Do Corporate Venture Capitalists Add Value to Start-Up Firms? Evidence from IPOs and Acquisitions of VC-Backed Companies

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We present evidence that corporate venture capitalists (CVCs) add value to start-up companies only when the start-ups have a strategic fit with the parent corporations of CVCs. We find that CVCs provide a variety of services and support that suit the specific needs of start-ups operating in different industries. CVC-backed start-ups are able to obtain higher valuations at the IPO than non-CVC-backed ones, and the value added by CVCs concentrates in start-ups with a strategic overlap with CVC parents. Entrepreneurial companies with strategic CVC backing also receive higher takeover premiums when they become acquisition targets.

The role of venture capitalists (VCs) as financial intermediaries investing in start-up companies is well documented and has been a subject of considerable research efforts (see Gompers, 2007; Gompers and Lerner, 1999, 2001a, 2001b, for surveys of the literature). Most studies in the literature either focus on traditional venture capitalists (TVCs) such as Kleiner Perkins Caufield & Byers and Sequoia Ventures or treat all VCs as TVCs when there is, in fact, a large degree of heterogeneity among venture organizations.[1,2] Notably, the venture arms of industrial corporations, the corporate venture capitalists (CVCs), are significantly different from traditional venture firms in organizational structure, objectives, investment behavior, and the range of services provided to portfolio companies (Gompers and Lerner, 2000).[3] These differences could have important implications in their ability to successfully finance and nurture start-ups.

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[1] By traditional venture capitalists, we refer to stand alone venture capital firms that are independent of government agencies, industrial firms, and financial firms such as commercial banks, investment banks, and insurance companies.

[2] Among the few exceptions are Gompers and Lerner (2000) who examine the performance of CVCs relative to that of traditional venture capitalists, and Hellmann, Lindsey, and Puri (2008) who focus on VCs affiliated with commercial banks.

[3] Corporate venture capital usually stands for the organized efforts of nonfinancial corporations to invest in and nurture young and risky firms. It is different from corporate activities in support of in-house entrepreneurship, where novel ideas of employees are developed within a corporation with the help from the corporation.

Academics and practitioners alike have long suggested that CVCs add value to their portfolio companies, but the evidence regarding this is rather limited. Previous studies, such as Gompers and Lerner (2000) and Santhanakrishnan (2002), find that CVC backing increases entrepreneurial firms' likelihood of going public or being acquired. However, it remains unclear how CVC-backed start-ups fare once they arrive at these stages. It would be premature to conclude that CVCs add value if their portfolio companies consistently go public or are acquired at valuation levels below those attained by non-CVC-backed companies.

Our goal is to provide clarity on this issue by analyzing a sample of VC-backed IPOs and a sample of acquisitions of VC-backed targets. We examine whether CVC backing affects the valuations start-ups obtain when they go public or the takeover premiums they receive when acquired. The unique attributes that distinguish CVCs from their independent counterparts make this an interesting empirical question. Some of the differences suggest that CVCs could benefit entrepreneurial firms in ways that TVCs may not be able to emulate. Specifically, CVCs are usually closely affiliated with large, established industrial companies. This vantage point enables them to draw upon their corporate parents' resources to aid in the growth and maturation of their portfolio companies. For example, CVCs can provide their portfolio companies quick access to markets, technical assistance, and product recognition through the marketing, distribution, and research arms of their parent corporations. CVCs can also obtain from the operational units of their parents some inside knowledge about the industry and the product market. This information can be used to better position entrepreneurial firms in product development and competition. In addition, the presence of CVCs or, more precisely, the association with the parent corporations of CVCs, can lend credibility to start-up companies in both the product market and the capital market. The popular business press also underscores the valuable services that CVCs can provide to start-up firms. For instance, *The Wall Street Journal* in a December 28, 1999 article notes

> For start-ups, a corporate venture partner can be especially attractive because a large company can provide resources potentially more valuable than money – research, marketing, and connections.

At the same time, however, there are also reasons to suspect that CVCs may not be able to add much value to entrepreneurial firms. CVCs are usually structured as divisions within industrial corporations, and, as such, lack the relative autonomy and high-powered incentive schemes that TVCs enjoy (Gompers and Lerner, 2000). As a result, CVCs often have trouble motivating and retaining employees, limiting their ability to provide adequate and quality support to the companies in their portfolios. The incentives of CVCs could also be compromised if a conflict of interest develops between a start-up and its CVC's corporate parent due to similar or even competing products (Hellmann, 2002). In addition, many general partners of TVCs have substantial prior business experience through which they acquired significant industry expertise and developed a wide network of connections within their specialized industries. These two factors may enable TVCs to match CVCs in providing resource-based services and support to start-up companies.[4] Therefore, it is an empirical question whether CVCs can add value to their portfolio companies over and beyond the contributions by TVCs.

[4]There is evidence that VCs can assist start-ups in developing more strategic alliances (Hsu, 2006; Lindsey, 2008), contribute to their professionalization (Hellmann and Puri, 2002), and accelerate the speed at which they bring products to the market (Hellmann and Puri, 2000). However, these studies are silent regarding whether there is any differential effect between CVCs and TVCs on the provision of these services. To the best of our knowledge, the only study that touches upon this issue is by Bottazzi and Hellmann (2008), who find that CVCs in general are less involved in the recruiting of directors and mangers at entrepreneurial companies than TVCs. However, they make no distinction between strategic CVCs and financial CVCs, which, as we indicate in this paper, play quite different roles at entrepreneurial companies as indicated by the former's significantly greater board control and equity ownership (see Panel B of Table I).

