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When does corporate venture capital investment create firm value?

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Abstract

Over the past decade, billions of dollars have been invested by established companies in entrepreneurial ventures—what is often referred to as corporate venture capital. Yet, there is little systematic evidence that corporate venture capital investment creates value to investing firms. Scholars have suggested that established firms face underlying challenges when investing corporate venture capital. Namely, structural deficiencies inherent in corporate venture capital may inhibit financial gains. However, firm value may still be created as a result of other benefits from investing—primarily providing a window onto novel technology. In this paper, we propose that corporate venture capital investment will create greater firm value when firms explicitly pursue corporate venture capital to harness novel technology. Using a panel of CVC investments, we present evidence consistent with our proposition. The findings are robust to various specifications and remain unchanged even after controlling for unobserved heterogeneity in investing firms. Our results have important implications for corporate venture capital in particular, and technology strategy in general.

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1. Executive Summary

Over the past decade, billions of dollars have been invested by established companies in entrepreneurial ventures, yet there is little systematic evidence that such investment—often referred to as Corporate Venture Capital (CVC)—creates value to investing firms. Established firms may be well positioned to gain direct financial benefits from CVC due to privileged knowledge in selecting valuable ventures and the possession of complementary assets that enhance the value of their portfolio companies. In addition, CVC may offer a valuable window on technology, as it provides an effective means of scanning the environment for novel technologies that either threaten or complement core businesses. Such benefits, however, may be diminished due to internal conflicts, lack of incentives for fund managers, and rampant information asymmetries leading to potential adverse selection.

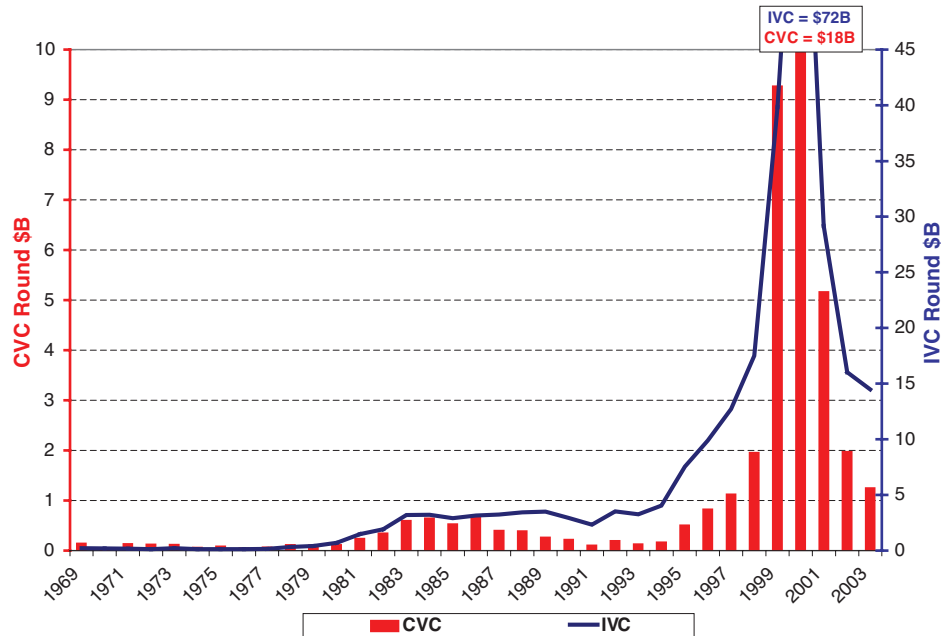
Analyzing a panel of U.S. public firms during 1990s, we find that corporate venture capital is associated with the creation of firm value—measured as firm's Tobin's q —but that this relationship is conditional on both sector-specific and firm-specific factors. In particular, the positive relationship between CVC and firm value creation is greatest within the devices, semiconductor, and computer sectors. Moreover, the contribution of corporate venture capital investment to firm value is greater when firms explicitly pursue CVC to harness entrepreneurial inventions. Thus, variance in CVC performance may be best explained by differences in the underlying objectives of the programs. We conclude that in those industries where entrepreneurial ventures are an important source of innovations, corporate venture capital can be a vital part of a firm's innovation toolkit.

2. Introduction

The history of corporate venture capital (CVC), i.e., equity investments by established corporations in entrepreneurial ventures, has been marked by periods of rapid growth and decline.² At the turn of the 21st century, a new wave of CVC activity occurred—the third such wave since CVC first appeared as an investment vehicle for firms in the 1960s. In 2000, more than 400 manufacturing and service firms invested close to \$16 billion in entrepreneurial ventures—approximately 15% of all venture capital investments (Venture Economics, 2001). In 2001, investment activity dropped precipitously as the market for new public offerings dried up. Many firms who had established funds only a few years earlier shut down their investment operations. In recent years, aggregate CVC investment has begun to pick up and remains well above historical levels (see Fig. 1).

Scholars have speculated that the dramatic cyclical nature of corporate venture capital is indicative of underlying structural deficiencies. For one, firms may be disadvantaged in

² We distinguish “corporate venture capital” from “corporate venturing”. The latter is broader in scope and includes investments in internal divisions of the firm (see Guth and Ginsberg, 1990; Thornhill and Amit, 2001). Key to our analysis is the fact that both the CVC firm and the entrepreneurial ventures are participating in the markets for entrepreneurial financing. To the extent that a firm and its internal venture do not go to the market for entrepreneurial financing, we do not consider such investments as corporate venture capital activity.



IVC (Independent Venture Capital) scale on right
CVC (Corporate Venture Capital) scale on left

* Data derived from Venture Economics, amounts in 2004 dollars.

Fig. 1. Total dollar volume of rounds by year.

reducing information asymmetries due to ventures' fears of expropriation by established firms. Corporate venture capital programs may not provide the same high power incentives to fund managers as independent venture capital funds, leaving funds in either less motivated or less capable hands (Block and Ornati, 1987; Chesbrough, 2000). Corporate CVC funds may be harmed by internal politics as business units compete over scarce resources (Sykes, 1986). When CVC funds do not produce substantial, immediate returns, top management may be quick to abolish funds and exit the venture capital market.

