

DO VCS MATTER? THE IMPORTANCE OF OWNERS ON PERFORMANCE VARIANCE IN START-UP FIRMS

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Adding to the corporate effect literature, we study the effect of owners on firm performance in a new context, that of venture capital firms (VCs) and the start-up firms in which they invest. After discussing the effect that VC ownership can have on start-ups, we estimate that start-up-specific, owner (VC), and year effects account for significant variance in performance (26.3 percent, 11.2 percent and 3.7 percent, respectively). The effects of industry and investment stage are not statistically different from zero. We also provide an analysis that separates the owner effect into two components: a selection component—which impacts investment—and a management component—which explains significant variance in performance. By examining the owner effect in a different institutionalized form of governance—that of the start-up and its relationship to VC owners—our study also contributes to an understanding of the ‘ownership’ effect in the strategy literature more generally. Copyright © 2008 John Wiley & Sons, Ltd.

INTRODUCTION

Many strategic management theories about sources of performance differences across firms highlight decisions about asset ownership. For example, the resource-based view focuses on which resources and capabilities a firm owns (e.g., Barney, 1986; Hatten and Hatten, 1987; Wernerfelt, 1984); transaction cost economics suggests that the ownership of assets relating to, and the control over, certain transactions is critical to firm performance (Williamson, 1991); and theories of economies of scope underlying diversification strategies (e.g., Baumol, Panzar, and Willig, 1988; Teece, 1980) point to the significance of which business units (and their associated assets) a corporation owns.

One notable research stream on the importance of ownership for performance differences studies the ‘corporate effect’ (McGahan and Porter, 1997, 2002; Rumelt, 1991; Schmalensee, 1985). This effect is an estimate of how much variance in business unit performance is explained by the identity of the corporate parent or owner.¹ Emerging from the debate among strategy scholars on the relative importance of firm (business unit) versus industry differences, this research has evolved empirically to attribute variability in performance to different levels of analysis, such as the business unit, corporate owners, industries, and countries. In recent years, the resource-based view of strategy (e.g., Barney, 1986; Hatten and Hatten,

Keywords: venture capital; start-up firms; entrepreneurship; governance

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¹ In this study, we prefer the term ‘corporate owner’ to that of ‘corporate parent’ because studies of the corporate effect include firms with a wide range of reporting and control relationships between corporate headquarters and business units. While undoubtedly an equally diverse set of parenting styles exist among people, we find the parent-child metaphor to imply a relatively hands-on relationship.

1987; Wernerfelt, 1984) has motivated variance decomposition studies that paid more attention to factors internal to firms (e.g., Bercerra, 1997; Bowman and Helfat, 2001; Brush and Bromiley, 1999). Other recent contributions in this area contextualized these findings. Researchers have found that the relative importance of industry, corporate, and business unit effects vary depending on the broad economic sector in which a company is participating, or the country in which the corporation is operating (Makino, Isobe, and Chan, 2004; McGahan and Porter, 1997).

While the evolution of this research has taken us a long way toward understanding how much variance in performance is attributable to different levels of analysis, our understanding of how generalizable these findings are to other ownership forms has not advanced as quickly. Extant research on the corporate effect has limited its sights to the owner-asset or superior-subordinate relationship in a relatively specific governance form: the publicly held, diversified corporation. Few, if any, scholars have examined which levels of analysis explain variability of performance in relatively nascent firms.

In this study, we focus on the importance of owners in the context of venture capital firms (VCs) and the start-ups they own. To some extent, this relationship between VCs and their start-up firms is analogous to the role of a corporate owner and its business units. Like corporations, VCs help the companies in which they invest formulate strategy, develop the professionalization of the firm, and transfer reputational assets, network resources, and other intangible assets (e.g., De Clercq *et al.*, 2006). The potential for conflicts of interest or agency costs arises between VCs and the venture firms as it does for corporate top managers and business unit managers. The extent to which VCs are involved in the management and control of start-up firms varies across VCs, as it does across corporations and their involvement in business units. Finally, both VCs and corporations make active decisions about which start-ups or business units they should hold in their portfolios.

Nonetheless, notable differences exist with this analogy. Most start-up firms with VC backing have multiple owners, drawing from a diverse pool of private equity investors, such as VCs, angel investors, corporations, and individuals, including firm founders and key employees, whereas most business units have only one corporate owner.

VCs do not supply tangible assets to start-up firms except for monetary investments, whereas corporate owners provide a mix of financial, tangible, and intangible resources to their business units. Most VCs are privately owned and subject to disciplining forces directly from their private investors; to our knowledge, studies of the corporate effect include only publicly traded corporations subject to the disciplining forces of the market for corporate control (e.g., Davis and Stout, 1992; Jarrell, Brickley, and Netter, 1988; Pound, 1997). Despite the similarities and differences in how different types of owners may affect the value of their units, scholars have yet to quantify how much ownership effects, as well as industry and unit effects, influence business unit performance variance in the context of start-up firms.

Our study makes three main contributions. First, it makes a contribution to the literature that identifies contingencies in the nature of the relationship between variance in firm performance and firm effects (Makino *et al.*, 2004; McGahan and Porter, 1997) by examining a different context: the start-up firm. Second, we contribute to an understanding of how much VCs can affect the value of their portfolio companies. Thus, our study integrates the research stream on firm/owner effects with studies on how VCs add value to assess empirically how much variance in portfolio company performance is explained by VCs versus by the business unit (i.e., the portfolio company itself), industry, and other factors. Third, we contribute to an understanding of how owners affect the value of their portfolio companies by separating the VC owner effect into two parts: a selection component and a management component.

EXTANT RESEARCH ON THE OWNER EFFECT

Schmalensee (1985) pioneered a research stream that examines the relative contribution of various components to variability in the profitability of corporations engaged in diverse manufacturing operations. He used variance decomposition analysis to measure the percent of total variance in a dependent performance variable—business unit profitability based on reported accounting data—that is explained by categorical variables of interest (i.e., being associated with a particular industry, being associated with a particular corporate owner).

By disaggregating business unit profits into their component parts, Schmalensee found no corporate effects. Rumelt (1991) extended this work to include data from multiple years, which allowed for a broader indicator of business unit effects, and found a corporate effect of 14.9 percent. McGahan and Porter (1997) expanded the sample beyond manufacturing firms to include service sectors of the economy and estimated corporate effects as explaining 9.1 percent of the variance in business unit profitability. Other studies in the area (Bercerra, 1997; Brush and Bromiley, 1999; Chang and Singh, 2000; Hawawini, Subramanian, and Verdin, 2003; McGahan and Porter, 2002; Roquebert, Andrisani, and Phillips, 1996) reported similar findings.

With the magnitude of corporate effect estimated from zero percent to 14.8 percent and all but one study indicating some statistically significant effect, scholars have drawn frequently from the resource-based view of strategy to explain the corporate influence on business units. Business units may benefit from the idiosyncratic collection of resources owned and controlled by corporations (e.g., Barney, 1986; Hatten and Hatten, 1987; Wernerfelt, 1984). A corporation can share its expertise in implementing organizational structures (Grant, 1996), planning, control, and disciplining mechanisms (Goold and Campbell, 1987; Liebeskind, 2000), and business unit strategies (Goold and Campbell, 1987), and can share reputational and network resources (Dierickx and Cool, 1989).