Our investigation yields evidence consistent with the value-adding role of CVCs. In the IPO analysis, we find that CVCs provide a variety of valuable services and support to their portfolio companies. Specifically, between start-up companies and their corporate venture investors, we often observe customer or supplier relations, marketing/sales/distribution agreements, and joint research or product development agreements. These relationships exhibit interesting variations across different industries. For example, joint research agreements are more common for pharmaceutical and biotech firms, while firms from industries such as internet/business services, electronics, and machinery and computer equipment have more product development and marketing/sales/distribution associations with their corporate venture investors.

Further analysis indicates that these services and support from CVCs translate into higher IPO valuations for the start-up companies. Using a method of propensity score matching to control for the endogeneity of CVC backing, we find that IPOs with CVC backing are able to obtain significantly higher valuations than those with just TVC backing. This suggests that CVCs add value to their portfolio companies and the value added is incremental to that of TVCs. Moreover, we find that the higher valuations largely accrue to start-ups that have a strategic fit with the parent corporations of their CVCs, where strategic fit is defined as the existence of a strategic alliance or close business relationship. This is consistent with the argument that the benefits of CVC backing primarily come from asset or operation complementarities between start-ups and corporate venture investors. Our results hold for a number of widely used price multiples and are robust to controlling for a host of IPO pricing determinants. To investigate whether the higher valuation of CVC-backed IPOs is simply driven by the superior project selection ability of CVCs, we estimate a system of simultaneous equations in which both CVC backing and IPO valuation are endogenous. We find that CVCs do exhibit some project selection ability, but they also add value to their portfolio firms.

To shed more light on the incremental value added by CVCs, we compare the offer-day valuations between strategic CVC-backed IPOs and TVC-backed IPOs that have strategic alliances with other corporations. We find that strategic CVC-backed IPOs continue to have significantly higher valuations, suggesting that IPO companies benefit more from strategic CVC backing than from general corporate alliances. One possible reason for this is that strategic CVCs hold substantially larger ownership in portfolio companies than do other corporate alliance partners. As a result, CVCs have stronger incentives to develop and nurture entrepreneurial firms. The higher equity stakes may also help resolve potential hold up problems between partners in strategic relationships (Klein, Crawford, and Alchian, 1978; Grossman and Hart, 1986; Hart, 1988, 2001).

We also supplement the IPO analysis with an examination of acquisitions of VC-backed targets since acquisitions and IPOs are the two most successful exit outcomes for start-ups. We find that targets with CVC backing tend to receive higher takeover premiums than their counterparts with only TVC backing. These higher premiums again concentrate in targets having strategic overlap with their CVCs' corporate parents. This result echoes the evidence based on IPO valuation and lends further credence to the CVC value-added claim.

We make two major contributions to the literature. First, we present systematic evidence concerning the services and support that CVCs provide to their portfolio companies. In doing so, we shed light on the channels through which CVCs can potentially add value to their portfolio companies. Second, we demonstrate that strategic CVC backing boosts the valuations that entrepreneurial companies receive when they either go public or are acquired by third parties. Our findings quantify the value added by CVCs and, more importantly, deliver a more definitive answer to the question of whether CVCs add value. Specifically, strategic CVC backing not only increases the probability that entrepreneurial firms will go public or be acquired

(Gompers and Lerner, 2000; Santhanakrishnan, 2002) but also helps generate more successful IPOs in terms of higher valuations and more successful acquisitions in terms of higher premiums.

A recent paper by Chemmanur and Loutskina (2006) also finds that CVC-backed IPOs are associated with higher valuations. Our study differs from theirs in several aspects. First, we apply a more accurate method to identify CVC-backed IPOs. Chemmanur and Loutskina (2006) classify an IPO as backed by CVCs if the IPO company has ever received funding from CVCs. In contrast, we also require that at least one CVC who provided funding in the past is listed as a shareholder in the IPO prospectus since CVCs are unlikely to impact IPO performance if they have terminated their involvement with the IPO company before the IPO. Our practice is more in line with the way the literature identifies VC-backed IPOs in general. Second, we carefully address the endogeneity of CVC backing using a propensity score matching procedure. We also employ a simultaneous equation framework to examine the issue of whether CVCs really add value or simply select better start-ups to invest in. Third, in addition to the IPO valuation analysis, we also examine takeover premiums received by VC-backed targets, and the two sets of analysis yield highly consistent results. Fourth, we differentiate among CVC-backed start-ups based on whether there is a strategic fit between a start-up and its CVC's corporate parent and find that only when there is a strategic fit do CVCs add value.

The remainder of the paper is organized as follows. Section I develops the testable hypotheses. Section II describes the sample construction. Section III documents the services and support that CVCs provide to their portfolio companies. Section IV presents the results from the IPO valuation analyses. Section V examines the takeover premiums received by VC-backed targets. Section VI concludes the paper.

I. Hypotheses Development

Most corporate venture programs are set up by industrial corporations with strategic benefits rather than purely financial returns in mind. Through strategic investments in entrepreneurial firms, CVCs can serve as their parent corporations' eyes and ears for promising technologies and innovations. They can also identify and foster start-ups whose products and technologies have the potential to either lower costs or expand the sales of their parents. Given these CVC functions, it is not surprising that CVC activities appear to benefit the parent corporations (Dushnitsky and Lenox, 2005, 2006). However, the effect of CVC backing on entrepreneurial companies is less clear. Since CVCs almost always coinvest with TVCs, the value that CVC backing adds to start-up companies depends on whether CVCs can make contributions incremental to those of TVCs. Some of the institutional differences between the two types of venture organizations suggest that CVCs can, while other differences suggest otherwise. These differences will jointly determine how valuable CVC services and support are to entrepreneurial companies.