Empirical work paints a mixed picture. Gompers and Lerner (1998) found that the performance of ventures with corporate backers is as successful as independent VCs when there were similarities between the investing firm's and venture's lines of business. Block and MacMillan (1993) and Chesbrough (2000) provide evidence that corporate investors supply valuable complementary non-pecuniary resources and capabilities to the ventures they invest in. Others report that CVC-backed ventures received higher valuations at IPO compared to ventures funded solely by traditional VCs (Ginsberg et al., 2003; Maula and Murray, 2001).

However, the financial benefits to the firms who invest corporate venture capital have been found to vary widely across CVC programs (Sykes, 1986; Block and Ornati, 1987; Siegel et al., 1988; Block and MacMillan, 1993; Gompers and Lerner, 1998; Chesbrough, 2000). Gompers and Lerner (1998) verify that CVC investment is more volatile than the

general venture capital market. The average life span of a CVC fund is far shorter than that of independent venture capital funds. Furthermore, they found that corporate investors pay a premium to secure equity stakes in entrepreneurial ventures relative to traditional VCs, which may result in lower returns to the investing corporations.

We propose that variance in CVC performance can be explained, in part, by differences in the orientation of CVC funds. Some firms seek not only direct financial returns on investment but indirect strategic benefits as well. These strategic benefits may offset poor financial returns and justify corporate venture capital investment. In particular, some firms invest in new ventures to provide a window on new technologies and practices. Exposure to new ventures may help investors innovate themselves or procure promising technologies through licensing or acquisition. Also, supporting new ventures that develop complementary product and services may further increase the demand for current and future corporate products. CVC programs with a strategic orientation typically adopt practices and routines that facilitate coordination as well as the transfer of knowledge between the venture and the investing firm.

In this paper, we extend beyond the existing literature by looking at the overall benefits to CVC investment and not just the narrow financial returns to the investment. We study the conditions under which CVC investment creates value for investing firms. To capture firm value creation, we adopt Tobin's q —the market valuation of a firm over the value of firm tangible assets. By looking at value creation, we capture both the narrow financial returns to CVC investment and the strategic benefits. We build a robust data set and perform multiple tests to explore whether CVC investment impacts firm valuation and whether this relationship is driven primarily by financial or strategic CVC orientation.

We present evidence that corporate venture capital investment is associated with the creation of firm value, but that this relationship is conditional on both temporal and sectoral factors. In particular, the positive relationship between CVC and firm value is greatest within the devices and information sectors. We find that this heterogeneous CVC performance may be best explained by differences in the underlying objectives of the funds. We find that the marginal contribution to firm value is greater when firms explicitly pursue CVC as a window on technology. To the best of our knowledge, this is the first study to provide large-sample evidence of the creation of firm value through corporate venture capital activity.

3. Theory review

Scholars have been cautious in their assessment of the benefits of investing corporate venture capital. By leveraging their industry and technology expertise as well as their complementary assets, established firms can gain direct financial benefits through superior selection of valuable ventures and enhancement of their portfolio companies' value. However, internal conflicts, weak incentives and rampant information asymmetries may erode these direct benefits. We argue that—if a firm assumes a strategic orientation to its CVC program—CVC investment may yield indirect benefits that compensate for the structural deficiencies. Corporate venture capital may enhance a firm's value by offering an effective means of scanning the environment for novel technologies that either threaten or complement core businesses. Therefore, we conjecture that corporate venture capital

investment will create greater firm value when firms harness novel technology, rather than passively seek financial returns.

Established firms are well positioned to reap lucrative financial returns. First, they may be skilled in selecting valuable ventures. Firms often have expert personnel who possess in-depth knowledge of markets and technology. Larger firms may experience economies of scale and scope in managerial effort that allows them to perform superior due-diligence at lower cost. Second, corporate investors may be better positioned to provide complementary capabilities and resources to new ventures (Gompers and Lerner, 1998). Such support may increase the likelihood of venture success and ultimately lead to higher financial returns to the investing firm. Investing firms may provide valuable assets such as manufacturing capability, bargaining power with suppliers, and access to distribution networks (Teece, 1986). Investing firms may also provide access to valuable social and professional networks and an endorsement on the future viability of the venture (Stuart et al., 1999; Maula and Murray, 2001).

However, there are reasons to be skeptical of corporate venture capital as purely an investment vehicle. CVC investors often suffer from rampant information asymmetries. Entrepreneurial ventures have private information about their future prospects that are often not directly observable by potential investors (Gans and Stern, 2003). This may lead to adverse selection as low-quality ventures portray themselves as good investments. The problem is particularly pronounced for CVC investments since high quality ventures are hesitant to share information about their key technology with established firms for fear that those firms may expropriate their innovations (Dushnitsky, 2004). Moreover, entrepreneurs wary of corporate involvement may make it difficult for investing firms to monitor their portfolio companies. Lack of experience with a portfolio company's markets or technology may alleviate venture's expropriations concerns but may result in negligible corporate support (Sykes, 1986).

In addition to conflicts between the CVC investor and entrepreneurs, there may be internal conflicts within the investing corporation. In order to maintain pay uniformity and to avoid inter-departmental jealousy, firms typically do not compensate their fund managers in the same way as independent venture capitalists (Block and Ornati, 1987; Birkinshaw et al., 2002). In particular, CVC fund managers typically receive a larger portion of their compensation in fixed salary than independent VC fund managers. As a result, CVC fund managers often do not have the same high powered incentives. In some cases, high quality fund managers have left CVC units for independent VCs, leaving the CVC fund in less capable hands (Block and Ornati, 1987). Compounding this problem is that corporate investments may be subject to capture by individuals in the organization with ulterior motives that may run counter to CVC fund performance. Top executives may wish to invest in new ventures simply to increase the scope of the firm. Finally, CVC funds may be harmed by internal politics as business units compete over scarce resources (Sykes, 1986).

Despite these structural deficiencies inherent in CVC programs, Gompers and Lerner (1998), among others, propose that any potential loss may be offset by indirect benefits investors receive. To distinguish these indirect payoffs from the direct financial return on investment, we refer to them as "strategic benefits". Perhaps the most important strategic benefit is that CVC may provide a valuable window on technology. Corporate venture capital may provide an effective means of scanning the environment for novel

technologies that either threaten or complement core businesses. Such scanning may provide critical knowledge about potential competitors and help identify future alliance partners and acquisition targets. A recent survey of global CVC programs finds that 67% of firms invest in new ventures for strategic reasons (Ernst and Young, 2002). Additional survey results (Siegel et al., 1988; Block and MacMillan, 1993; Yost and Devlin, 1993), case studies (Chesbrough, 2000; Henderson and Leleux, 2002) and practitioner accounts (Sykes, 1986; Winters and Murfin, 1988) support the claim that firms often pursue CVC as much for indirect strategic benefits as for direct financial return on investment.