We find little discussion of alternative explanations for the corporate effect. For example, the extant literature does not speak to whether the corporate effect is a result of different abilities of corporations to select profitable business units for acquisition or profitable industries for business entry versus differences in their abilities to manage their business units and provide them with the necessary resources to succeed. The reasons why some business units are more successful than others can derive from different theoretical explanations: they had superior performance prior to being purchased by the corporation versus the corporation provided rare, valuable, inimitable, and nonsubstitutable resources to them.

The next section links the practices, policies, and structures associated with the VC-new-venture relationship with theoretical discussions of how ownership can create value.

THE VC OWNER ROLE

Entrepreneurship research has suggested that VCs influence the performance of the new ventures in which they invest—the latter are called ‘portfolio companies’ because these start-up firms form the investment portfolio of the VC. VCs raise money from outside investors, such as institutional investors, and place these funds into a venture capital fund. Managers of a VC fund, in turn, invest in a portfolio of entrepreneurial companies. VCs invest in portfolio companies at various points in their development. These points in time are generally referred to as rounds, meaning that the earliest VC investments in a firm would be considered Round 1, the second Round 2, and so on. The length of time between rounds varies by the specific needs of a portfolio company at different points in time. Whenever a new investment is made, the value of the portfolio company is established based on what the new investors negotiate with the current owners (e.g., VCs who invested in earlier rounds). This valuation is called the pre-round valuation (the post-round value is the pre-round value plus the money invested in the round). While the market value of a portfolio company is not known until it either goes public through an initial public offering (IPO) or is sold to another entity, the pre-round valuation is a close proxy to a market measure and is perceived as reasonably objective (Gompers and Lerner, 1998, 2001; Gompers, 1995; Hsu, 2004).

Vcs, however, do more than just provide financial resources. They are typically considered to be value-added investors, contributing value to their portfolio companies in excess of their monetary investments (Baum and Silverman, 2004; Busenitz, Fiet, and Moesel, 2004; Dimov and Shepherd, 2005; Edelman, 2002; Hellmann and Puri, 2002; Lerner, 1995; Sapienza, 1992). They can add value by participating in a wide range of activities from formulating firm strategy to assisting in the execution of that strategy.

Similar to a corporate owner, a VC can play an active role in shaping strategies of its portfolio companies in its capacity as a board member in these firms (Fried, Burton, and Hisrich, 1998). A corporate owner may instigate common reporting procedures and operational or organizational practices across its units. Also, VCs

increase the professionalization of their portfolio companies by bringing in professional managers, standardizing HR policies, hiring marketing executives, adopting stock option plans (Hellmann and Puri, 2002), and facilitating the adoption of other professional management systems (Bygrave and Timmons, 1992; Hochberg, 2003; Kaplan and Strömberg, 2001, 2003; Sahlman and Gorman, 1989; Sapienza, 1992). In addition, VCs can facilitate access to financial resources to fund initiatives of their portfolio companies (Lerner, 1995; Megginson and Weiss, 1991). VCs also transfer reputational resources. The quality of a start-up is often hard to evaluate, so it may be difficult for these firms to find people who are willing to invest their time (e.g., managers) or other resources (e.g., suppliers) with them. Being associated with a highly reputable VC can act as a quality signal, which can induce others to commit time and resources to these firms (Busenitz *et al.*, 2003; Gladstone and Gladstone, 2003; Hsu, 2004; Megginson and Weiss, 1991). To some extent, these reputational resources are transferred not only directly to a VC's portfolio companies, but also to other VCs with which a VC co-invests (Godesiabo, 2007). Thus, network resources are transferred with direct and indirect ties to portfolio companies.

Another important role the VC plays that is similar to a corporate owner is controlling and disciplining management (Admati and Pfleiderer, 1994; Busenitz *et al.*, 2003; Hellmann and Puri, 2002; Kaplan and Strömberg, 2001, 2002, 2003; Lerner, 1995). VC monitoring can result, for example, in the replacement of a nonperforming CEO (Fried *et al.*, 1998). Often such disciplining occurs in less visible ways, involving the constant application of pressure to reach certain milestones within a specified time. Thus, VCs may add value to portfolio companies by reducing agency costs.

In addition to improving the performance of businesses they own, VCs can also create value through superior selection of companies in which to invest. (The same is true for corporations that have superior skills at choosing acquisition targets and divesting current businesses.) During the investment stage of any VC fund, VCs continually seek out and evaluate new businesses for investments prior to using any management abilities to build and grow these companies. This emphasis on VC selection is reflected in a large body

of entrepreneurship research on how VCs choose portfolio companies in which to invest (Fried and Hisrich, 1994; Sahlman and Gorman, 1989; Shepherd, 1999).

Despite the well-documented benefits VCs can provide to their portfolio companies, little research exists that quantifies and compares the contribution of this 'ownership' effect to the relative contribution of industry or business unit (i.e., start-up) effects in explaining variance in start-up firm performance. Examining variance in the performance of start-up firms owned at least in part by VCs offers a view into the effects of a distinct ownership structure, broadening our knowledge about the effect of superordinate entities on the companies they own.

RESEARCH METHODS

In the current study, we measure the effect of VCs on the variability in performance of portfolio companies by comparing them to other factors that may influence portfolio company performance. Specifically, we assess the importance of VC, portfolio company, industry, round, and year effects. We do this by applying a variance decomposition analyses, based on an analysis of variance (ANOVA) estimation technique. We estimate the following equation:

$$\text{Vinc}_{i,r} = \mu + \alpha_{v,r} + \gamma_{y1,r} + \nu_{y2,r} + \lambda_{\text{ind}} + \varphi_{s,r} + \phi_i + \varepsilon_{i,r} \quad (1)$$

$\text{Vinc}_{i,r}$ represents the value increase (in percentage) per month of a portfolio company i in the period between two funding rounds—the inter-round period r . This value increase is the difference between the post-money valuation of a portfolio company in a funding round and the pre-money valuation in the subsequent round. We explain this measure in more detail in the Measures section. Measures based on this value increase are standard in the literature on VC performance (Gompers and Lerner, 1998, 2001; Gompers, 1995; Hsu, 2004). The explanatory variables are: μ , the average value increase per month per inter-round period of all portfolio companies over the entire period captured in our data; $\alpha_{v,r}$, the premium (or deficit) associated with the VC who invests in the portfolio company in inter-round period r ; $\gamma_{y1,r}$, the

premium (or deficit) associated with the year y in which the inter-round period began; $\nu_{y2,r}$, the premium (or deficit) associated with the year y in which the inter-round period ended; λ_{ind} , the premium (or deficit) associated with the industry to which the portfolio company belongs; $\varphi_{s,r}$, the premium (or deficit) associated with the (development) stage of the start-up at the beginning of the inter-round period; and ϕ_i captures the premium (or deficit) associated with the portfolio company itself. ε_i represents the residual.

