in **Table 4** reports regression results that are similar to the results in **Panel A** in terms of both the impact of venture-capital (Hypothesis 1) and past growth (Hypothesis 2). The use of instrumental variables makes the coefficient for prior growth hard to interpret. The magnitude of the coefficient for the venture capital variable is 0.707 for absolute growth indicating that the presence of venture funding leads to a growth of 0.707 people per month faster than non-venture-backed firms. Age is not significant while size has a similar interpretation as in **Panel A**. The low value of R^2 suggests that even if our hypotheses explain part of the variation, the model still leaves unexplained a significant portion of the growth. We also run the regression using percentage growth rather than absolute growth as the dependent variable. The coefficient on the venture-capital variable was positive (0.054 with $t=4.70$) while the coefficient on past growth was also positive and marginally significant (2.157 with $t=1.92$). One limitation of using a percentage variable in our sample is that the dependent variable is greatly affected by the small size of many firms in the sample (the denominator in the percentage computation).

Initial Growth and the Attracting Venture Capital

Hypothesis 3 investigates whether the growth of startups attracts venture capital firms. In other words, it builds on Hypothesis 1 (**Table 4**) to examine whether there is a selection process where venture capital firms fund companies that are already growing or, alternatively growth only happens after the company has received venture financing. The date of the first venture capital inflow (through a seed round or first round of financing) is an important input when testing Hypothesis 3 because we only have headcount data for firms after they join the HR-PEO system. The overall sample can be subdivided into three groups:

- (1) firms that already have venture funding when they join the sample (148 firms),

(2) firms that join the sample before they get their first round of financing but that are subsequently venture funded later on in their lives (36 firms are in this new group), and

(3) firms that never get venture funding during our research period (290 firms).

We lose nine venture-backed companies that do not disclose the date of their first venture capital funding event . We also lose 11 non-venture-backed firms we do not have number of employees in the second month.

For sub-samples (2) and (3)—firms without venture funding when they join the sample—we run a logit model. The dependent variable is a dummy variable that takes value of 1 for group (2) and 0 for group (3). The independent variables include growth during the first month, natural logarithm of the size when the company enters the database, and industry dummies. If venture capital is attracted to growth firms (Hypothesis 3), then we expect the coefficient on growth in the first month to be positive. The significance of this coefficient would indicate that growth is a predictor of future venture capital funding.

Panel A in **Table 5** presents the results. The coefficient on growth in the first month is not significant, which is inconsistent with growth being a predictor of whether the company will get venture financing. This finding suggests that venture capital firms are not selecting firms with a differential level of headcount growth prior to the first round of funding. To check the robustness of the results, we used quarterly rather than monthly growth to capture headcount growth over a longer window; the interpretation of the results does not change. We also used as dependent variable a dummy taking value of one if the company received venture funding within three (9 companies) and six months (17 companies) of joining the HR-PEO sample, the results were again comparable.

As a further robustness check, we test whether companies with venture capital funding when they join the HR-PEO sample grow faster than those without venture funding (groups (2) and (3)). The test is similar to the one reported in **Table 4** but restricted to the first month . If the coefficient for venture capital-backed firms is not positive and significant, then we would not be able to separate the two signaling stories underlying Hypothesis 3. Growth of all firms would be equal when joining the HR-PEO database and the result in **Panel A** would be inconclusive. The dependent variable is growth in the first month and the independent variables include whether the company had venture capital prior to joining the sample. We run the regression for all firms in the sample for which we have growth over the first month. If venture capital leads to growth, then we expect the coefficient on the presence of venture capital to be positive. **Panel B** in **Table 5** reports the results. The results are similar to those of **Table 4** where we used the full sample. Companies that receive venture-financing before they enter the sample grow faster than the ones that do not have this type of financing. We obtain similar results when we study growth over the first quarter rather than the first month. The overall results in **Table 5** indicate that growth firms do not self-select into venture capital financing, but it is the presence of this type of financing in the equity of the firm that drives the growth of the firm.