Most importantly, CVC investment may provide important innovative benefits to firms. Strategically driven CVC programs employ various mechanisms to increase the stock of entrepreneurial knowledge they gain access to. Corporate investors often secure board seats, or at least board observation rights, which provide them with knowledge of ventures' key activities and technologies (Maula and Murray, 2001; Bottazzi et al., 2004). Firms also institute specific organizational routines to encourage and funnel learning through increased interaction and information flows (Arrow, 1974; Daft and Lengel, 1986). For example, in addition to securing board seats to its CVC group—Sony Strategic Venture Investments—Sony's business divisions establishes liaisons with its portfolio companies (International Business Forum, 2001). Indeed, recent research provides empirical evidence that, in some sectors, firms who invest CVC realize significant increases in their internal innovation rates (Dushnitsky and Lenox, 2005a,b). Even the outright failure of the venture may not be a bad outcome if the strategic benefits outweighed the initial investment. Such strategic benefits may accrue to the investing firm when technologies remain viable after the originating venture has dissolved (Hoetker and Agarwal, 2004) and failure itself carries informational weight (McGrath, 1999).³

Among the potential strategic benefits of investing in new ventures is that a firm may be able to build demand for its technologies by helping develop ventures that provide complementary products and services (Brandenburger and Nalebuff, 1996). For example, Intel spends substantial resources to explicitly encourage external development of technologies and services that use its microprocessors (Gawer and Cusumano, 2001). Such complementarities are common in the presence of demand externalities (Katz and Shapiro, 1994). Consistent with this, Dushnitsky (2004) finds that the likelihood of an investment in an innovative venture increases with the level of complementarity between the firm and the venture.⁴

In sum, we expect firms that adopt a strategic orientation to experience greater value creation than firms that adopt a purely financial orientation. Firms are explicit in their CVC investment objective in their actions if not their words. As outlined above, firms who are engaged in CVC for strategic reasons put in place a series of structures which allow them to interact with and learn from the ventures they fund. This is not to say they are not

³ This may also explain why CVC investing firms pay a premium to access valuable new ventures (Gompers and Lerner, 1998).

⁴ Dushnitsky (2004) concludes that ventures are most likely to avoid corporate investors for fear of expropriation of their technologies when the two operate within the same market and intellectual property regime is weak. However, both parties are interested in an investment partner with complementary products or services. Thus, CVC investors are often privy to ventures with products that complement, not substitute, their own products.

concerned with the financial return on their investment, but simply that they receive additional value from the investment. Thus, we propose that the potential benefits of CVC when a firm assumes a strategic orientation will compensate for the structural deficiencies that plague CVC programs.

Proposition. *All else being equal, strategically focused CVC investment will create greater value than financially focused CVC investment.*

4. Data and measures

To explore the relationship between corporate venture capital investment objectives and firm value creation, we constructed a large panel of U.S. public firms during the period 1990–1999. Our sample contains information on firms' venturing activity collected from Venture Economic's VentureXpert database and financial data from Standard and Poor's Compustat database. The VentureXpert database contains a comprehensive coverage of investment, exit, and performance activity in the private equity industry and provides us with the population of all private equity investments by established firms.

We augmented these data with Compustat data on all U.S. public firms within the same industries as those firms in our CVC data set. Any results based only on a sample of CVC firms may cause gross misinterpretation. While the coefficient for CVC investment may reflect the contribution of CVC investments, it can also capture other factors such as macroeconomic upturns and industry-wide boosts in productivity. In order to address this concern, we include non-investors as a control group. An automated, matching algorithm and hand-checking were used to link the VentureXpert data with the Compustat data set. The resulting data set includes 1173 firms (8630 firm-year observations), where 171 of these firms invested corporate venture capital some time during the period 1990–1999.

4.1. Dependent variable

We adopt Tobin's q as our measure of firm value. Tobin's q is the market valuation of a firm over the value of its tangible assets and is a good proxy for a firm's competitive advantage (Montgomery and Wernerfelt, 1988). A Tobin's q greater than 1.0 indicates investors have a positive outlook for the firm's growth opportunities. The higher a firm's q , the greater the growth opportunities for that firm. We use Tobin's q as a measure of firm value rather than accounting-based measures (e.g., return on assets), because Tobin's q reflects expected future earnings and captures the lag between CVC investment and realized benefits. In addition, Tobin's q accounts for risk and is not as liable to reporting distortions as measures such as ROA (Lindenberg and Ross, 1981).

We calculate Tobin's q by dividing the sum of firm equity value, book value of long-term debt, and net current liabilities by total assets (see Chung and Pruitt, 1995). We do not calculate replacement values using the method proposed by Lindenberg and Ross (1981) because past research has found little qualitative difference between this measure and the simplified version used in this analysis (Chung and Pruitt, 1995). As a robustness check, we also estimated each of our models using the market-to-book ratio as our dependent variable. The market-to-book ratio was calculated as the ratio of the stock price to book

equity divided by the number of shares outstanding. Estimates from these models were consistent to those using Tobin's q .

4.2. Independent variable

Our primary independent variable is annual CVC investment in millions of dollars (*CVC Investment*). This variable has the desirable trait of being continuous and observable over time. This allows us to calculate the elasticity of Tobin's q to CVC investment. This measure is calculated as the sum of all dollars invested via all venturing funds of a firm in a year. We further coded venturing programs to reflect the main avenue through which they provide value to the firm: as a narrow investment vehicle (*Financial*) or as a window on technology (*Strategic*). Overall, 64% of these firms stated a strategic motivation for starting their program, and 36% stipulated a singular desire to reap lucrative financial returns.