The portfolio company's industry, the inter-round period beginning and ending year, the development stage of the portfolio company, the VC owners (owners are all VCs who invested in the current round as well as all VCs who invested in previous rounds), as well as the portfolio company effect itself are represented with a set of dummy variables (for example coding one if a specify VC is among the owners).

We compare estimates of Equation 1 with estimates of an equation that omits a specific effect (Judd and McClelland, 1989) to ascertain the performance variance associated with a specific effect. For example, the portfolio company effect is determined by comparing the explained variance (R^2 and adjusted R^2) of an equation that contains all effects with the explained variance of an equation that omits the dummies representing the portfolio companies.

A key advantage of our ANOVA approach over methods used in the past (Hawawini *et al.*, 2003; Makino *et al.*, 2004; McGahan and Porter, 1997, 2002; Roquebert *et al.*, 1996; Rumelt, 1991; Schmalensee, 1985) is the ability to control for covariance between the effects. Previous studies that estimated industry and owner effects (e.g., McGahan and Porter, 1997; Rumelt, 1991; Schmalensee, 1985) used either a nested ANOVA or a components of variance technique. These types of variance decomposition analyses, however, rely on some restrictive assumptions. In both methods, a set of dummies represents each individual effect (e.g., a set of dummies for all industries in the sample). In a nested ANOVA, these dummy sets are introduced into the model in a stepwise fashion. The residual of a regression containing the first effect of interest is regressed on the second effect of interest; the residual of this regression is then regressed on the third effect of interest, and so on until the last effect of interest. This approach

assumes that no covariance exists between the individual effects.² Similarly, the component of variance technique is based on a random-effects model, which assumes that each effect is independent of the other effects in the model.

These assumptions may be overly optimistic. For example, McGahan and Porter (1997) found a strong covariance between industry and owner effects, because a given corporation (or VC) might only hold businesses in certain industries. Although the authors acknowledge these shortcomings, they chose these methods partly because of limited computational resources at the time. More recently, McGahan and Porter (2002) address these shortcomings and employ a different type of variance decomposition analysis by using a simultaneous ANOVA. To a certain degree, this approach controls for covariance between the different effects. McGahan and Porter's (2002) model, however, still has a nested character. They introduce one effect at a time, and the amount of considered covariance increases with the introduction of each effect. Our approach goes further, because we measure all effects in the context of a model that allows for the maximum possible covariance. An additional advantage of our approach over others is that the order in which the effects are introduced into the model is not important.

Although our method offers these advantages over techniques used in the past, due to the nature of our data we are not always able to control for covariance between all effects. This is due to the fact that some variables can be expressed as linear combinations of others. For example, since a portfolio company can only be in one industry, any particular industry can be expressed as a perfect linear combination of the portfolio companies within that industry. Therefore, the portfolio company effect cannot be used as a covariant to the industry effect. Accordingly, we measure all effects in the context of a model that allows for the maximum possible covariance. For example, the industry effect is measured as the incremental increase in explained variance between a model containing the industry, year, VC, and round effects with a model containing only the year, VC, and round effects. This procedure is illustrated in Figure 2.

² If covariance exists, the size of the measured effects will depend on the order in which the effects are introduced.

Our data contain multiple successive inter-round periods for the same portfolio company, so we control for the possibility of first-order serial correlation, that is the effect round $t-1$ can have on round t . This effect is captured by the new parameter ρ , which represents the rate of persistence.

$$\varepsilon_{i,r} = \rho \varepsilon_{i,r-1} + v_{i,r} \quad (2)$$

With serial correlation, the value of the error term ($\varepsilon_{i,r}$) in the current period is not independent of the value of the error term in the previous period ($\varepsilon_{i,r-1}$). The parameter ρ captures the persistence of all effects (VC, year, industry, stage, and start-up), independent of the source of this persistence. The Equation 1 parameters $\alpha_{v,r}$, $\gamma_{y1,r}$, $v_{y2,r}$, λ_{ind} , $\varphi_{s,r}$, and ϕ_i , capture the effect the VC owner, year, industry, stage, and portfolio company respectively have on the variance in performance of a portfolio company in the complete period captured by our data. To discern the portion of effects that are stable and that are not influenced by the previous round, we subtract ρ from Equation 1.

$$\begin{aligned} \text{Vinc}_{i,r} = & \rho \text{Vinc}_{i,r-1} + (1 - \rho)\mu \\ & + (1 - \rho)\alpha_{v,r} + (1 - \rho)\gamma_{y1,r} + \\ & (1 - \rho)v_{y2,r} + (1 - \rho)\lambda_{ind} + (1 - \rho)\varphi_{s,r} \\ & + (1 - \rho)\phi_i + (1 - \rho)\varepsilon_{i,r} \end{aligned} \quad (3)$$

As in Equation 1, the left hand represents the value increase per month of the value of portfolio company i in the inter-round period r . The first term on the right side is the rate of persistence multiplied by the value increase per month of the same portfolio company in the last inter-round period. The other terms on the right side represent the different effects of interest. Please note that, because we calculate lagged variables, we drop first round data for each portfolio company.

We use a maximum likelihood (Jennrich and Schluchter, 1996) estimation to determine the value of ρ .³ Similar to McGahan and Porter (1997), we then calculate a null model based on Equation 3 that restricts the VC (owner), year, industry, stage, and portfolio company effect to zero. In other words, the null model assumes that the value increase of a start-up is only determined by the rate of persistence and the economic

mean. As described above, the individual effects are then estimated by regressing the residual of this null model on a set of dummies representing all effects (VC, portfolio company, year, industry, and stage) and comparing the explanatory power of this regression with the explanatory power of a regression that omits a specific effect. We use externally studentized residuals (Judd and McClelland, 1989) to eliminate outliers based on our fully specified model. This procedure results in the deletion of seven observations.

Our estimation technique relies on average returns, as do the nested ANOVA and covariance method employed in previous studies. This means that only the average of the performance of all companies within a VC's portfolio influences the estimate of the VC effect. As a result, a VC only needs to impact a sufficiently large amount of its portfolio companies to impact the measurement of average performance. In addition, some VC actions might have a positive effect on some of its portfolio companies, but a negative effect on others. This would result in an overall zero effect in our model. Accordingly, our results must be interpreted with the appropriate caution.

DATA

We use the VentureXpert database from Thomson Financial. VentureXpert is the database associated with the primary trade association of venture capitalists, the National Venture Capital Association (NVCA). The goal of VentureXpert is to provide comprehensive information on venture funds, venture-backed companies, and investments in these companies. This database is frequently used by venture capitalist firms to research comparable companies and deals.

The database contains 67,505 portfolio companies. Of these companies, 34,214 were based in the United States. From these we excluded all portfolio companies that did not have at least two rounds of funding in the database. This resulted in 4,252 portfolio companies. For these 4,252 portfolio companies, the database contains 7,428 inter-round periods. We excluded all inter-round periods for which the evaluation was not available; this reduced our sample to 6,512 inter-round periods. Additionally, for 22 of these periods the amount

³ In our results, we report the effects from a model that corrects for autocorrelation as well as one that does not.