A. Arguments for CVC Value Added

The defining feature of CVCs is their close affiliation with large established industrial corporations. They are usually created as either separate corporate subsidiaries or informal units within corporations' research and development departments. As a direct result of this affiliation, they can leverage the assets and capabilities of their parents to facilitate the growth and development of portfolio companies (Block and MacMillan, 1993). For example, they can provide start-ups with

technological and R&D support, product development assistance, manufacturing capacities, and access to marketing and distribution channels. CVCs can also connect entrepreneurial firms with various business units of their parent corporations and help establish cooperative relationships between them.

Being a part of large industrial corporations also gives CVCs access to the intrafirm information network. Their contacts with other divisions of the parent corporations could generate some inside knowledge concerning the industries and product markets in which those divisions operate. CVCs can use this information to assist entrepreneurial companies devise better business strategy and compete more effectively in the product market.

Another way in which CVC backing benefits start-ups is by bringing credibility to these young, unproven enterprises (McNally, 1997). Most CVC parent corporations are well-known leaders in their respective industries. Their presence as investors could send a positive signal about a start-up's prospect and mitigate the information asymmetry surrounding the start-up. The reduced uncertainty should facilitate the start-up's interactions with potential alliance partners, suppliers, and customers, and help the start-up obtain a higher valuation in the capital market. Consistent with this argument, Stuart, Hoang, and Hybels (1999) find that biotech start-ups with prominent strategic alliance partners go to IPO faster and receive higher valuations than comparable firms without such connections.

B. Arguments against CVC Value Added

The unique organizational structure of CVCs also puts them at certain disadvantages as compared to TVCs. Most of the traditional venture funds are set up as limited partnerships in which VCs are the general partners and they invest the money contributed by limited partners. The prespecified finite life of limited partnerships (usually 10 years) and the covenants in the contractual agreements between limited partners and general partners ensure that VCs put forth their best efforts in selecting and managing portfolio companies (Gompers and Lerner, 1996). However, both features are largely missing from corporate venture programs. Therefore, it is questionable whether CVCs have enough incentives to exert best efforts in the selection and development of start-up companies.

The problem is exacerbated by the fact that CVCs do not have the high-powered compensation schemes that TVCs usually adopt, probably due to their less autonomous status as part of a larger industrial company.[5] Therefore, CVCs frequently experience difficulties in recruiting and retaining talented employees (Gompers and Lerner, 2000), further undermining their ability to provide value-added services to entrepreneurial companies.

CVCs' incentives may also be called into question when conflicts of interest arise between their corporate parents and their portfolio companies due to similar or competing products and technology. As active equity investors, CVCs have access to the business strategy and trade secrets of the entrepreneurial firms and should try to prevent any leakage of such sensitive information. However, in cases of conflict, CVCs are likely to side with their parent corporations (which they are a part of) and engage in activities such as information sharing and technology transfer that may jeopardize the survival and growth of start-ups (Hamel, 1991). Having a corporate venture investor could also constrain start-ups from developing interorganizational relationships. For example, CVCs may prevent their portfolio companies from forming alliances with their parent corporations' competitors even though such alliances can bring significant strategic benefits to the start-ups.

[5]For example, jealousy from other divisions and bureaucracy in a large corporation both could deter the use of high-powered compensation schemes.

C. Testable Hypotheses

The arguments in the previous two subsections suggest that there are both advantages and disadvantages associated with CVC backing. Thus, it is an empirical question whether CVCs add value to the portfolio companies they finance. We address this question by first examining the nature and scope of services and support that CVCs provide to start-ups and then investigating whether the presence of CVCs in a VC syndicate boosts the valuations of entrepreneurial companies when they go public or are acquired. Our first conjecture is as follows.

> H1: Ceteris paribus, if the net effect of CVC backing is positive (negative), entrepreneurial companies with CVC backing will obtain higher (lower) valuations than those without CVC backing in the IPO market or the market for corporate control.

As Gompers and Lerner (2000) point out, CVCs do not always make strategic investments and they sometimes make investments for financial returns only, especially when the corporate venture programs lack focus and do not have clearly defined objectives. We expect CVCs to enjoy greater comparative advantages relative to TVCs in strategically oriented investments since the technological and operational support that CVCs can provide will be more relevant and value enhancing for start-ups with strategic overlap with CVCs' corporate parents. This gives rise to our second hypothesis

> H2: Any positive valuation effect of CVC backing will be greater when there is a strategic fit between entrepreneurial companies and CVC parent corporations.

Before we move on to the empirical part of the paper, it is important to note that our focus on the value added by CVCs does not suggest that TVCs do not provide valuable services to entrepreneurial companies. In fact, Bottazzi, Da Rin, and Hellmann (2008), Hellmann and Puri (2000), Hellmann, (2002), Hsu (2006), and Lindsey (2008) all indicate that VCs, in general, contribute to the development of entrepreneurial companies. In light of this evidence and the fact that CVCs rarely invest without TVCs, any value added by CVCs that we can identify will be incremental to that by TVCs.[6]

II. Sample Construction and Summary Statistics for the IPO Analysis

We construct a sample of VC-backed IPOs from 1981 to 2000 by merging SDC's VentureXpert database and its New Issue database. We find that some IPOs are classified as non-VC-backed by the New Issue database, when in fact they have received VC funding according to the information from VentureXpert. We include these issues in our sample. We also find that some IPOs classified as VC-backed by the New Issue database are not covered by VentureXpert. We exclude these issues from our sample since we cannot obtain their VC financing details such as the timing, amount, and participants of each financing round. As per literature conventions, we exclude best efforts offers, ADRs, closed-end funds, REITs, financial institutions, utilities companies, partnerships, reverse LBOs, issues with an offer price below $5, and offers not covered by CRSP within six months of the offering. We require that IPO firms have the following financial statement data available from Compustat for the fiscal year prior to the offering: 1) total assets (Item 6); 2) cash

[6]CVCs invest without TVCs in all but one case in our sample.