We used information disclosed by the firm during the announcement of its venturing program to determine program objectives.⁵ For each CVC firm in our sample, we conducted an extensive search for announcements of CVC fund formation in hundreds of newspapers, trade magazines, newsletters and other sources available through Lexis-Nexis Academic Universe. For each media mention, two research assistants independently coded the primary fund objective (inter-coder reliability was 92%). Firms were coded as *Unknown* when we were unable to confidently discern program objectives. We were able to confirm the espoused CVC objectives for 55 firms of the 171 CVC firms in our sample. The results of nonparametric Wilcoxon–Mann–Whitney tests suggest that the two samples are from populations with the same distribution (Appendix A, Panel A). Specifically, coded and uncoded CVC firms exhibit levels of investment, capital expenditures, growth, leverage, and size which are similar at a significance level of $z > 0.05$.

4.3. Control variables

We include a number of measures commonly used in the analysis of financial performance as controls (e.g., Berger and Ofek, 1995). A company's size (*Firm Size*) is calculated as the log of the company's assets. The amount by which a firm is growing (*Growth*) is calculated as the annual percent change in sales. The degree to which the firm is leveraged (*Leverage*) is expressed as the ratio of its debt to assets. *Capital Expenditures* and *R&D Expenditures* are taken directly from the Compustat data set. In addition, we

⁵ We established CVC objectives using the goals stated by parent firm executives or CVC personnel, as well as observations regarding learning mechanisms. A CVC unit was coded as financially driven when the following, or similar, statements were made "solely for financial return" (MitsuiPE), "the first priority of Oracle's venture effort is financial returns" (Oracle), "companies that provide the potential for outstanding financial returns" (Chevron Technology Ventures). Alternatively, a CVC unit was coded as seeking strategic objectives where an announcement of the type of "Dell... makes investments first and foremost to get access to important developing technology" (Dell Ventures), "it is not primarily profit-oriented... take risks at an early stage for the sake of innovative ideas" (Novartis AG) are made, or when a learning mechanisms is mentioned "In order to further interaction between UPS and the portfolio companies, the SEF seeks board observation rights for business managers" (UPS), "...the venture group selects two individuals from the business unit to transfer knowledge from the start-up company to the parent corporation" (Motorola).

include measures of average industry q to control for time-variant, industry specific variation. At any point in time, differences in industry profitability may have to do with any number of factors including industry structure, technological innovation, or government regulation. *Industry q* is calculated as the average q of all firms within a firm's four-digit SIC code in a given year.

4.4. Selection variables

In a number of models, we control for the fact that firms self-select to invest corporate venture capital by adopting two-stage specifications in line with Maddala (1983) and Heckman (1979). The first stage of these models is used to predict the likelihood that a firm will invest corporate venture capital. To this end, we collected data for three additional measures: *Cash Flow*, *Patent Stock*, and *Tech Opportunity*.

Since CVC investment is often a considerable capital expenditure, firms with greater cash flow are more likely to have the financial flexibility to invest (Dushnitsky and Lenox, 2005a). We define *Cash Flow* as income before extraordinary items (i.e., income after interest and taxes) plus depreciation and amortization (Fazzari et al., 1988). Since firms treat R&D as an expense, some studies have added R&D back into the accounting definition of cash flow. Because we control for R&D expenditure separately, we did not follow this procedure.

We employ the firm's stock of prior patents (*Patent Stock*) as a proxy for the firm's absorptive capacity (Cohen and Levinthal, 1990). According to Hall et al. (2001), patents (and by extension patent stocks) should be a good proxy for knowledge capital, and thus the firm's ability to absorb new knowledge, because it represents the success of an R&D program. Arguably, those firms who are better able to absorb and understand technical knowledge generated by ventures will find it more enticing to invest CVC (Dushnitsky and Lenox, 2005a). We define *Patent Stock* as the depreciated sum of all patents applied from 1963 to the current year using the NBER's version of U.S. Patent Office Data (Hall et al., 2001).

Finally, firms are more likely to invest when there are rich technological opportunities within their industry. *Tech Opportunity* is defined as the average number of citation-weighted patents applied for by firms in a given year in a given industry defined by each four-digit Standard Industrial Classification (SIC). Because this measure is highly skewed, we employ the natural logarithm of *Tech Opportunity* in our analysis.

5. Analysis and results

In Table 1, we present summary statistics and the pairwise correlation matrix for our measures. We see that the average Tobin's q for the firms in our sample was 1.388 in the 1990s. On average, firms invest \$1.03M per year in entrepreneurial ventures. However, this number is skewed by the high number of firms in our sample (85%) who do not invest corporate venture capital. The average annual investment among those who establish CVC funds is approximately \$6.4M per year. At the extreme, firms have invested well over \$100M in CVC in a single year. In terms of intensity of investment, CVC investment

Table 1
Descriptive statistics

Variable	Description	Mean	Std.	Min	Max
Tobin's q	Sum of firm equity, long-term debt, and liabilities over firm assets	1.388	1.879	0	56.35
CVC investment	Log of total corporate venture capital invested (\$M)	0.030	0.241	0	5.09
R&D expenditures	Log of research and development expenditures (\$M)	2.022	2.001	0	9.19
Capital expenditures	Log of capital expenditures (\$M)	3.173	2.021	0	9.66
Growth	Change in sales (\$M) over sales (\$M)	0.184	4.151	-1	343
Leverage	Ratio of debt (\$M) to firm assets (\$M)	0.164	0.174	0	4.82
Firm size	Log of firm assets (\$M)	6.100	2.042	0.64	12.67
Industry q	Average industry Tobin's q (by 4-digit SIC code)	1.391	1.026	0	9.77
Patent stock	Log of the depreciated count of patents issued to a firm	1.975	1.807	0	8.73
Cash flow	Log of income after interest and taxes plus depreciation and amortization (\$M)	3.436	2.224	0	10.50
Tech opportunity	Log of average citations within a 4-digit SIC classification in each year	3.602	2.226	0	8.13

Pairwise correlations	1	2	3	4	5	6	7	8	9	10	11
1. Tobin's q	1.00										
2. CVC investment	0.15*	1.00									
3. R&D expenditures	0.13*	0.17*	1.00								
4. Capital expenditures	0.02	0.15*	0.52*	1.00							
5. Growth	0.12*	0.00	0.00	-0.02	1.00						
6. Leverage	-0.10*	-0.03*	-0.12*	0.12*	-0.02	1.00					
7. Firm size	-0.06*	0.15*	0.50*	0.94*	-0.02	0.13*	1.00				
8. Industry q	0.51*	0.15*	0.22*	-0.04*	0.07*	-0.15*	-0.07*	1.00			
9. Patent stock	0.07*	0.14*	0.78*	0.53*	-0.01	-0.06*	0.50*	0.12*	1.00		
10. Cash flow	0.02	0.15*	0.46*	0.86*	-0.02	0.02	0.87*	-0.02	0.47*	1.00	
11. Tech opportunity	0.12*	0.08*	0.53*	0.11*	0.01	-0.13*	0.06*	0.24*	0.47*	0.07*	1.00

$n=8630$.