Insert **Table 5** around here

Timing of Financing Events and the Growth Path of Startups

Hypothesis 4 investigates whether financial resources constrain the growth path of venture-backed startups. An event study approach is used to probe this hypothesis. For each of the 275 venture-capital financing events we identify the month in which the event happened (termed month 0). The three months prior to the financing event are designated

months -3 , -2 , -1 , and the three months after the event as months $+1$, $+2$, $+3$. For each seven-months period surrounding a financing event we identify companies that did not receive financing in the same calendar time period (both venture-backed companies that do not receive funding even if they may have received it outside this window and non venture-backed companies). **Figure 2** plots the mean change in employees around the financing event (labeled as VC funding event) compared to the growth in the same date of two other groups: venture-backed firms that do not receive venture capital funding during these seven months and non-venture-backed firms (that never receive venture capital). **Figure 2** suggests that the growth of firms increases before and mainly after they receive new funds (relative to firms not receiving venture money in that same calendar time period). This result is consistent with the timing of financial resources having an impact upon the growth of the firm.

Insert **Figure 2** around here

To further probe the impact of financing events on headcount growth, we use the sub-sample of venture-backed firms. For this sub-sample, growth per company per month is regressed against dummies for each of the months around the financing event. Month_3 is a dummy that takes value of one if three months later the company receives venture funds and zero otherwise. We define the dummies for the other five months in a similar way. We also include a dummy if the company went public (Initial Public Offering) on that month as another significant financing event. We control for the natural logarithm of age of the firm since its founding (to control for liability of newness) (results are robust to defining age as time in the HR-PEO database as we do in previous tests, but founding date is available for most venture-backed firms and is a better measure of age), the natural logarithm of size at the beginning of the month (to control for liability of smallness), and growth in the previous

month (to control for the momentum hypothesis). None of the firms in the sample received successive rounds of venture funding less than four months apart. This means that having designated month 0 as the venture round month, there is not another round of venture funding for that firm on either months -3, -2, -1, or months 1, 2, or 3. Because of the lagged dependent variable, we use the same statistical techniques as in **Table 4**.

Panel A in **Table 6** presents the results. Growth around the financing event is significantly greater than in other months—all the seven variables for the months are positive and significant. The growth in months prior to the funding event can be interpreted in several ways. The possibility of incoming funds may already be a signal that stimulates growth. Alternatively, firms may increase their pace of growth to signal to potential investors both their need for additional funds as well as their attractiveness. Venture capital funds may be attracted to growing firms (as suggested in Hypothesis 3) but only when they already have venture funding. The first month after receiving funding (month_{+1}) is the one that has the largest coefficient (1.783 with $t\text{-statistic}=6.46$) consistent with Hypothesis 4 and the intuition in **Figure 2**. As soon as companies receive funding, the slope of their growth path increases. **Panel B** includes the F-test for differences across the coefficients for the months around the financing event. These differences directly test Hypothesis 4. If funding limits the growth of startups, then growth in the month after receiving funding should be significantly larger than previous months. Consistent with Hypothesis 4, the coefficient for month_{+1} is significantly larger than coefficients in the other months. The effect of new funding on growth carries over into month two although the effect is not as large as in the first month after funding.

Insert **Table 6** around here

Startup Valuation and Headcount Growth

Hypothesis 5 relates growth in headcount and change in valuation. If growth in number of employees is important for the value creation process of young firms, then we expect that it is reflected in the change in value of the company. Each time a startup receives a venture round of funding, it is valued. Knowing the amount of money that venture capitalists invest and the percentage of equity that they get in exchange allows us to estimate the value of the firm (post-money valuation). To be able to estimate changes in value we need to have access to two successive valuation points (two successive rounds of financing). We have 148 of these sequential events for which we also have headcount for a total of 74 data points. The Spearman rank correlation between percentage change in value and percentage change in employees is 0.24 (significant at the 3.5% level one-tailed), indicating a positive relationship between both measures. To take into account the impact that industry may have, we run two different models, one using absolute magnitudes of changes in value and in the number of employees. We also control for the number of employees in the first round of each couple of successive rounds to control for size and reduce heteroskedasticity. The second model regresses percentage changes in value on employee growth (relative to size). The first model avoids the problems associated with small denominators in the relative measure of employee growth used in the second model. However, it may overstate the size effect. To avoid the influence of large observations in the second model, we use a rank regression. If growth in headcount and change in valuation is related (as Hypothesis 5 suggests), then we expect the coefficients on absolute (first model) and relative (second model) employee growth to be positive and significant.