(Item 1); 3) sales (Item 12); 4) earnings before interest, taxes, depreciation, and amortizations (EBITDA) (Item 13); and 5) earnings before extraordinary items (Item 18).

We also require that the IPOs in our sample have information available from the SDC Platinum's VentureXpert database about the type and identity of their venture investors. We use this information to determine whether an IPO company has received any funding from CVCs.[7] We also examine each IPO's prospectus to identify the lead VCs and any participating CVCs. The lead VC is the venture firm with the largest pre-IPO ownership. When two or more VCs are tied, the one with the largest number of directors on the board or with the longest board tenure is identified as the lead VC. Comparing the information from VentureXpert and the information from IPO prospectuses, we find that occasionally when VentureXpert lists CVCs as investors in a start-up the IPO's prospectus does not. This discrepancy could be due to data collection errors by VentureXpert, or it may be because some CVCs had an initial investment in a start-up but later sold their stakes, thereby terminating their participation. For the purpose of our study, we only consider CVCs listed in both VentureXpert and the IPO prospectus as corporate venture investors in a given IPO since CVCs who are no longer investors at the time of the offering are unlikely to have an impact on IPO performance. Our final sample consists of 1,510 VC-backed IPOs, of which 1,291 are backed by TVCs only and 219 are backed by both CVCs and TVCs or by CVCs only. For expositional convenience, we call the former group TVC-backed IPOs and the latter CVC-backed IPOs, although it is very rare for an IPO to have CVCs as its only backers.

We then identify whether there is a strategic fit or overlap between an IPO firm and its corporate venture investor. Specifically, for each IPO, we read its prospectus to determine whether there is any mention of a strategic relationship or alliance between the IPO firm and its CVC's parent corporation. If such an association exists, we classify the IPO firm as having a strategic fit with the corporate parent of its CVC. We also search Factiva (formerly Dow Jones Interactive), Mergent, and Dun & Bradstreet for any mention of a business relationship (e.g., customer or supplier) between the CVC's parent corporation and the IPO firm. If such a relation exists, the IPO is also classified as having a strategic fit. We term CVC-backed IPOs with a strategic fit with their CVC backers as "strategic CVC-backed IPOs" and those without a strategic fit as "nonstrategic CVC-backed IPOs" or "financial CVC-backed IPOs." Of the 219 CVC-backed IPOs in our sample, 123 fall in the former category and 96 the latter.

Panel A of Table I displays the distribution of our sample of VC-backed IPOs over three time periods, 1981-1989, 1990-1998, and 1999-2000. Not surprisingly, most of the IPOs took place in the 1990s with a significant number of them from 1999 to 2000. Panel B of Table I presents the summary statistics of our sample. We notice that the three types of IPOs exhibit significant differences in many characteristics. When compared to TVC-backed IPOs, CVC-backed IPOs, as a whole, tend to be smaller, less profitable, and younger, but are underwritten by more reputable investment banks and raise higher proceeds. These differences, however, appear to be primarily driven by strategic CVC-backed IPOs. Strategic CVC-backed IPOs are smaller, less profitable, and younger, but are underwritten by more reputable investment banks and raise higher proceeds than financial CVC-backed IPOs, while there is no significant difference except size between TVC-backed IPOs and financial CVC-backed IPOs. The three types of IPOs are similar in terms of lead VC's experience and major industries represented.

[7] To address the concern regarding the accuracy of CVC classification by VentureXpert, we manually check whether each VC designated by VentureXpert as a CVC is indeed a CVC. We find some misclassifications. For example, VentureXpert classifies American Express, a financial institution, and Wilson Sonsini Goodrich & Rosati, a law firm, as CVCs. Alternatively, Eli Lilly, which is a CVC, was mistakenly classified as a private equity firm.

Table I. Summary Statistics of Venture Capitalists (VC)-Backed IPOs

The sample consists of 1,510 VC-backed IPOs from 1981 to 2000, of which 1,291 are traditional venture capitalists (TVC)-backed and 219 are corporate venture capitalists (CVC)-backed. Of the 219 CVC-backed IPOs, 123 are strategic CVC-backed and 96 are nonstrategic CVC-backed. Panel A presents the distribution of the sample by IPO year. Panel B reports the summary statistics of some company and issue characteristics with the figure in each cell being the mean and figure in parenthesis the median. *Early Stage* is a dummy variable that equals one if, according to VentureXpert, a start-up is at its early stage at the time of the initial VC investment, and zero otherwise. TVC-backed IPOs and all CVC-backed IPOs form one comparison group with the significance symbols attached to the larger means or medians. Strategic CVC-backed IPOs and nonstrategic CVC-backed IPOs form another comparison group with the significance symbols attached to the larger means or medians.

	TVC-Backed	CVC-Backed	Strategic CVC-Backed	Nonstrategic CVC-Backed
Panel A. Distribution by IPO Year				
1981-1989	224	38	17	21
1990-1998	795	86	42	44
1999-2000	272	95	64	31
1981-2000	1,291	219	123	96
Panel B. Summary Statistics: Mean (Median)				
Total assets ($ mil)	45.2^{+++} (16.5)	30.1 (16.5)	29.5 (16.8)	31.3 (16.0)
Sales ($ mil)	49.4^{+++} (18.5)***	22.7 (8.9)	11.2 (5.1)	37.8^{+++} (11.1)***
Profitability (%)	−4.89^{++} (0.06)***	−12.4 (−0.78)	−19.4 (−1.3)	−3.7^{++} (−0.3)***
Firm age	7.7^{+++} (6.0)***	5.6 (5.0)	5.0 (4.0)	6.7^{+++} (5.0)
IPO proceeds ($ mil)	47.5 (36.9)	54.4^{++} (44.3)***	57.3^{++} (46.2)***	51.5 (41.3)
Underwriter rank	7.9 (8.1)	8.3^{+++} (8.9)***	8.4 (9.1)*	8.3 (8.8)
Lead VC age	12.9 (12.0)	13.9 (13)	13.5 (13.0)	14.1 (12.0)
Major industries based on two-digit SICs	73, 36, 38, 35, 28	73, 36, 28, 38, 35	73, 28, 36, 87, 38	73, 36, 35, 38, 28
CVC directors			0.85 (1.0)**	0.50 (0.0)
CVC ownership			21.05% (18.1%)**	15.1% (11.1%)
Number of CVCs			1.5 (1.0)	1.2 (1.0)
Early stage			0.59 (1.0)	0.62 (1.0)