* $p < 0.01$.

represents 0.4% of firm assets on average compared with 8.1% for internal research and development. Among those who invest, CVC investments represent, on average, 3% of the firm's annual capital expenditures.

In Model 1 of Table 2, we estimate a base model of firm performance for comparison purposes. We include *R&D Expenditures*, *Capital Expenditures*, *Growth*, *Leverage*, *Firm Size*, and *Industry q* as regressors. Because Tobin's q reflects the market's expectations of future discounted cash flow, we use contemporaneous values for each of our independent variables.⁶ We adopt a fixed-effect specification that includes both firm and year dummies to address stable, unobserved heterogeneity across firms, as well as macroeconomic trends, respectively. Our model is highly significant (F -test=85.32) and explains

⁶ We also estimated the model using a 1-year lag for each independent variable and found consistent results.

Table 2
CVC investment impact on Tobin's q (1990–1999)

Model	1	2	3	4	5
Specification	FE	FE	Treatment	FE	Heckman
Sample	Full	Full	Full	Investors	Investors
CVC investment ^a		0.408*** (0.069)	0.527*** (0.131)	0.283*** (0.074)	0.288*** (0.069)
R&D expenditures	0.024 (0.045)	0.006 (0.045)	0.033*** (0.007)	0.376** (0.124)	0.375** (0.114)
Capital expenditures	0.138*** (0.032)	0.135*** (0.032)	0.119*** (0.016)	0.018 (0.084)	0.016 (0.077)
Growth	0.014*** (0.003)	0.014*** (0.003)	0.030*** (0.003)	0.117*** (0.012)	0.117*** (0.011)
Leverage	−0.731*** (0.127)	−0.724*** (0.127)	−0.226*** (0.068)	−0.783 (0.527)	−0.780 (0.484)
Firm size	−0.420*** (0.051)	−0.437*** (0.051)	−0.123*** (0.016)	−0.214 (0.132)	−0.216 (0.121)
Industry q	0.771*** (0.027)	0.760*** (0.027)	0.688*** (0.012)	0.622*** (0.058)	0.622*** (0.053)
Year fixed effects	Included	Included	Included	Included	Included
Firm fixed effects	Included	Included	Included	Included	Included
Observations	8630	8630	8630	1160 ^b	1160 ^b
Firms	1173	1173	1173	171	171
Overall R^{2c}	0.192	0.198		0.330	
F -test	85.32***	82.34***		26.77***	
Wald χ^2			16 143***		5360***

Standard errors in parentheses.

^a In Model 3, CVC Investment is treated as a binary variable where all non-zero investments equal one.

^b In Models 5 and 6, we reduce the sample to only those firms that pursue CVC investment.

^c This does not include the variance explained by the firm fixed effects.

** $p < 0.01$.

*** $p < 0.001$.

approximately a fifth of the variance of Tobin's q . We find that firms who make larger capital expenditures and who are growing have higher Tobin's q . Finally, we find that *Leverage* and *Firm Size* has a significant, negative impact on *Tobin's q*. The magnitude and sign of the coefficients are consistent with those reported by other scholars (Morck and Yeung, 1991; Lang and Stulz, 1994).

In Model 2, we add our main independent variable, *CVC Investment*. We find that investments in entrepreneurial ventures by established firms have a positive, significant impact on the firm's Tobin's q . That is, firms that pursue corporate venture capital experience higher values of Tobin's q than their non-investing industry peers.⁷ The coefficient estimates for the control variables are consistent with Model 1.

⁷ We also test for the temporal relationship between firm's CVC and its Tobin's q . Specifically, we adopt a distributed lagged structure for CVC Investment, including contemporaneous as well as 1-, 2-, and 3-year lagged CVC investment as regressors. The coefficient for contemporaneous CVC Investment remains significant and positive. The coefficients for the lagged values are insignificantly different than zero.

Another possible explanation for our findings is that those firms who invest CVC may be of a superior type than firms who do not invest. CVC investment may serve as a signal of this underlying superiority and not reflect the hypothesized relationship between investment and the creation of firm value. Alternatively, firms who invest CVC may simultaneously invest in some other unobserved factor that in turn leads to higher Tobin's q .⁸ At the heart of this issue is that firms self-select to invest CVC based on their attributes and context, which are not fully observed by the researcher. In the presence of self-selection, our previous estimates may overstate the effect of CVC on firm value creation.

As a first attempt to address this issue, in analyzing the full sample that includes CVC as well as non-CVC investing firms, we adopt a treatment effects model to account for firms' self-selection to invest CVC (Maddala, 1983). In Model 3, we estimate two relationships: (1) a set of factors that drive the decision to invest corporate venture capital, and (2) the effect that decision has on Tobin's q . To operationalize our treatment model, we create a binary version of *CVC Investment* where all levels of investment greater than zero are assigned the value of one. In the first stage, we assume that the decision to invest corporate venture capital is driven by the firm's innovativeness (*Patent Stock*), the availability of funds (*Cash Flow*), the asset base of the firm (*Firm Size*), and the technology opportunities present within the firm's industry (*Tech Opportunity*). Model 3 presents the estimates for the treatment effects model.⁹ We find that, even after controlling for self-selection, *CVC Investment* continues to have a significant, positive impact on Tobin's q . By comparing the q levels of a firm that is likely to invest CVC to those of a firm that is also likely to invest but did not (Greene, 2000), we calculate that a CVC investing firm experiences an average 'net' increase of 0.51 (std. 0.007) in its Tobin's q .