Table 1. Descriptive statistics of sample used

	Round amount [in \$1000]	Pre-money valuation [in \$1000]	Valuation increase between rounds [in \$1000]	Valuation increase between rounds [in %]	Length between rounds (inter- round period) [in month]	Valuation increase between rounds [in % per month]
Minimum	11	0	-4,918,290	-7,516	1	-250
Mean	14,093	61,873	15,491	56	12	7
Maximum	401,000	5,708,040	2,706,040	3,797	151	327
Standard deviation	20,708	166,823	152,599	170	10	26

Table 2. Distribution of method of disinvestment in our sample compared with the VentureXpert database*

	Information in the sample	Information in the database
Total sample size	3,756	67,505
Portfolio companies with known outcome [in %]	64	38
Portfolio companies with outcome pending [in %]	36	62
Exit events for portfolio companies with known outcomes		
IPO [in %]	45	48
Sold [in %]	38	32
Failed [in %]	17	19

* The time period of this comparison is 1980 to 2004. Percentages in Table 2 do not add to 100 due to rounding.

invested was not available. As a result 6,490 inter-round periods contained all the necessary information (evaluation, amount invested, name of VC firms, round dates, round stage). We deleted VC firms that appeared only once (that invested only in one portfolio company), because these VCs would be perfectly correlated with the portfolio company they invested in, so their unique effect on $Vinc_{i,t}$ cannot be disentangled from effects internal to this company. In addition, we excluded all unspecified investors such as unspecified individuals and unidentified funds. The final dataset contains 3,756 portfolio companies, 6,490 inter-round periods and 1,418 venture firms, representing 58 different industries (based on two-digit venture economic industry codes [VEIC]) covering the period of 1980 to 2005. The average, minimum, and maximum values for each of our variables are reported in Table 1. Additionally, the maximum number of rounds in our sample is 14 and the median age of the portfolio companies when they receive their first round of investment is around one year. Though portfolio companies do not necessarily have to be start-up firms, in this database most portfolio companies are relatively young.

One concern about the process we use to develop our final dataset may be whether it contributed to a nonrepresentative sample. VCs might tend to report valuation data for successful investments and omit these data for unsuccessful ones, resulting in missing values in the database. To evaluate whether this bias exists, we compared the firms represented in our sample to all portfolio companies in the VentureXpert dataset along various dimensions (e.g., number of portfolio companies reporting each round of data, founding year of portfolio company, number of investors for each portfolio company, number of investors per round, age distribution of portfolio companies) and found our sample to be representative of the larger database.

In addition to reporting biases, our selection is based on complete round information. This might lead to a bias toward more successful companies. The results of our comparison, as presented in Table 2, suggest that the firms in our sample are representative. Of the companies in the VentureXpert database for which the final outcome is known, 80 percent were sold or went public; in our sample this number is 82 percent (comparing the same time periods). However, the method of

exit is reported for 64 percent of the portfolio companies in our sample, but the method of exit is reported for 38 percent of the portfolio companies in the database overall. This might indicate that VCs tend to report more data to the VentureXpert database after they complete the involvement with the portfolio company. Such behavior could be a sign of a larger bias; to protect deal-specific information, some venture capital firms may not report any data about specific investments before an exit event. Thus, our sample as well as the entire VentureXpert database may be biased toward portfolio companies from which the VC had already cashed out its investment (as opposed to portfolio companies that are still active in a fund). This concern cannot be addressed using the information available to us, however, any effect associated with this should be limited. Most VC funds exit within eight to 10 years after their first investment in a portfolio company (e.g., Hochberg, Ljungqvist, and Lu, 2007), and since our database starts in 1982, most companies had enough time to have an exit event. Most of the firms in our sample for which the database does not state a method of exit (that is firms that are still owned by VCs in 2005) received their first VC investment after 2000. The percentage of investments in start-ups that are still VC owned by 2005 is shown in Table 3. We do not expect that companies that are still privately owned by VCs are significantly different from companies that already had an exit event.⁴ The only way they might be different is if the investment environment differs between recent years and more distant years. We include year effects in our model, which accounts for differences specifically attributable to a time period.

Due to the nature of venture capital investments, our data are not evenly distributed across industries. The most represented industries are Internet software with 442 inter-round periods and Internet services with 429. Biotechnology and health care related firms are also well-represented (i.e., 305 inter-round periods for biotech human and 298 for medical therapeutics). The least represented industries are industrial products, agricultural, forestry, and oil and gas exploration with one, two, and three inter-round periods, respectively.

⁴ As a sensitivity test, we also conducted our analysis excluding all portfolio companies that received their first investment after the year 2000. The results of this analysis are similar to our main results.

Table 3. Investments for which the final state of the start-up company is unknown by 2005 (start-up is still owned by VC in 2005) [in percent of total investments per year]

1995	0
1996	0
1997	0
1998	0
1999	5
2000	19
2001	23
2002	25
2003	27
2004	28
2005	28

Note: All investments prior to 1995 have a known outcome.

As described in the Research Methods section, we delete the first observation (inter-round period) for each portfolio company in the process of adjusting for serial correlation. By doing so, we also delete all portfolio companies in our sample for which we have only one observation. This is consistent with recent owner-effects studies; including business units (or in our case start-ups) with only one observation artificially inflates the business unit (start-up) effect (Bowman and Helfat, 2001; Roquebert *et al.*, 1996). As a result, our estimation of Equation 1 contains 3,157 observations and 922 portfolio companies (3.42 inter-round observations per start-up firm on average). Of the start-ups that are used to estimate Equation 1, 100 percent have at least two observations, 50 percent have three or more, and 24 percent have four or more.

One advantage of our dataset is that it allows us to cover a larger time frame than previous studies of owner effects. Since our data spans 1980–2005, it incorporates the effects of several business cycles. One other key consideration associated with our data source is its coding system for industry. Industry is represented by VEIC, not standard industrial classification/North American industry classification systems (SIC/NAICS) codes as in the corporate and industry effect studies. The VEIC system tends to aggregate *non-high-tech* industries into a couple of codes, so, in some cases, strategic similarities or differences among industries are not represented by the VEIC mapping. On the flip side, this system provides a more fine-grained coding for some technology-intensive industries, especially those typically invested in by

venture capital funds. Due to these differences, our results for the industry effect must be interpreted with the appropriate caution.

MEASURES

Dependent variable

Consistent with prior studies (Gompers and Lerner, 1998, 2001; Gompers, 1995; Hsu, 2004) we use the change in company valuation between two funding rounds as our measure of portfolio company performance. This valuation occurs through a negotiated process between the current company owners (including owners who are not VCs, such as founders, family investors, etc.) and new investors to the start-up. Our dependent variable is the percentage increase (or decrease) between the firm valuation associated with the previous funding round, which includes the cash invested in this previous round (the so-called 'post-money evaluation' of the previous round) and the firm valuation associated with the subsequent funding round, which does not include the cash invested in the latest round (the so-called 'pre-money valuation')⁵ divided by the number of months between the two rounds. Figure 1 illustrates how this measure is

constructed. Thus, our dependent variable captures an assessment of the change in value of the portfolio company between these two time points that is independent of the cash infusion as well as of the length of the funding round. This change in value reflects theoretical effects of interest, such as the managerial activity of the company's management, the industry environment of the company, and/or the non-monetary contribution of the VCs who are invested in the company at the time. We calculated the dependent variable on a per month basis to control for the fact that the time between rounds can vary. We chose to divide by months, rather than days, because funding events are unlike a true market where there is daily trading and information exchange. With VC valuations, funding events are also influenced by administrative issues, such as the coordination time across VCs in a syndicate needed to agree on a valuation price.