Description of two-digit SIC codes
SIC 28: Chemicals and allied products (pharmaceutical)
SIC 35: Industrial and commercial machinery and computer equipment
SIC 36: Electronic and another electrical equipment and components
SIC 38: Measuring, analyzing, and controlling instruments
SIC 48: Communications
SIC 73: Business services
SIC 87: Research (biological and laboratory)

$^{+++}$Significance for the *t*-test for differences in means at the 1% level.
$^{++}$Significance for the *t*-test for differences in means at the 5% level.
***Significance for the Wilcoxon signed-rank test for differences in medians at the 1% level.
**Significance for the Wilcoxon signed-rank test for differences in medians at the 5% level.
*Significance for the Wilcoxon signed-rank test for differences in medians at the 10% level.

We also compare CVC involvement between the two types of CVC-backed IPOs and find that strategic CVCs have more board representation and own larger equity stakes in entrepreneurial companies than financial CVCs. This suggests that strategic CVCs have both greater power and stronger incentives to be actively engaged in the development of start-ups. There is no difference in the number of CVCs in an IPO and the stage of the start-up at the initial VC investment.

III. Services and Support from CVCs

One of the purported advantages of CVCs is that their close affiliation with established industrial companies enables them to provide start-up companies with unique services and support that TVCs are less capable of offering. For example, CVCs may be able to leverage the resources of their parent corporations, such as R&D capabilities and marketing, sales, and distribution (MSD) channels, to successfully nurture their portfolio firms until they are ready for an exit. However, there has been no systematic evidence on this issue in the literature.

To fill this void, we identify the specific services and support provided by CVCs to the 123 strategic CVC-backed IPOs in our sample. Panel A of Table II summarizes our findings. First, we find that there often exists a customer-supplier relationship between the CVC parent and the start-ups. For 30.1% of the start-ups, CVCs are users of their services and products, and for 23.6% of the start-ups, CVCs are their suppliers. Second, 26.8% of the start-ups engage in product development agreements with their CVCs and 17.9% of the start-ups (primarily in the pharmaceutical and biotech industries) and their CVCs have agreements for joint research, usually aimed at drug development, which is the equivalent of product development agreements in other industries. Lastly, a very important service provided by CVCs is the MSD agreement, which is present in 35% of the start-ups. Also note that CVCs sometimes provide more than one of these services simultaneously given that there are 165 identifiable relations for the 123 strategic CVC-backed IPOs.

In Panel B of Table II, we break down the CVC services and support by the industries in which IPO companies operate. We only focus on industries with at least five IPOs in our sample. Some interesting patterns emerge. Research agreements are more common for pharmaceutical and biotech firms (SIC 28 and SIC 87) with 60% and 66.7% of the support in these two industries falling into this category. IPOs in machinery and computer equipment (SIC 35), electronics (SIC 36), and Internet and business services (SIC 73) industries have more product development and MSD associations with their corporate venture investors. The customer relationship, in which the CVC parent is a customer of the CVC-backed start-up, is most common for machinery and computer equipment (SIC 35), electronic and electrical equipment (SIC 36), and telecommunication (SIC 48) industries at 33.3%, 34.8%, and 42.9%, respectively. Conversely, firms from instruments and related products (SIC 38) industries tend to have supplier relations in which the CVC parent corporation is a supplier to the start-up. Overall, the evidence is consistent with the CVC value-added argument since the services and support from CVCs appear to suit the needs of start-ups operating in different industries and help them develop, improve, and, ultimately, sell their products. Next, we turn to the issue of whether CVC backing can help start-ups obtain higher valuations when they go public or are acquired.

IV. Analysis of IPO Valuations

To test whether CVC-backed IPOs have higher valuations than their TVC-backed counterparts, we construct price-to-fair value (P/V) ratios for each CVC-backed IPO following a procedure

Table II. Types and Distributions of Services and Support Provided by Corporate Venture Capitalists (CVCs)

The table presents the type and distribution of development relations between CVCs and start-ups at 123 strategic CVC-backed IPOs in our sample. C, S, PD, RAD, and MSD stand for the five types of services and support provided by CVCs as listed in Panel A. In Panel A, the percentages (numbers) signify the proportions (numbers) of strategic CVC-backed IPOs where a given type of service or support exists. In Panel B, the percentages (numbers) represent the proportions (numbers) of strategic CVC-backed IPOs from a same industry where a given type of service or support exists. In each row, the percentages for C, S, PD, RAD, and MSD add up to 100%.