As a further robustness test, we limit our sample to only those firms who invest CVC and re-estimate the specification in Model 2. In other words, we estimate the impact of the *magnitude* of CVC investment on Tobin's q given that a firm chooses to invest CVC. Investing more in new ventures allows a firm to either (a) access a greater number of new ventures (i.e., more opportunities to conduct and learn from due-diligence, as well as a chance to seed multiple complementary ventures and increases demand for parent products), or (b) enjoy greater access to their portfolio companies (i.e., greater bargaining power and hence more chances to secure board seats, deploy liaisons or ensure development of complementary products). In Model 4, we continue to observe a positive and significant coefficient on *CVC Investment* for our restricted sample. We are not surprised by the slight decrease in the magnitude of the coefficient since, assuming decreasing returns to CVC investment, removing the marginal impact of investing that first dollar of corporate venture capital should have the greatest impact.

To address the possibility that self-selection is biasing the marginal effect of CVC on firm's q , Model 5 adopts a Heckman selection model using the same first-stage selection equation

⁸ Of particular concern is that a handful of firms appear as outliers in terms of Tobin's q . These are primarily information technology firms who experienced incredible market valuations in the late 1990s (e.g., Qualcomm, Cisco, and Yahoo). We estimated each model with and without these firms and found consistent results.

⁹ The estimates for the first stage of Model 3 are as follows: $\beta_{\text{Patent Stock}}=0.037$, $\beta_{\text{Cash Flow}}=0.012$, $\beta_{\text{Firm Size}}=0.214$, $\beta_{\text{Tech Opportunity}}=0.087$ ($\lambda=0.082$).

used in the treatment effects model.¹⁰ Particularly, the Heckman model corrects for the fact that the marginal effect of CVC on firm's q in the limited sample (i.e., solely investors) may be biased, whereas the treatment effects model facilitated the interpretation of Tobin's q levels between CVC and non-CVC investing firms (i.e., full sample). In Model 5, we find that even controlling for self-selection, *CVC Investment* has a positive, significant impact on *Tobin's q*.

Thus, we find that firms that pursue corporate venture capital experience more value creation, compared to firms who do not (Model 2 and 3). Moreover among those firms who invest corporate venture capital, we find that greater CVC investment increases firm value (Models 4 and 5). In other words, increases in firm value are associated not only with the existence of CVC effort but also with the magnitude of the investment. If we consider the financial impact of investing in new ventures, we find that \$1M spent on CVC raises Tobin's q by 0.20 (using Model 5 estimates). Based on these estimates, the change in Tobin's q for \$1M spent on internal R&D is 0.26. Thus, CVC stands up well in comparison.

Our sample covers a multitude of industries. Given the pros and cons of corporate venture capital, it is likely that the payoffs to CVC are highly contingent on industry conditions. For example, the health of the market for IPO's is critical. To the extent that firms tend to invest in ventures that are similar (in terms of underlying technologies and markets), CVC payoffs will be greater in growing industries with rich technological opportunities.

While our firm fixed effects will capture stable sector differences, pooling the samples may mask underlying heterogeneity in the coefficient estimates themselves. To address whether inter-industry variability is driving our results, we break our sample down by industry sector for the six highest CVC investing sectors: Chemicals, Devices, Information Technology, Metals, Pharmaceuticals, and Vehicles.¹¹ Replicating Model 2 at the sector level, we find that the benefits of CVC investment only accrue to firms in certain sectors (See Table 3). In particular, only for firms in the devices and information sectors do we find that CVC is associated with increases in Tobin's q (Models 7 and 8, respectively). For the remaining sectors (Models 6, 9, 10, 11), we have no confidence that the impact of CVC is greater than zero.

The finding of statistically significant effect in Models 7 and 8 give us greater confidence that cross-industry variation is not completely driving our findings. We explicitly include a control group of all non-CVC firms who operate in the same industry. If cross-industry variation in Tobin's q is driving our results, we would expect all the firms in a focal industry (and not just CVC investing firms), to exhibit different Tobin's q values.

While we should be cautious in inferring too much from the lack of a statistically significant coefficient across different samples, the pattern of results in the sector analysis is consistent with our proposition that strategically oriented CVC will create more value than narrowly financially oriented CVC. Prior research suggests that information technology firms typically engage in CVC as a window on novel technology (Chesbrough, 2000). In

¹⁰ The estimates for the first stage of Model 5 are as follows: $\beta_{\text{Patent Stock}}=0.212$, $\beta_{\text{Cash Flow}}=0.104$, $\beta_{\text{Firm Size}}=0.361$, $\beta_{\text{Tech Opportunity}}=-0.128$ ($\lambda=0.019$).

¹¹ Sectors are defined by SIC code: chemicals (28** excluding 2834 and 2836, 29**, 3080), devices (38**), information (357*, 367*, 48**, 3663), pharmaceuticals (2834, 2836), metals (33**), and vehicles (37**). We exclude other sectors for parsimony sake.

Table 3
CVC investment impact on Tobin's q by sector (1990–1999)

Model	6	7	8	9	10	11
Sector	Chemicals	Devices	Information	Metals	Pharma	Vehicles
CVC investment	0.089 (0.261)	0.983** (0.375)	0.510*** (0.096)	1.162 (0.595)	0.082 (0.560)	−0.026 (0.225)
R&D expenditures	−0.011 (0.063)	0.020 (0.249)	−0.001 (0.109)	0.129 (0.070)	2.335** (0.849)	0.100 (0.071)
Capital expenditures	0.084 (0.045)	0.149 (0.205)	0.081 (0.063)	0.105*** (0.030)	1.426** (0.549)	−0.043 (0.046)
Growth	0.005 (0.004)	−0.163 (0.188)	0.110*** (0.012)	0.271*** (0.077)	0.003 (0.012)	0.253* (0.111)
Leverage	−0.113 (0.230)	−1.707*** (0.338)	−0.402 (0.437)	0.186 (0.169)	−3.536 (2.126)	−0.663** (0.236)
Firm size	−0.278*** (0.078)	−0.986*** (0.263)	−0.077 (0.123)	−0.231*** (0.052)	−5.799*** (0.804)	0.014 (0.097)
Industry q	0.923*** (0.057)	0.855*** (0.126)	0.389*** (0.050)	0.966*** (0.054)	0.469 (0.327)	0.962*** (0.091)
Year fixed effects	Included	Included	Included	Included	Included	Included
Firm fixed effects	Included	Included	Included	Included	Included	Included
Observations	777	783	1350	319	357	506
Firms	112	110	196	41	46	65
Overall R^{2a}	0.239	0.085	0.296	0.481	0.176	0.228
F -test	23.23***	7.61***	19.60***	35.68***	6.93***	16.11***

Standard errors in parentheses.