Results in **Table 7** support a positive relationship between changes in value and changes in the number of employees. In both models, the coefficient for employee growth is positive and significant. Growth in employee headcount is linked to growth in valuation indicating not only the relevance of headcount increase to the creation of value, but that there is a positive relationship between two different measures of growth.

Insert **Table 7** around here

DISCUSSION

The objective of our study was to understand the growth of new firms in the early stages of their lives. We focused mainly on the role of venture capital firms as a source of financial resources on the growth of startups. Venture capital firms are primarily involved in financing new ventures. To deal with the high levels of uncertainty, risk, and information asymmetry, these firms heavily invest their own management talent into understanding the industry that they invest in, evaluating the prospects of the startups that they finance, coaching their management teams, and providing access to a network of external resources. Our findings indicate that the presence of venture capital is related to faster firm growth. We also report that the timing of new funds has a significant impact on the growth of the firm. Even if financial resources are commodities and it is not in the interest of the parties involved to slow growth because of them, our results indicate that startups increase their growth pace when they receive new funds. We also found support for past growth being a predictor of future growth. Even if the growth of startups may be related to different factors—internal as well as external—past growth captures the momentum that drives current growth. Finally, we find an association between headcount growth and changes in the valuation of startups over successive rounds.

Our headcount measures come from a Personal Employer Organization (PEO) that startups subcontract with to do their human resources management. One limitation is a potential selection bias induced by firms leaving the sample. A total of 210 firms exited the HR-PEO database during the sample period. The exits from the database were examined to see whether those firms differed in size or time in the HR-PEO database from those remaining in the database. Firms exiting are relatively smaller and stayed relatively longer. There is no difference between the two types of firms. The exit pattern seems to reflect two different types of startups. Consistent with the liability of smallness identified in the organizational ecology literature, smaller firms are more likely to exit the database. However, this observation should be read with care. Some companies leaving the database do not shift their payroll at once but rather do it over several months. If this behavior is commonplace, then the smallness of firms exited is overstated. On the other hand, firms that have been in the database longer (probably older firms) are more likely to exit. This is consistent with firm's age increasing the likelihood of HR activities become sourced internally rather than outsourced activities (Baron, Burton, & Hannan, 1996). If becoming larger increases the likelihood of a company exiting the HR-PEO database, firms that survive in the sample over long periods of time may be firms with lower growth rates. The multiple forces working in the exit pattern of firms from the sample may bias the survivorship bias both ways and thus the overall effect is unclear. However, these different sources operate similarly for both types of firms—venture-backed as well as non-venture-backed.

The results of this paper have implications for research on the growth of new firms and their relationship with venture capital firms. The findings reported view the various rounds of financing as homogeneous events. But these events happen at different stages of the life of

the firm that may eventually affect their significance to the startup (Kazanjian, 1988). If financing events disturb the smooth growth path of startups and such an effect does not seem to favor any of the parties involved, future research should consider explaining such an anomaly and finding whether it is rational behavior on the part of any of the players in the game.

The evidence in the paper indicates that financing events affect the growth path of startups. One of the rationales suggested for these results relates to the signaling properties of these events to outside parties. A further exploration of this signaling effect can be explored in the employee turnover. If funding has a positive signal to people external to the firm, current employees may also view it as a positive event and increase the attractiveness of staying in the firm.

Another potential extension of this research is examining how the presence of venture funding and financing events affect cash salary payments of startups to their employees. Venture-backed startups use more non-cash incentive systems (for example, stock options), than other startups. This may result in lower cash salary payments. However, venture capitalists professionalize the firms they invest in faster (Hellman and Puri, 1999b) and may need to offer higher overall compensation and cash compensation to attract these professional managers.