Panel A. Types of Relations between CVCs and IPOs

Type of Services and Support	Percentage (No.) of IPOs
The CVC parent is a customer of the IPO firm (C)	30.1% (38)
The CVC parent is a supplier of the IPO firm (S)	23.6% (29)
Product development agreement (PD)	26.8% (33)
Research agreement for joint development of drugs, chemicals, agricultural products, etc. (RAD)	17.9% (22)
Marketing/sales/distribution agreement (MSD)	35.0% (43)

Panel B. Distribution by IPO Industry of Relations between CVCs and IPOs

Industry		Type of Services and Support					
Description	SIC	C	S	PD	RAD	MSD	Total
Chemicals and allied products (pharmaceutical)	SIC 28	10% (2)	5% (1)		60% (12)	25% (5)	100% (20)
Industrial machinery and equipment	SIC 35	33.3% (3)		33.3% (3)		33.3% (3)	100% (9)
Electronic and other electrical equipment	SIC 36	34.8% (8)	21.7% (5)	26.1% (6)		17.4% (4)	100% (23)
Instruments and related products	SIC 38	9.1% (1)	36.3% (4)	18.2% (2)	18.2% (2)	18.2% (2)	100% (11)
Communications	SIC 48	42.9% (3)	28.5% (2)	14.3% (1)		14.3% (1)	100% (7)
Business services	SIC 73	22.7% (17)	18.6% (14)	24.0% (18)		34.7% (26)	100% (75)
Research (biological and laboratory)	SIC 87	16.7% (2)	8.3% (1)		66.7% (8)	8.3% (1)	100% (12)

similar to the one used by Purnanandam and Swaminathan (2004). In our analysis, a *P/V* ratio is the ratio of a CVC-backed IPO's valuation multiple to that of a carefully selected TVC-backed IPO. If CVC backing has only a marginal effect and matching IPOs are properly chosen, the *P/V* ratio should be close to one. On the other hand, if CVCs add value to start-ups beyond that by TVCs, the *P/V* ratio should exceed one. We compute the following two widely used valuation multiples for each CVC-backed IPO and its matching TVC-backed IPO, where *Shares Outstanding* is the number of shares outstanding on the closing of the IPO offer day obtained from CRSP.

$$\left(\frac{P}{S}\right) = \frac{Offer\ Price \times Shares\ Outstanding}{Prior\ Fiscal\ Year\ Sales}$$

$$\left(\frac{Enterprise\ Value}{S}\right) = \frac{Market\ Value\ of\ Equity + Book\ Value\ of\ Debt - Cash}{Prior\ Fiscal\ Year\ Sales}$$

A. Propensity Score Matching Approach

In selecting matching firms for CVC-backed IPOs, we recognize that obtaining CVC financing is a choice that an entrepreneurial firm faces at some point in its life cycle and this choice may not be random. Some firm-specific characteristics could affect a start-up's decision to resort to CVC financing. Alternatively, CVCs may choose to invest only in certain types of start-ups. Therefore, CVC-backed IPOs can be significantly different from other IPOs. These differences, rather than CVC backing, may be responsible for any differences in valuation.

To address this endogeneity concern, we apply a matching procedure based on propensity scores developed by Dehejia and Wahba (1999, 2002). The same approach has been used by other studies such as Drucker and Puri (2005) and Villalonga (2004) to deal with the self-selection issue. Its major appeal to econometricians is its ability to control for a large set of observable characteristics, but like almost all matching techniques, it does not take into account unobservables. In our context, a propensity score is the probability that a start-up will receive CVC financing conditional on a set of independent variables. The matching algorithm consists of three steps. First, we estimate a probit model where the dependent variable is equal to one if a start-up has CVC participation and zero otherwise. Second, we compute the estimated probability (propensity score) of each IPO receiving CVC financing based on the coefficient estimates from the probit model. We then pair each CVC-backed IPO with the TVC-backed IPO with the closest propensity score in the so-called "nearest neighborhood" matching. We also require that the selected TVC-backed IPO has the same two-digit SIC code as the CVC-backed IPO. Finally, we calculate the *P/V* ratios for each CVC-backed IPO relative to its matching TVC-backed IPO and test whether these ratios are significantly greater than one.

In the probit model, we control for the following variables that may explain whether an entrepreneurial company receives CVC backing. Lerner (1995) argues that the location of a start-up affects its access to venture capital. To capture the effect that access to corporate venture capital may also be geographically driven, we create a dummy variable, *Location,* which is equal to one if a start-up is located in California or Massachusetts. To the extent that CVCs may have a preference regarding the development stage of the start-ups they finance, we create a dummy variable *Early Stage*, that is equal to one if a start-up was in the early stage at the initial VC investment or zero otherwise. To address the possibility that CVCs may tend to coinvest with TVCs of certain caliber, we measure the lead VC's reputation and experience by the logarithmic transformation of its age [log(*VC age*)]. We also try to measure the size, growth potential, and profitability of the start-up at the time of the initial VC investment, but unfortunately data constraints do not allow us to do so directly. To overcome this difficulty, we use company characteristics around the IPO as surrogates. We recognize that doing so could possibly introduce some look-ahead bias, but it would also lead to more accurate matching.[8] We use the logarithmic transformation of the start-up's pre-IPO sales as a proxy for firm size [log(*Sales*)], we use the start-up's industry average market-to-book ratio (*Industry MTB*) at the IPO as a proxy for growth, and we use the start-up's

[8]The results are qualitatively the same when we omit these variables.

ratio of EBITDA to sales in the pre-IPO year as a proxy for *Profitability*. To capture the general availability of CVC funding, we create a variable *CVC Activity* that is equal to the percentage of CVC investments in the total VC investments in the year when a start-up received its first venture investment. We expect this variable to be positively related to the probability of a start-up receiving CVC funding. Lastly, we also control for year and industry fixed effects. Panel A of Table III presents the results from the probit model regression. We find that start-ups that received initial VC funding in the early stage, start-ups headquartered in California or Massachusetts, and smaller start-ups are more likely to receive CVC financing, and CVC backing is more likely in years with greater CVC activities.

Panel B of Table III presents the median *P/V* ratios of CVC-backed IPOs relative to their matching TVC-backed counterparts. For the full sample of 219 CVC-backed IPOs, we find that the *P/V* ratio is 1.29 for the Price/Sales multiple and 1.30 for the Enterprise Value/Sales multiple, both significantly greater than one. This suggests that CVC-backed companies are able to obtain higher valuations than TVC-backed ones when they go public. This is consistent with Hypothesis 1 in that CVCs add value to their portfolio companies in addition to that added by TVCs.