^a This does not include the variance explained by the firm fixed effects.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

contrast, firms in mature industries like chemicals and metals undertake CVC mainly as a way to gain superior financial return on investment (Sykes, 1986). The information technology sector is characterized by greater technological opportunity and weak appropriability (Cohen et al., 2001), and is the most fertile ground for scanning and sourcing of external technologies, i.e., pursuing a window on technology. Thus, the results presented in Table 3 are consistent with the view that corporate venture capital is most valued as a window on technology.

To this point, the analysis provides limited direct evidence that the relationship between CVC and Tobin's q is driven primarily by strategic benefits. If we break our data down by program objective, we find that the average investment by firms who pursue CVC as a window on technology is slightly lower than those who pursue CVC for narrow financial gain (\$5.8M vs. \$6.5M per year on average), but they tend to invest for substantially longer periods of time (see *Total Years CVC*). Strategically focused CVC firms exhibit higher values of Tobin's q (mean of 2.63 vs. 1.33).¹²

¹² Nonparametric Wilcoxon–Mann–Whitney tests suggest we cannot reject the hypothesis that the group of uncoded CVC firms invests amounts that are similar to either strategically oriented, or financially oriented, programs (Appendix A, Panel B). However, the longevity of investment activity significantly (insignificantly) differs between CVC of unknown orientation and financially (strategically) driven programs.

To help tease this apart more systematically, we break down CVC Investment by the espoused goal of the fund. The analysis in Model 12 (Table 4) is analogous to Model 3, with the addition of three terms: *CVC*Strategic*, *CVC*Financial* and *CVC*Unknown*. We find a positive, significant coefficient for *CVC*Strategic*. On the other hand, we find a negative, non-significant coefficient on *CVC*Financial*. While the coefficient for *CVC*Unknown* is positive and differs from zero significantly, it does not differ significantly from that of *CVC*Strategic* (F -stat=0.71). The coefficient does, however, differ significantly from the coefficient on *CVC*Financial* (F -stat=5.53). These results suggest that investing in new ventures with the goal of winning strategic benefits may create value, while financially driven venturing activity may actually lead to the destruction of firm value.

Table 4
CVC investment impact on Tobin's q by program goal (1990–1999)

Model	12	13	14	15	16
Specification	FE	FE	FE	FE	Heckman
Sample	Full	Investors	Information sector	Information and investors	Information and investors
CVC investment					
CVC*Strategic	0.324* (0.141)	0.213* (0.089)	0.335* (0.159)	0.370* (0.200)	0.370* (0.183)
CVC*Financial	-0.552 (0.423)	-0.387 (0.394)	-1.803 * (0.934)	-0.749 (1.352)	-0.748 (1.211)
CVC*Unknown	0.461*** (0.080)	0.314*** (0.076)	0.637*** (0.117)	0.497*** (0.151)	0.498*** (0.136)
R&D expenditures	0.003 (0.045)	0.340** (0.125)	-0.019 (0.109)	0.100 (0.251)	0.100 (0.225)
Capital expenditures	0.135*** (0.032)	0.014 (0.084)	0.078 (0.063)	0.128 (0.154)	0.128 (0.138)
Growth	0.014*** (0.003)	0.116*** (0.012)	0.110*** (0.012)	0.110*** (0.017)	0.110*** (0.015)
Leverage	-0.722*** (0.127)	-0.712 (0.528)	-0.382 (0.436)	-1.599 (1.305)	-1.598 (1.169)
Firm size	-0.437*** (0.051)	-0.217 (0.132)	-0.077 (0.123)	-0.082 (0.280)	-0.081 (0.251)
Industry q	0.759*** (0.027)	0.623*** (0.058)	0.379*** (0.050)	0.701*** (0.118)	0.701*** (0.105)
Year fixed effects	Included	Included	Included	Included	Included
Firm fixed effects	Included	Included	Included	Included	Included
Observations	8630	1160	1350	433	433
Firms	1173	171	196	69	69
Overall R^{2a}	0.198	0.347	0.297	0.358	
F -test	72.86***	23.96***	17.79***	8.41***	
Wald χ^2					2236***

Standard errors in parentheses.

^a This does not include the variance explained by the firm fixed effects.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

As a robustness test, we limit our sample to only those firms who invest CVC. Please note that in Model 12, all non-CVC investors will have a zero for the three interaction terms. By limiting our sample to only investors, we partially control for firms decision to invest CVC. In Model 13, we continue to find a positive coefficient for *CVC*Strategic* and a negative coefficient for *CVC*Financial*. As a further test, we limit our sample to only the information technology sector (including all firms in that sector, investors and non-investors) to ensure that our results are not driven by sector differences. In Model 14, the pattern between *CVC*Strategic* and *CVC*Financial* remains. Controlling for selection in this way leads to significance on both of these coefficient estimates. Finally, we limit ourselves to only firms who invest CVC and are members of the information technology sector. In Models 15 and 16, we estimate a fixed-effect specification. In Model 16, we adopt the Heckman selection specification.¹³ In both cases, we continue to find that those firms who pursue CVC for strategic reasons realize a positive, significant increase in firm value creation while those who pursue CVC for financial reasons realize either no or negative value creation.

6. Discussion

We present evidence that corporate venture capital investment is associated with the creation of firm value. We find that this relationship is most salient in the devices and information technology sectors. Moreover, we present evidence that the contribution of corporate venture capital investment is strongest when it is focused on attaining a window on technology rather than a purely narrow return on investment.

To be clear, we find that greater investment in CVC leads to higher Tobin's q . We recognize that the validity of Tobin's q as a measure of firm value is contingent on the assumption that the capital markets (i.e., investors) rationally price firm's securities (which are the numerator of Tobin's q). In the field of strategy, Tobin's q has been used as a measure of firm's rents, or value creation (Montgomery and Wernerfelt, 1988), and it had been put to use in numerous studies. Accordingly, we interpret the positive and significant impact of CVC on firm's q to imply that corporate venture capital is associated with firm's value creation. To allay concerns that our results are driven purely by the internet bubble of the later 1990s, we excluded the bubble year (1996–1999) and re-ran our analysis and found consistent results.