Finally, a fruitful extension of the relationship between valuation and growth in the number of employees is to further segment employees according to the skills that they bring to the startup and investigate their impact on the value of the firm. Having access to the financial statements of these startups would also bring additional insights on the relevance of the other factors (such as profitability) that affect company valuation.

Implications for practitioners

The results of the present study also have relevant implications to startup managers and venture capital firms. Our finding that past growth is a predictor of future growth is relevant for venture capitalists as an additional criterion to assess whether to give an additional round of financing; it is also relevant to startup managers to evaluate the likelihood of success of their firm. Venture capital proves to be a significant factor in explaining growth; this result is informative to entrepreneurs that are deciding how to structure their startup. If growth is a key element in their strategy, the results from this paper indicate that venture capital is a source of capital adequate to achieve this goal. We do not conclude that it is the only way to finance high-growth startups. Venture capital financing has its own limitations and our research gauged against a mix of alternative financing options that can include some feasible substitutes of venture capital. A key finding relevant to practitioners is the apparent lack of coordination between the timing of venture financing and the growth of the firm. It indicates that institutional frictions can constrain hiring practices that may hurt growth in the product markets.

Conclusion

This article contributes to the theory of the growth of the firm and shows how financing decisions affect the early phases of a startup. While the empirical results are informative to the literature and to practitioners, they also open up several research opportunities to improve our understanding of the role of venture capital and the growth of the firm.

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TABLE 1
Industry Statistics

	<u>Venture-backed firms</u>	<u>Non-venture-backed firms</u>
Communications and networking	29	38
Electronics & Computer Hardware	9	12
Semiconductors	8	11
Software	60	47
Information Services	38	82
Healthcare & Biotechnology	22	37
Business & Consumer Services and Products	27	74
Total	193	301

TABLE 2
Descriptive Statistics on Venture-Backed Startups in the Database

Panel A: Number of Financing Rounds

<u>Founded</u>	<u>Mean</u>	<u>Median</u>	<u>Min.</u>	<u>Max.</u>	<u>St. Dev.</u>	Number of Companies
Before 1994	3.10	3	1	7	1.97	20
1994-95	3.41	3.5	1	6	1.28	34
1996-97	3.00	3	1	6	1.49	62
1998-99	1.93	2	1	5	0.93	54
Total	2.75	2	1	7	1.47	170

Panel B: Time (in months) From Founding to First Round of Financing

<u>Founded</u>	<u>Mean</u>	<u>Median</u>	<u>Min.</u>	<u>Max.</u>	<u>St. Dev.</u>	Number of Companies
Before 1994	12.15	5	1	38	13.64	20
1994-95	4.88	3	1	18	5.13	34
1996-97	3.61	2	1	12	3.18	62
1998-99	2.08	2	0	7	1.40	54
Total	4.36	2	0	38	6.29	170

Panel C: Valuation

Rounds of financing	<u>Amount</u> (in millions of dollars)			<u>Post-money valuation</u> (in millions of dollars)			Number of Rounds
	<u>Mean</u>	<u>Median</u>	<u>St. Dev.</u>	<u>Mean</u>	<u>Median</u>	<u>St. Dev.</u>	
Seed	\$1.50	\$1.23	\$1.31	\$3.34	\$3.00	\$1.70	62
1	5.58	3.88	7.38	13.62	10.50	13.73	166
2	9.39	6.90	8.64	46.58	29.50	50.58	129
3	13.99	9.13	16.62	57.00	49.00	44.90	68
4	15.87	10.00	18.96	112.40	66.00	149.16	38
5	29.12	25.00	25.94	147.70	135.37	70.06	17
6	18.61	12.13	22.66	347.84	347.84	172.76	4
Overall	\$9.00	\$5.00	\$12.78	\$45.90	\$20.00	\$74.07	484

Panel D: Exit strategies

<u>Rounds of financing</u>	<u>IPO</u>	<u>Acquisition</u>	<u>Ceased operations</u>
1	3	9	2
2	4	8	3
3	5	9	0
4	5	5	1
5	10	3	0
6	2	0	0
7	0	1	0
Total	29	35	7