When we break the sample of CVC-backed IPOs based on whether they have strategic overlap with CVC parent corporations, we find that the median *P/V* ratios are significantly greater than one for those that do, and indistinguishable from one for those that do not. These results provide support for Hypothesis 2 and suggest that the value added by CVCs is primarily through the services and support that CVCs provide by leveraging their parent corporation's assets, operations, and expertise.

To rule out the possibility that our results are driven by the bubble period, we repeat the above analysis while excluding IPOs from 1999 to 2000. Our results continue to hold (see Panel C). We also obtain similar results when we experiment with two other valuation multiples, Price/Earnings and Price/EBITDA.[9]

B. Value Added versus Project Selection

An alternative explanation for our finding of higher valuations for strategic CVC-backed IPOs is that CVCs are better than TVCs at identifying promising start-up companies to invest in. As our arguments in Section I.A point out, being part of large established industrial companies may enable CVCs to obtain inside knowledge about certain industries and markets and develop a deeper understanding of the ingredients of the winning formula in these environments. This could give CVCs a potential edge in sifting through hundreds of funding proposals and finding the start-ups with the best chance to succeed. Therefore, the entrepreneurial companies chosen by CVCs may be able to achieve higher valuations when they go public, but they do so by their own virtues rather than as a result of any value added by CVCs.

Our view is that superior project selection and value added need not be mutually exclusive. It is reasonable to expect that CVCs are capable of doing both simultaneously, especially when they invest for strategic reasons. Nevertheless, to ensure that out results are not entirely driven by CVCs' superior project selection ability, we estimate a system of simultaneous equations where both CVC backing and IPO valuation are endogenously determined. One of the equations in the system is a probit model of a start-up having CVC backing where the dependent variable is a dummy equal to one if the IPO firm is backed by CVCs. The other equation is an OLS regression with the log of the price multiples of VC-backed IPOs as the dependent variable. We employ a

[9]Using these two valuation multiples is difficult for CVC-backed IPOs since most of them have negative pre-IPO earnings and EBITDA and have to be dropped from our analysis. As a result, the number of CVC-backed IPOs is reduced to 53 for the Price/Earnings multiple and 45 for the Price/EBITDA multiple. Nevertheless, the statistical significance remains.

Table III. Tests for Differences in Valuations of Corporate Venture Capitalists (CVC)-Backed and Traditional Venture Capitalists (TVC)-Backed IPOs–*P/V* Ratios Based on Offer Prices

The sample consists of 1,510 venture capitalists (VC)-backed IPOs from 1981 to 2000, of which 1,291 are TVC-backed and 219 are CVC-backed. Of the 219 CVC-backed IPOs, 123 are strategic CVC-backed and 96 are nonstrategic CVC-backed. Panel A presents the regression results of probit models in which the dependent variable equals one if an IPO is backed by CVC. Panels B and C report the median *P/V* ratios for the three types of IPOs over the entire sample period and the period from 1981 to 1998. In parentheses in Panel A are two-sided *p*-values based on heteroskedasticity-consistent standard errors. In parentheses in Panels B and C are two-sided *p*-values from the Wilcoxon signed-rank tests.

Panel A. Probit Model Regressions

Independent Variables	Coefficient Estimates (*P*-Values)	
	Full Sample	1981-1998
Intercept	−2.70 (0.00)	−3.48 (0.00)
Early Stage	0.39 (0.00)	0.47 (0.00)
Location	0.38 (0.00)	0.45 (0.00)
CVC Activity	4.40 (0.01)	4.23 (0.01)
Log(*Sales*)	−0.11 (0.01)	−0.10 (0.02)
Log(*VC Age*)	−0.02 (0.71)	0.09 (0.11)
Industry MTB	−0.18 (0.28)	−0.05 (0.82)
Profitability	0.001 (0.88)	0.002 (0.32)
Year Dummies	Included	Included
Industry Dummies	Included	Included
Pseudo-R^2	0.15	0.19
Prob > chi-squared	0.00	0.00
Number of observations	1,510	1,143

Panel B. Full Sample

Multiple	CVC IPOs		Strategic CVC IPOs		Nonstrategic CVC IPOs	
	No. of Issues	Median *P/V* Ratio (*P*-Value)	No. of Issues	Median *P/V* Ratio (*P*-Value)	No. of Issues	Median *P/V* Ratio (*P*-Value)
Price/Sales	219	1.29 (0.00)	123	1.51 (0.00)	96	1.01 (0.92)
Enterprise Value/Sales	219	1.30 (0.00)	123	1.57 (0.00)	96	0.96 (0.94)

Panel C. 1981-1998

Price/Sales	117	1.34 (0.01)	59	1.73 (0.00)	58	1.05 (0.19)
Enterprise Value/Sales	117	1.35 (0.01)	59	1.63 (0.00)	58	1.06 (0.17)

two-stage estimation procedure described in Maddala (1983), which is similar to two-stage least squares, but applies specifically to systems in which one equation is a binary choice model. In the first stage, we estimate the reduced form of the two equations. The second-stage models use the instrumented version of the strategic CVC dummy and log(price multiple) derived from the first stage.