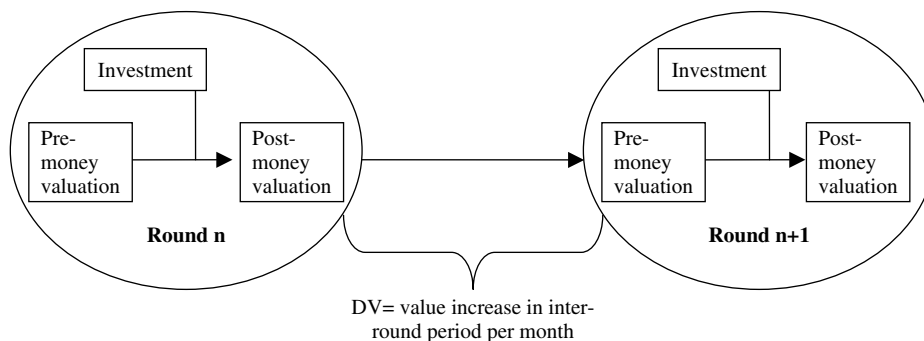
Independent variables

The portfolio company's industry, its VC owners, as well as the portfolio company effect itself are represented with sets of dummy variables. The assignment of a portfolio company to an industry is based on two-digit VEICs.

Control variables

The stage of the investment round is included as a proxy for how advanced the portfolio company is in its development. It is operationalized with a dummy variable for each stage. These stages are reported in the VentureXpert database and are based on the VCs' evaluation of the investment.

⁵ These values are the result of negotiations among the parties involved and therefore do not necessarily reflect a unanimous or consensus viewpoint. However, these valuations are reasonably objective because the pre-round valuation of a start-up determines the ownership stake and consequently the influence and potential return of all investors. Given the experience of venture capital funds with this kind of negotiation, an evaluation that mirrors the real market value of the start-up is likely. While individual evaluations might not be perfect, we have no reason to suspect these valuations will be systematically biased.



Note: The dependent variable is the difference between the post-money valuation of round n and the pre-money valuation of round n+1 divided by the number of month between the two rounds

Figure 1. Illustration of dependent variable

The VentureXpert database differentiates the following stages: startup/seed, early stage, expansion, late stage, and buyout/acquisition stage.

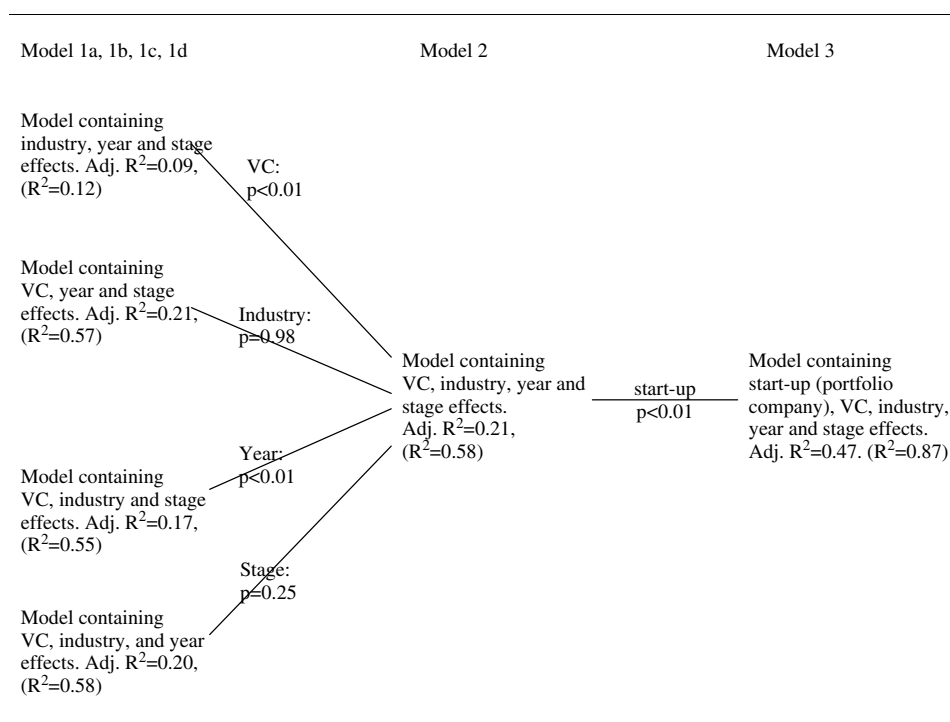
To account for general economic conditions during the inter-round period, we also include year dummies. Since the value increase between two rounds of investment depends on the economic (market) conditions of the first as well as of the second round, we include a set of dummies for the beginning of the investment period as well as a set of dummies for the end of the investment period. Due to the nature of our estimation technique, our model assumes that the effect of the general economic conditions is equal for all industries and all business units (McGahan and Porter, 2002).

RESULTS

We set out to measure the VC, industry, year, round, and start-up effects on the value increase

of a portfolio company between two rounds, comparing the explanatory power of a full model with all effects with a model in which one effect is restricted to be zero. Figure 2 summarizes our empirical approach. This approach not only reveals the change in explanatory power caused by each effect, but also whether a specific effect is worth including in the model (based on t-tests). Each block in Figure 2 represents a different model, including the number of dummies used in the model, the associated adjusted R^2 , and the amount of variance explained by the model.⁶ The adjusted R^2 for our model of 46.84 percent is comparable to the explanatory power of corporate effects models (e.g., McGahan and Porter's [1997] model explained 51.6% of the total variance in business-segment performance; Schmalensee's [1985] model accounted for 19.6%; Rumelt [1991]

⁶ The adjusted R^2 is similar to the R^2 , but it takes the number of independent variables and the sample size into account.



Note: Each block in Figure 2 represents a different model and the associated adjusted R^2 (the amount of variance explained by the model). A line between two models indicates the introduction of a new effect; the associated number is the probability at which a t-test rejects the addition of this new effect. For example, Model 3 contains all effects allowing for a full set of covariants. The difference between Model 2 and Model 3 is the introduction of the portfolio company effect, which is significant. The size of the portfolio company effect is the difference in adjusted R^2 between the two models.