TABLE 3
Descriptive Statistics on the Sample of Startups in the Database

Panel A: Venture-Backed Firms

<u>Venture-Backed Firms</u>					
	Mean	Standard deviation	Minimum	Maximum	Median
Employee growth (per month)	1.80	5.68	-82	96	1
Number of employees	31.76	35.06	1	367	21
Time in the sample (in months)	18.5	15.0	1	77	14

Panel B: Non-Venture-Backed Firms

<u>Non-Venture-Backed Firms</u>					
	Mean	Standard deviation	Minimum	Maximum	Median
Employee growth (per month)	0.68	3.65	-37	123	0
Number of employees	15.95	30.05	1	397	6
Time in the sample (in months)	18.3	16.5	1	77	13

TABLE 4^a**The Effect of Venture Capital Financing and Past Growth on Current Startup Growth****Panel A: Prediction of Current Growth Based on Past Growth and the Presence of VC Funding**

Dependent variable: current growth (1 if positive, 0 otherwise)

Independent variables	Coefficient	t-ratio
Constant	-1.096	-11.67
Presence of venture capital	0.486 **	9.55
Employee growth the previous month	0.119 **	9.49
Ln (time since joining the sample)	-0.412 **	-13.11
Ln (number of employees at the end of previous month)	0.596 **	24.19
Communication & Networks	0.178 *	2.22
Electronics & Computer Hardware	-0.086	-0.72
Semiconductors	0.034	0.30
Software	0.126 †	1.73
Information Services	0.372 **	5.04
Health and Biotechnology	-0.079	-1.01
Pseudo R ²	0.16	
# of observations	9,947	

Panel B: Association Between Current Growth, Past Growth, and the Presence of VC Funding

Dependent variables	Headcount growth on the current month	
Independent variables	Coefficient	t-ratio
Constant	-0.588 †	-1.94
Presence of venture capital	0.707 *	6.80
Employee growth on the previous month	0.886 *	5.79
Ln (time since joining the sample)	0.090	0.88
Ln (number of employees at the end of previous month)	0.153 †	2.13
Communication & Networks	-0.123	-0.86
Electronics & Computer Hardware	-0.320	-1.95
Semiconductors	-0.462 *	-3.11
Software	-0.283 †	-2.21
Information Services	0.528 *	3.48
Health and Biotechnology	-0.854 *	-6.12
R ²	0.09	
Estimated autocorrelation coefficient	0.37	
# of observations	9,947	

^aThe reference industry is business and consumer services and products. To avoid the influence of outliers, we delete the top and bottom 0.5% observations for the dependent variables. Results without deleting the outliers are comparable but less significant than in the table. T-ratios are computed using White's heteroskedasticity-adjusted standard errors. †, *, or ** indicate that the coefficient is significant at the 5%, 1% level (2-tailed).

TABLE 5^a
Growth and the Availability of Venture Capital Funding

Panel A: Growth as a Predictor of Future Venture Capital Funding

Dependent variable: future venture financing

Independent variables	Coefficient	z-ratio
Constant	-2.467	-5.07
Growth in the first month	-0.035	-0.63
Ln (number of employees at the time of joining the sample)	0.032	0.21
Communication & Networks	0.260	0.38
Electronics & Computer Hardware	-0.043	-0.04
Semiconductors	0.848	0.96
Software	0.991 [†]	1.82
Information Services	0.197	0.35
Health and Biotechnology	0.271	0.40
Pseudo R ²	0.02	
# of observations	326	

Panel B: Venture Capital Funding and the Growth of the Firm Over the First Month

Dependent variables	Growth in first month	
Independent variables	Coefficient	t-ratio
Constant	0.313	0.92
Presence of venture capital	0.846 [*]	2.41
Ln (number of employees at the time of joining the sample)	0.757 ^{**}	4.11
Communication & Networks	-0.254	-0.48
Electronics & Computer Hardware	-1.076 [*]	-2.50
Semiconductors	-0.661	-1.20
Software	-0.162	-0.35
Information Services	0.616	1.53
Health and Biotechnology	-0.997 [*]	-2.27
R ²	0.13	
# of observations	474	

^aThe sample in **Panel A** is startups that have not received venture financing as of the end of the first quarter in the sample. The sample in **Panel B** are all firms with growth information in the first quarter. The reference industry is business and consumer services and products. T-ratios are computed using White's heteroskedasticity-adjusted standard errors. †, *, or ** indicate that the coefficient is significant at the 10%, 5%, 1% level (2-tailed).