To ensure the association between firm's CVC and its Tobin's q are not an artifact of an unobserved factor, we addressed potential heterogeneity across firms within a sector.¹⁴ Our firm fixed effects help address this concern in part, by accounting for stable differences between firms (such as managerial talent). We further account for such self-selection in the decision to pursue CVC by adopting our treatment and Heckman selection models. These models require us to explicitly model the factors driving CVC behavior. Our results are robust to these specifications.

¹³ The estimates for the first stage of Model 16 are as follows: $\beta_{\text{Patent Stock}}=0.266$, $\beta_{\text{Cash Flow}}=-0.078$, $\beta_{\text{Firm Size}}=0.427$, $\beta_{\text{Tech Opportunity}}=-0.023$ ($\lambda=0.004$).

¹⁴ If firms with (unobserved) superior managerial talent undertake CVC while firms with average talent do not, we may incorrectly infer that CVC creates firm value when in fact superior managerial talent drives the results.

As with all analyses, we should be cautious in our interpretation. Our analysis of firm CVC orientation is constrained by the availability of announcement data. The difficulty in gathering announcement data limited our sample to the 1990s. Thus our interaction results may fail to detect a shift over time in the relative benefit of a strategic vs. purely financial orientation. Furthermore, while we do not find other systematic differences in the attributes of coded CVC and uncoded CVC firms, we tended to find announcement data for more research intensive firms (Appendix A, Panel A). It may very well be that the benefits of a strategic orientation are only realized when firms possess a set of complementary research capabilities that allow them to capitalize on the knowledge gained from invested ventures.

This study presents evidence that CVC investment is associated with the creation of firm value, particularly when it is aimed at strategically harnessing new ventures. It remains unanswered, however, whether investing firms appropriate the value in full. Gompers and Lerner (1998) observe that corporate venture capitalists tend to invest at a premium compared to independent VCs, and speculate that existing investors, or the ventures themselves, bargain away some of the value.¹⁵ Future work should further explore whether CVC creates value to begin with, and if so, what proportion is appropriated by the investing firm. Variation in the investment environment (e.g., hot vs. cold financial markets) as well as different bargaining positions (e.g., CVC prominence in the VC community) may prove useful instruments in such future exploration.

Another interesting question that we are unable to address with our data is whether the differential advantage in strategically oriented CVC firms is driven by the establishment of specific mechanisms for knowledge transfer, superior ability to pick portfolio ventures, or a combination of the two. Strategically oriented CVC firms may owe their success to the specific practices they adopt to funnel knowledge from ventures to their internal research efforts. Alternatively, they may be better able to identify venture partners from whom they have much to learn. We leave an exploration of these questions to future research.

7. Conclusion

Based on a large sample of all CVC investing firms and their industry peers, we find that corporate venture capitalists experience increased value creation, as measured by levels of Tobin's q . Our analyses suggest that CVC is likely to create firm value only when pursued for strategic reasons. A financially oriented firm is less likely to be able to benefit from such investment activity as structural deficiencies (misaligned incentives, internal conflicts, and incompatible objectives) are likely to overshadow CVC potential advantages (valuable complementary assets, preferential information about the underlying technology). However, if a firm actively pursues CVC in order to harness novel technology it may realize innovative benefits that will compensate for potentially lower financial returns.

The possibility that equity stakes in entrepreneurial ventures may provide a window on technology and aid in firm innovation efforts has important implications. Central to

¹⁵ Gompers and Lerner (1998) find the magnitude of the premium is not sensitive to the presence of a strategic fit. Therefore, our hypothesis that differences in the underlying objectives of the programs explain variance in CVC performance remains valid.

competitive success is the ability to acquire valuable resources and capabilities that allow firms to achieve favorable strategic positions (Teece et al., 1997). When unable to internally generate such assets, successful firms exploit knowledge external to the firm (Henderson and Cockburn, 1994). Corporate venture capital may be an important tool to create firm value by providing a valuable window on novel technologies and practices.

Appendix A. Comparing coded to uncoded CVC firms

Panel A: Overall

Variables	(A1) CVC coded for objectives				(A2) CVC uncoded for objectives				Wilcoxon test
	Mean	Std.	Min	Max	Mean	Std.	Min	Max	
CVC investment	1.43	0.82	0.01	3.84	1.77	1.00	0.26	5.09	−1.82
Total CVC years	6.88	4.53	1.00	21.00	7.12	5.16	2.00	16.00	0.54
Tobin's q	3.25	4.30	0.22	35.77	2.51	2.31	0.75	10.19	0.02
R&D expenditures	5.03	2.43	0	7.88	3.20	3.37	0	8.03	2.52*
Capital expenditures	5.32	1.92	0	8.70	6.04	1.79	3.13	8.41	−1.82
Growth	0.27	0.61	−0.50	5.31	0.23	0.61	−0.33	3.55	0.64
Leverage	0.12	0.15	0	0.82	0.14	0.13	0	0.56	−1.18
Firm size	8.33	1.78	2.64	10.98	8.89	1.28	6.70	10.42	−1.45
Industry q	2.48	1.91	0.39	9.49	2.20	1.75	0.77	7.80	0.66
Patent stock	4.15	2.34	0	7.99	2.85	2.96	0	8.14	2.29*
Cash flow	5.67	2.43	0	9.01	6.73	1.68	2.02	9.12	−2.13*
Tech opportunity	5.33	2.12	0	8.13	4.36	2.89	0	8.13	1.62

Wilcoxon–Mann–Whitney two-sample z -statistic tests the hypothesis that two unmatched samples (i.e., coded CVC firms and uncoded CVC firms) are from populations with the same distribution.

Panel B: by CVC orientation

Variables	Wilcoxon tests	
	(a) Financial vs. unknown	(b) Strategic vs. unknown
CVC investment	−1.29	−1.55
Total CVC years	2.12*	−0.03
Tobin's q	0.74	−0.19

Table reports Wilcoxon–Mann–Whitney two-sample z -statistic tests the hypothesis that two unmatched samples (i.e., (a) financially vs. unknown and (b) strategically vs. unknown) are from populations with the same distribution.

* $z < 0.05$.

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