Figure 2. Model comparison analysis: Analysis of variance explained by Equation 1 effects and significance of the various effects of Equation 1

Table 4. Increment [in %] in explanatory power and significance of each effect

	Number of dummies used to estimate Equation 1	Increment in R ²	Increment in adjusted R ²	p ^f	Increment in adjusted R ² without autocorrelation correction
Start-up ^a	924	29.48	26.32	<0.01	27.48
Owner (VC effect) ^b	1,383	45.59	11.15	<0.01	11.19
Year ^c	40	3.0	3.68	<0.01	3.76
Industry ^d	52	0.9	−0.55 ^g	0.98	−0.51
Stage ^e	5	0.24	0.22	0.25	0.41

Notes:

^a Increment in explanatory power of a full model over a model excluding start-up effects.

^b Increment in explanatory power of a model containing year, industry, stage, and owner effects over a model excluding owner effects.

^c Increment in explanatory power of a model containing year, industry, stage, and owner effects over a model excluding year effects.

^d Increment in explanatory power of a model containing year, industry, stage, and owner effects over a model excluding industry effects.

^e Increment in explanatory power of a model containing year, industry, stage, and owner effects over a model excluding stage effects.

^f Based on a model comparison, comparing a model without the set of dummies that represented each effect with a model including these dummies.

^g A small negative effect is usually interpreted to be zero (McGahan and Porter, 2002).

for 63%, and Makino *et al.*, [2004] for about 54%).

A line between the two models symbolizes the introduction of a new effect; the associated number is the probability at which a t-test rejects the addition of this new effect. For example, Model 3 contains all effects allowing for a full set covariance. The difference between Model 2 and Model 3 is the introduction of the portfolio company effect, which is significant ($p > 0.01$). Thus, we can conclude that the portfolio company effect is a statistically significant predictor of variance in portfolio company performance. The size of the portfolio company effect is the difference in adjusted R² between the two models. In the same way, comparing Models 1a–1d to Model 2 indicates that VC (ownership) and year are good predictors of variance in portfolio company performance, while the industry and round effects do not have a statistically significant effect on portfolio company performance.

Table 4 summarizes the change in explanatory power as well as the significance associated with each test of our models.

Table 4 reports that the portfolio company-specific effect accounts for 26.32 percent of the variance of portfolio company performance (value increase) and is statistically significant ($p < 0.01$). The VC effect, which is also statistically significant, accounts for 11.15 percent of the variance in portfolio company performance ($p < 0.01$), while

the year effect accounts for 3.68 percent ($p = <0.01$). The industry and stage effects with a p-value of 0.98 and 0.25, respectively, are not statistically significant.⁷

In addition to the primary analysis, as depicted in Table 4, we conducted four additional analyses. First, we differentiated early VC investments versus other VC investments to consider the relative importance of the management of portfolio companies versus the selection of portfolio companies. The results from this analysis provide information on how owners contribute value to their units. Second, we examined the variation of the VC effect across VCs to investigate the magnitude of average performance differences across VCs. Third, we addressed concerns about the stability of our estimates over different time periods, encapsulating distinct business cycles. Fourth, we estimated the effect sizes associated with different years (and accordingly, different business cycles) on our dependent performance variable.

Selection versus management

The question persists in the literature (e.g., Baum and Silverman, 2004; Brander, Amit, and

⁷ Based on these results, we also ran the model excluding industry and stage effects from the beginning (Model 1 in Figure 1). The resulting R² and adjusted R² for the other effects are identical to the ones presented here.

Antweiler, 2002) of whether VCs contribute to portfolio company value by simply selecting high potential start-ups initially, or through venture management. The term 'coaching' is frequently used in the VC literature instead of management, although we hesitate to use this term since the monitoring, control, and reigning in of managers falls a bit outside of the developmental term coaching. As noted earlier, this question is also salient for corporate-business unit relationships underlying the corporate effect.

In this study, we use the unique attributes of our methodology to contribute to the body of knowledge on selection versus management. Selection effects should be most prevalent in the earliest stage of the relationship between the VC and the portfolio company. Previous research shows that, in these early stages, issues such as the reputation of the entrepreneur are especially important, suggesting that selecting on characteristics of the start-up are most salient in early stage investments (De Clercq *et al.*, 2006). In contrast, over time VCs expect to stay involved, expect regular reports on the progress of the company, and often insist on control of the board and future decisions regarding ownership equity (Busenitz *et al.*, 2004; De Clercq *et al.*, 2006). Thus, over time, the VC becomes more involved with operational and strategic decisions of the firm, providing greater opportunities for better management. Successes in first round investments should therefore be primarily the result of choosing high potential start-ups, while later success is also influenced by a VC's ability to add value through management.

We investigate the selection effect by examining the value increase between the first and the second round as a dependent variable.⁸ Using this approach, we have only one observation per start-up, so we cannot estimate the importance of the portfolio company. We use a set of dummies representing the VCs who invest in each portfolio company to predict that company's average valuation increase per month in its first inter-round period, while controlling for industry and year effects.⁹

⁸ As explained above, our main analysis only contains data from the second round onward because the first inter-round period is deleted to correct for autocorrelation.

⁹ Investors who did not previously invest in a portfolio company have an incentive to set the value as low as possible to maximize their share of ownership. At the same time, investors who are already owners have an incentive to set a high valuation, which results in less ownership dilution. Thus, the actual valuation

Our empirical results show no significant VC effect in the first inter-round period. The venture capital investor is not a statistically significant predictor of the variance in portfolio company performance ($p = 0.9$) during the first round of investment. This does not mean that VCs are not good at picking portfolio companies; rather it means that they have the same abilities to pick portfolio companies (the VCs at this stage do not contribute to the *variance* in portfolio company performance).

This result is consistent with the idea that VCs use similar approaches for the selection of portfolio companies. VC selection processes are typically based on a very small set of variables, such as the potential of the venture idea or the ability of the entrepreneurial team. The VC industry is in general agreement as to the nature and relative importance of these factors at any point in time (Shepherd, 1999). As a result, it is unlikely that different VCs will apply vastly different selection criteria. Also, this finding is consistent with those of others who have tried to disentangle the selection versus management role of VCs. For example, Baum and Silverman (2004) found that VCs select on similar characteristics, regardless of whether these portfolio company characteristics by themselves are actually tied to ultimate performance of the company. This practice may be explained by isomorphic practices across firms, especially in the context of uncertainty (e.g., DiMaggio and Powell, 1983; Mizruchi and Fein, 1999; Zucker, 1987). In uncertain contexts, firms are likely to follow institutionalized norms (e.g., VCs place great emphasis on the reputation of an entrepreneur in early funding decisions).¹⁰ Taken together with our main results, these findings suggest that venture

depends on the negotiation powers of existing versus new investors. This may be a concern especially in the first round where the existing owner (in most cases the entrepreneur) might have limited negotiation power. Thus caution should be applied in interpreting these results.

¹⁰ Sørensen (2007) estimates the relative significance of management (what he calls 'influence') versus selection based on data similar to ours on VCs and portfolio company investments. Using a matching model that allows for more experienced investors to have greater access to superior deals, he finds that the effect of selection exceeds that of management. By only focusing on one lead investor per portfolio company investment, however, his estimation techniques ignore the significance of multiple investors, some of which are in a better position to select versus manage their portfolio companies. In addition, his underlying theoretical model does not allow for information asymmetries to change over time as information emerges about the viability and likely successes of portfolio companies. We take a different approach in this study, as described above, to

capitalists may be very similar to each other when it comes to choosing investments, but after the investment is made, they may add value differentially based on their coaching skills, their abilities to monitor and control, and their resource endowments.