TABLE 6^a**Financing Events and the Growth of Startups****Panel A: Employee Growth and the Occurrence of Financing Events**

Dependent variables	Employee growth in the current month	
Independent variables	Coefficient	t-statistic
Constant	0.297	0.53
Employee growth on the previous month	1.006**	4.41
Ln (time since joining the sample)	-0.391	-1.17
Ln (number of employees at the end of previous month)	0.389	1.30
Month ₋₃	0.444*	2.03
Month ₋₂	0.684**	2.96
Month ₋₁	0.392 [†]	1.66
Month ₀	0.981**	3.87
Month ₊₁	1.783**	6.46
Month ₊₂	1.375**	5.26
Month ₊₃	1.020**	4.61
Initial Public Offer month	0.598	0.90
Communication & Networks	-0.873*	-2.32
Electronics & Computer Hardware	-0.313	-0.63
Semiconductors	-1.071**	-2.80
Software	-0.889*	-2.48
Information Services	-0.616	-1.43
Health and Biotechnology	-1.158**	-3.36
R ²	0.07	
Estimated autocorrelation coef.	0.42	
Durbin Watson (transformed)	1.84	
# of observations	3,962	

Panel B: Difference Across Coefficients

F-test	MONTH ₋₃	MONTH ₋₂	MONTH ₋₁	MONTH ₀	MONTH ₊₁	MONTH ₊₂	MONTH ₊₃
EGROWTH _{tt}							
MONTH ₋₃		1.03	0.04	3.06 [†]	16.37**	8.38**	3.90*
MONTH ₋₂			1.49	1.02	11.28**	4.60*	1.29
MONTH ₋₁				5.48*	19.62**	9.55**	4.47*
MONTH ₀					8.10**	1.54	0.02
MONTH ₊₁						2.12	5.99*
MONTH ₊₂							1.80

^a The reference industry in **Panel A** is business and consumer services and products. T-ratios are computed using White's heteroskedasticity-adjusted standard errors. **Panel B** presents the F-test of equality of coefficients. [†], **, or *** indicate that the coefficient is significant at the 10%, 5%, 1% level (2-tailed).

TABLE 7^a
Employee Growth and Company Valuation

Panel A: Absolute Growth

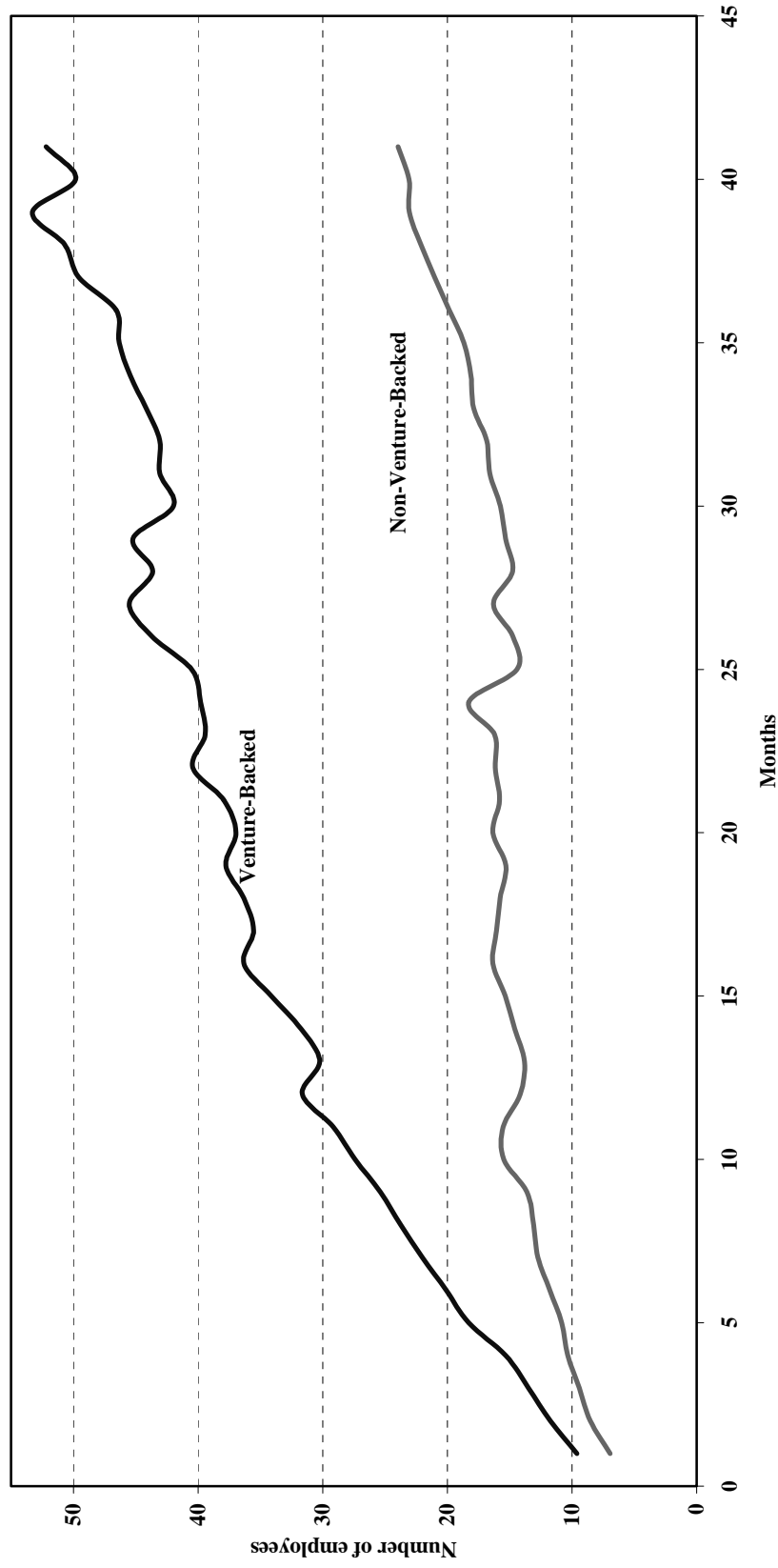
	Change in value	
	Coefficient	t-statistic
Constant	-11.85	-1.20
Growth in number of employees between rounds	0.89**	4.13
Number of employees	0.66**	2.70
Communication & Networks	11.28	1.48
Semiconductors	42.21 [†]	1.92
Software	4.44	0.46
Information Services	-0.62	-0.06
Health and Biotechnology	16.20	1.20
R-squared	0.32	
# of observations	74	

Panel A: Percentage Growth

	Percentage change in value	
	Coefficient	t-statistic
Constant	28.67	4.03
Percentage growth in number of employees between rounds	0.25 [†]	1.93
Communication & Networks	1.78	0.18
Semiconductors	-2.43	-0.18
Software	-2.80	-0.40
Information Services	0.01	0.00
Health and Biotechnology	1.32	0.15
R-squared	0.06	
# of observations	74	

^a The regression on the percentage change (**Panel B**) is a rank regression to minimize the impact of large observations. The reference industry is business and consumer services and products, electronics and computer hardware does not have any observation. Standard errors are White-adjusted. [†], **, or *** indicate that the coefficient is significant at the 10%, 5%, 1% level (2-tailed).