Across-VC variation

We estimate the VC effect to be 11 percent of the variation in start-performance; however, our model also allows us to evaluate across-VC variation by examining the individual regression coefficients for each VC dummy in our fully specified model. These coefficients are estimates of the average contribution of each individual VC to the portfolio companies' value increase, controlling for all other effects. To ensure that our results are generalizable to active VC firms, we follow Sørensen (2007) and exclude all VCs with less than 10 investments. Our results show that the worst VC in our database has an average negative effect of -18 percent while the best VC has an average positive effect of 19 percent.¹¹ Consistent with studies that assess

distinguish the possible effects of management versus selection, and find results contrary to Sørensen's.

¹¹ Based on this, we determined the top 10 VCs in our database and compared them with measures of VC prestige. A measure for prestige that is often used is industry deal experience of a VC (the number of deals completed in a specific industry). For example Hsu (2004) uses a dummy for above or below the mean on industry deal experience as a proxy for reputation. Based on

VC fund performance (e.g., Kaplan and Schoar, 2005), there is significant variance in performance across VCs.

Pre-bubble effects

Our dataset contains data from 1980 through 2005. This long time frame allows us to measure the various effects over a couple of complete business cycles. One could argue, however, that the time during the so-called dot.com bubble is not representative of the VC/start-up relationship in general. To test if our results are affected by the inclusion of the bubble years, we also conduct the analysis using only pre-bubble and post-bubble data. To do so we exclude all inter-round periods that fell into the time of the dot.com bubble (1999–2002) (we use the end-point of the inter-round period for this assessment). The results are in Table 5.

The size of the various effects excluding the bubble years is very similar to the sizes of the effects for the entire time period. This suggests that our overall results are not driven by the bubble period. It also suggests that the size of the various effects is relatively stable and independent of market conditions.

this definition our 'top' VCs are all high reputation VCs. They also score high on Hsu's network resources rating, as well as on (Gompers, 1996) age proxy for VC reputation.

Table 5. Increment [in %] to explanatory power excluding dot.com bubble years versus all data

	Increment in adj. R ² excluding bubble years	p ^f	Increment in adj. R ² all data	p ^f
Start-up ^a	28.5	<0.01	26.3	<0.01
Owner (VC effect) ^b	7.9	<0.01	11.1	<0.01
Year ^c	2.7	<0.05	3.7	<0.01
Industry ^d	-0.5^g	0.72	-0.6^g	0.98
Stage ^e	0.5	0.23	0.2	0.25

Notes:

^a Increment in explanatory power of a full model over a model excluding start-up effects.

^b Increment in explanatory power of a model containing year, industry, round, and owner effects over a model excluding owner effects.

^c Increment in explanatory power of a model containing year, industry, round, and owner effects over a model excluding year effects.

^d Increment in explanatory power of a model containing year, industry, round, and owner effects over a model excluding industry effects.

^e Increment in explanatory power of a model containing year, industry, round, and owner effects over a model excluding round effects.

^f Based on a model comparison, comparing a model without the set of dummies that represented each effect with a model including these dummies (see Figure 2).

^g A small negative effect is usually interpreted to be in fact zero (McGahan and Porter, 2002).

The effect of the dot.com bubble on individual year coefficients

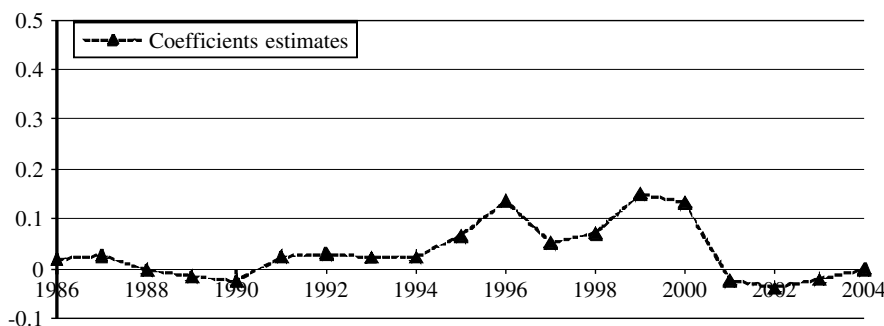
Our goal in this study is not to report or compare the individual regression coefficient estimates for each dummy in the model, but to analyze sets of dummies representing each category of effects. Taken together the set of year dummies is a significant predictor of start-up performance, however most of the individual regression coefficients are not statistically significant. Nevertheless these individual coefficients do contain some interesting information. Given the abundance of venture capital financing during the dot.com bubble one might expect a larger year effect because valuations during this time may be higher (overvalued) compared to non-bubble times. Analysis of the data indicates that this is the case. In the context of a model containing all significant effects (VC, portfolio company, and year), the regression coefficients for the dummies that represent the years in which an inter-round period ended (the year of the next evaluation) are indeed higher during the bubble year. Interpreting these coefficients, however, is difficult since our data are not expressed as deviations; nevertheless, the size of these coefficients indicate a trend of start-up value increases (between two rounds of funding) during the bubble, and start-up value decreases right after the bubble. Figure 3 presents a graphical depiction of these relationships.

DISCUSSION AND CONCLUSION

The current study follows in the tradition of the research on corporate effects to study how owners influence firm performance in a sample of VCs investing in portfolio companies. While owner effects have been widely studied in samples of diversified corporations owning business units, we studied a different institutional arrangement to offer another view of how owners can add value to businesses. We discussed theoretical reasons for similarities and differences between, on one hand, corporate owners and business units and, on the other hand, VCs and portfolio companies. We also estimated empirically the contributions of owners to variation in firm performance in the VC-portfolio company context.

To estimate the owner effect, the empirical technique we employed decomposed variance in performance across different levels of analysis: owners, firms, and industries. We found that variation in the performance of portfolio companies is attributable, first and foremost, to the effects specific to the portfolio company, which accounts for 26 percent of the variance in start-up performance. After portfolio company-specific effects, VC effects account for the next highest percentage of variance in firm performance (11%).¹² In addition, we find a relatively small effect associated

¹² It is also worth noting that, in our study, we had to exclude VCs that did not invest in at least two firms. (If there is a one-to-one correspondence between the VC and a start-up, we are



Note: This figure shows the coefficient estimates for each of the year dummies based on a model containing all significant effects (owner, start-up, and year effect) in our regression analysis. These regression coefficients are higher during the dot.com bubble years. Interpreting these coefficients, however, is difficult since our data are not expressed as deviations; nevertheless, the size of these coefficients indicates high value increases during the bubble and high value decreases right after the bubble.

Figure 3. Coefficients estimates for the year effect dummies

with the time period in which performance was evaluated. Interestingly, industry membership and stage of development did not significantly affect variance in performance.