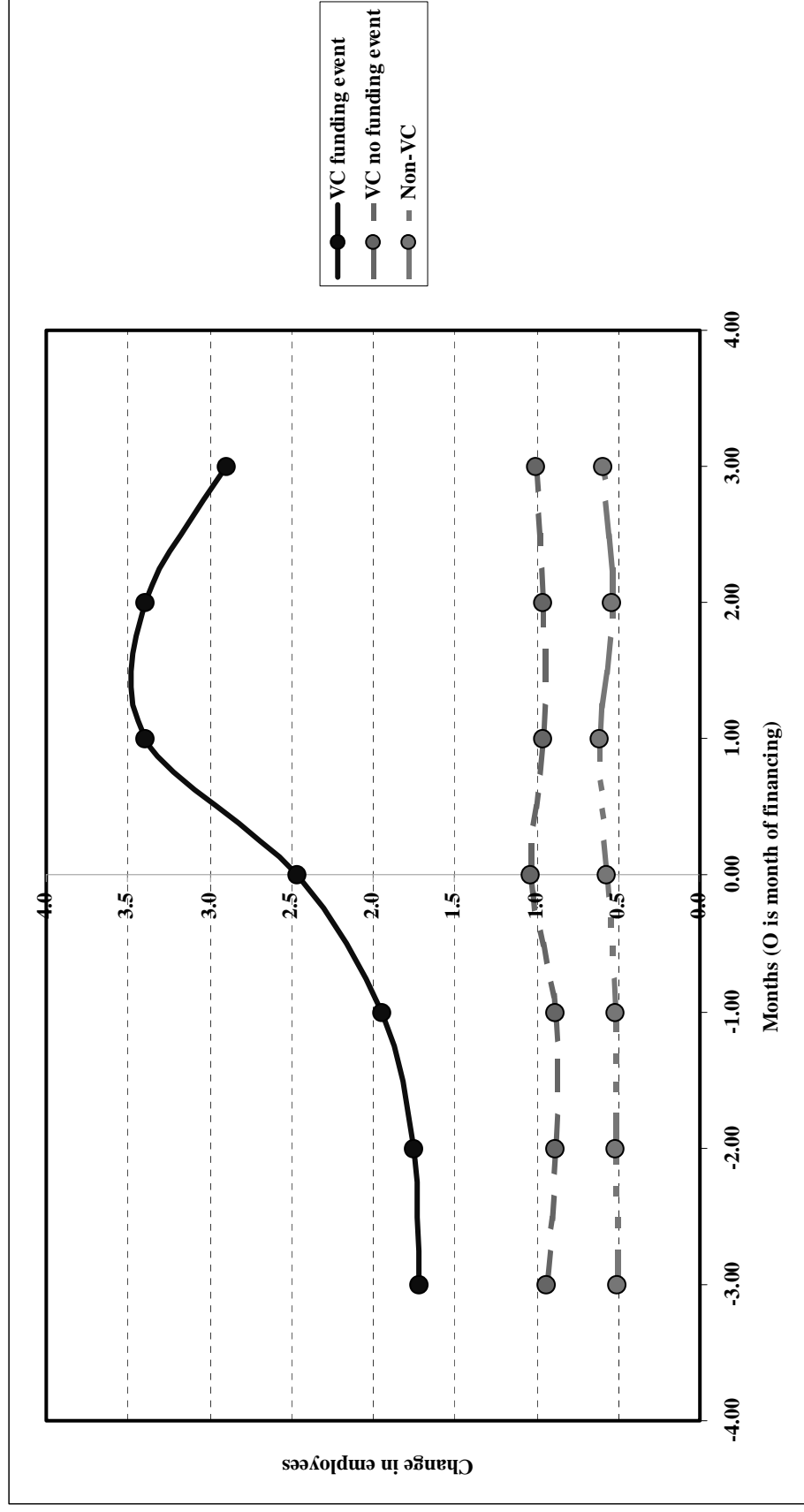
FIGURE 1^a
Growth for Venture-Backed and Non-Venture-Backed Firms (mean number of employees)



VC-backed startups 189 162 137 104 75 45 44 40 29
non VC-backed startups 283 215 147 111 86 62 50 50 33

^a The plot shows the mean size of the companies in the SV-PEO sample. For every month the mean size of VC-backed firms is significantly larger than non VC-backed firms (two-tailed t-test, 1% significance).

FIGURE 2^a
Mean Change in Growth Around Month of Financing Event



^a The plot shows the mean change in number of employees around the month when VC-backed companies receive external financing compared to venture-backed and non-venture-backed firms on the same dates.