The finding that the portfolio company effect explains the largest amount of variance in performance is consistent with the large business unit effects found by previous studies (e.g., McGahan and Porter, 1997, 2002; Rumelt, 1991). Thus, our findings show that the importance of these firm-specific effects is consistent with young, privately owned firms, complementing the findings from the corporate effects literature conducted primarily on large, publicly traded firms. This finding is consistent with the resource-based view of strategy, which postulates that performance differences result from the heterogeneous distribution of critical resources among competitors and potential competitors (e.g., Barney, 1986; Hatten and Hatten, 1987; Wernerfelt, 1984). At this stage, however, we cannot dismiss other alternative explanations for the portfolio company effect, including market power explanations. Thus, we cannot exclude the possibility that the portfolio company effect is attributable to differential levels of market power among the companies in their respective industries.

The finding of a statistically significant VC effect is also consistent with the resource-based view of strategy to the extent that VCs may contribute resources that bolster the performance of their portfolio companies. In our analysis that separated first round investments from later investments, we find that performance variance attributable to VC owners appears to occur after the initial round of VC investing rather than before. (Put differently, it is unlikely that the owner effect is attributable solely to having winning deals walk through the doors more often for some VCs, or to having superior selection abilities in some VCs.) Also our secondary analysis of the magnitude of differences among VCs indicates some VCs provide a high value added on average (estimated to be 19% over at least 10 investments), while others appear to destroy value on average (estimated to be -18% over at least 10 investments). Taken together, these findings suggest VCs may possess

similar resources that guide their selection of companies to invest in, however, their resource base yields differences in how VCs manage companies within their portfolio.

In addition to capital, VCs can bring legitimacy, prestige, governance expertise, social networks, management ability, and knowledge related to a start-up's technological or market foundations. The VC effect may not be restricted, however, to the contribution of resources. The results of this study cannot distinguish between the resources that VC firms bring to their portfolio companies versus a disciplining force that they may impose upon portfolio companies. While one could describe the latter as a form of management expertise—and therefore classify it as a resource—it goes beyond know-how of what to do and taps into the willingness to take whatever disciplining steps are necessary to meet the company's goals. Given the private ownership of portfolio companies, VCs can, to some extent, exert more direct pressure to perform than the market pressures experienced by publicly traded firms. In addition, we cannot exclude the possibility that VCs differ in their investment strategies, time horizons, risk tolerance, emphasis on taking portfolio companies public versus private placements, and so on. These consistent differences in how they manage, direct, and guide their portfolio companies—which relate to how different VCs discipline their portfolio companies—could also explain the VC effect.

The relatively small but statistically significant time effect is also consistent with prior studies on the valuation of start-up firms, which advocate controlling for the nature of market conditions, such as whether an IPO occurs during a 'hot market.' Our findings lend further support to the arguments that it is important to incorporate the time period into models of start-up performance. We are optimistic, however, that the estimates of the magnitude of the different effects did not change when the pre- versus post-bubble periods were distinguished. This suggests the possibility that the relative importance of owners versus firm-level factors may not vary dramatically over time.

Interestingly, we find no evidence of an industry effect. This is contrary to the body of work on corporate effects, which consistently finds that the industry effect accounts for significant variance in firm performance. One possible explanation for our inability to find an effect may be our measure of performance. Our findings are

not able to separate out the VC effect from the start-up effect.) Accordingly, our study may underestimate the magnitude of the VC effect.

based on the use of a quasi-market-based measure of firm performance. Prior studies on corporate effects used accounting-based measures of profitability. Accordingly, our results represent unanticipated changes in firm value, as market-based measures of performance should already incorporate anticipated future changes (Fama, 1970; Heeley and Jacobson, 2008; Lintner, 1965; Mossin, 1966; Sharpe, 1964; Treynor, 2008). In our study, changes in industry performance are anticipated by the venture capitalists involved in the investment syndicate. Of relevance are the expectations of the venture capital community, which may be influenced by broader market expectations about the future performance of different industrial sectors.

Lastly, we do not find evidence of a stage effect in our results. Early stage investments might be riskier than later stage ones, or they might have higher growth potentials. Similar to the industry effects, the stage effects may already be reflected in the value of the start-up at the beginning of the inter-round period. Thus, the value change during the inter-round period does not depend on the stage of development.

Our results also suggest interesting avenues for future research. Our findings open the door for more studies that examine the source of differences in how VCs add value. For example, conducting this type of analysis on different types of VCs, based perhaps on their resource endowments, strategies, or whether they are a lead investor or not, may further contribute to our understanding of how VCs affect performance variance in their portfolio companies. Additionally, it would be interesting to assess how specific VC syndicates act together to affect the performance of their portfolio companies. Also, examining other measures of performance may yield useful results. In the study of VCs and their portfolio companies, one could examine which factors explain the likelihood of taking a company public (or IPOing) as another indicator of performance. Lastly, our findings indicate that the magnitude of the owner effect is on par with the magnitude of the corporate effect found in prior studies. Though our study is different from corporate effect studies in many respects, both empirically (e.g., we use a quasi-market-based measure of performance rather than an accounting-based measure of performance) and theoretically (e.g., VCs are a different type of institutionalized governance structure), the similar magnitude of the owner effect is interesting.

It suggests perhaps it is not so much the nature of the specific resources provided by the owner-organization that matters, but rather the affiliation itself and the general control and discipline mechanisms that this affiliation affords. Studying the effects of different types of owners may contribute to greater understanding of how different types of superordinate entities, such as corporate owners, VCs, and institutional investors in large public companies contribute to the firms they own and control.

As with all studies, ours is not without limitations. Our estimation technique assumes the portfolio company effects do not change over the time period of our study. Yet because of portfolio companies' changing and uncertain natures, one interesting question in this context is whether portfolio company effects persist over time. The original founding team of a portfolio company might be replaced by professional managers, and business strategies may rapidly evolve as information about new products, markets, and technologies emerges. Do portfolio company effects have their own momentum even in the face of such drastic changes and persist; or, do VC effects become more important during such transformations as one of the few critical factors that may be held constant? Unfortunately, the current methodology does not allow us to account for variable portfolio company effects and address these questions. Further, start-up funding is restricted to only certain types of industries. Our findings confirm similarities across owner effects only in industries in which venture capital funding is available. Start-ups in different industries might have different abilities to generate profits, or they might have different growth perspectives, or different risk profiles. Thus, readers should exercise caution in interpreting the generalizability of our results across all industry contexts.

In conclusion, VCs appear to matter, but less so than do the firms in which they invest. In demonstrating this, our study suggests a broader strategic context into which past research on the actions and decisions of VCs and entrepreneurial firms can be placed. Also, in highlighting sources of heterogeneity in entrepreneurial firm performance, our study may be useful in guiding future research on entrepreneurship that teases apart common versus specialized aspects of the VC-portfolio company relationship.

ACKNOWLEDGEMENTS

We thank Gautam Ahuja, David Balkin, Gregory Carey, Tom Dean, Michael Heeley, Anita M. McGahan, our editor Will Mitchell, and two anonymous reviewers for helpful comments on earlier drafts of this article.

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