For the strategic CVC dummy, we select three instrumental variables (IVs) from the propensity score matching analysis: 1) *Location*, 2) *CVC Activity*, and 3) *Early Stage*, all of which are significantly related to the probability of a start-up receiving CVC backing (Panel A of Table III) and therefore pass the validity requirement for IVs. These IVs also satisfy the exclusion restriction since they should not directly impact a start-up's valuation when it goes public. Specifically, we do not expect *Location* to be significantly related to IPO valuations as it is ultimately the quality of a start-up, the reputation of its VCs and underwriters, and the IPO market conditions, rather than the state in which it is located, that determine its valuation at the IPO. Our next instrument, *CVC Activity*, is the fraction of total VC investments that come from CVCs in the year of a start-up's initial VC funding. This VC industry level characteristic is unlikely to affect a start-up's valuation at IPO since typically a considerable amount of time will pass between when the variable is measured and when the start-up goes public. In the meantime, the VC industry landscape may have experienced significant changes. The third instrument, *Early Stage*, captures a start-up's stage of development when it received first VC funding. It could be related to the start-up's probability to exit in an IPO or acquisition since when compared to late-stage companies, early-stage start-ups are associated with greater uncertainty. As the uncertainty resolves over time, a larger fraction of them may fail before reaching the exit stage. However, the focus of our paper is on start-ups that end up going public. We do not expect the stage at which they receive their initial VC funding to impact their IPO valuation. The reason is that no matter whether a start-up received its initial VC funding at an early or late stage, it will need to go through a process of cultivation and development by VCs and, generally, additional rounds of financing until it is ready to go public. In the end, any initial differences between early- and late-stage start-ups will be neutralized by this process given that by the time of exit, early-stage start-ups will likely have gone through a lengthier process and received more nurturing than late-stage ones in order to have a successful exit. As additional assurance for the appropriateness of the three IVs, the Hansen-Sargan J-statistic from the overidentifying test has a p-value of 0.17 for the Price/Sales multiple and 0.33 for the Enterprise Value/Sales multiple.

We select two instrumental variables for IPO valuation multiples. One is a dummy variable that is equal to one if the offer price is above the preoffer filing price range (*Above Range*), and the other is the percentage of secondary shares sold in the offering (*Secondary Shares*). Both IVs are measured at the IPO. They satisfy the exclusion restriction as it is implausible that they would affect a start-up's CVC backing status, which is determined considerably prior to the IPO. The two IVs also pass the validity requirement as they are significantly correlated with our valuation measures. In the regression equation of price multiples, we also include the age of the IPO firm [log(*Firm Age*)], *Profitability*, log(*Sales*), log(*VC Age*), a dummy variable equal to one if the firm is in a high-tech industry (*Tech*) based on the classification by Loughran and Ritter (2004), and a dummy variable (*Underwriter Reputation*) equal to one if the Carter-Manaster (1990) rank of the lead underwriter is greater than seven. In order to capture the industry-wide valuation level and growth potential, we also control the average market-to-book ratio of the IPO company's industry in the year it goes public (*Industry MTB*), where the market-to-book ratio is calculated as the market value of common equity divided by the book value of common equity.

We estimate the system of simultaneous equations using the Stata command CDSIMEQ developed by Keshk (2003) to obtain the correct standard errors. The sample for the test consists of TVC-backed IPOs and strategic CVC-backed IPOs given that earlier evidence indicates that only CVC-backed IPOs with strategic fit obtain higher valuations than their matching TVC-backed counterparts. Results are qualitatively similar if we include all CVC-backed IPOs. We report the second-stage coefficient estimates of the simultaneous equations system in Table IV.[10] In

[10]For the sake of brevity, we do not report the results of the first-stage regressions, which are available upon request.

Table IV. Corporate Venture Capitalists (CVC) Valued Added versus Superior Project Selection—System of Simultaneous Equations

The sample used in this table consists of 1,291 TVC-backed IPOs and 123 strategic CVC-backed IPOs from 1981 to 2000. The first two columns of coefficient estimates are from the second-stage regression of a simultaneous equations system where the dependent variables are the strategic CVC dummy and the logarithmic transformation of Price/Sales valuation multiple. The next two columns of coefficient estimates are from the second-stage regression of a simultaneous equation system where the dependent variables are the strategic CVC dummy and the logarithmic transformation of Enterprise Value/Sales valuation multiple. In parentheses are two-sided *p*-values based on heteroskedasticity-consistent standard errors. *Strategic CVC**, log(*Price/Sales*)*, and log(*Enterprise Value/Sales*)* are the instrumented versions of each variable.

Independent Variables	Coefficient Estimates (*P*-Values)		Coefficient Estimates (*P*-Values)	
	OLS: Log (Price/Sales)	Probit: Strategic CVC	OLS: Log (Enterprise Value/Sales)	Probit: Strategic CVC
Intercept	4.82 (0.00)	−4.87 (0.00)	4.37 (0.00)	−3.88 (0.00)
*Strategic CVC**	0.50 (0.00)		0.40 (0.00)	
Log(*Price/Sales*)*		0.67 (0.01)		
Log(*Enterprise Value/Sales*)*				0.23 (0.00)
Early Stage		0.06 (0.61)		0.17 (0.12)
Location		0.25 (0.04)		0.27 (0.02)
CVC Activity		2.72 (0.08)		3.19 (0.04)
Log(*Firm Age*)	−0.17 (0.05)		−0.19 (0.00)	
Log(*Sales*)	−0.64 (0.00)		−0.53 (0.00)	
Log(*VC Age*)	−0.02 (0.63)		−0.01 (0.81)	
Industry MTB	0.11 (0.13)		0.10 (0.15)	
Profitability	0.001 (0.01)		0.005 (0.01)	
Underwriter Reputation	0.47 (0.00)		0.44 (0.00)	
Secondary Shares	−1.04 (0.01)		−1.15 (0.01)	
Above Range	0.50 (0.00)		0.51 (0.00)	
Tech	−0.21 (0.11)		−0.15 (0.19)	
Year Dummies	Included	Included	Included	Included
Industry Dummies	Included	Included	Included	Included
Adjusted R^2 or Pseudo R^2	0.59	0.29	0.59	0.19
Prob >chi-squared	0.00	0.00	0.00	0.00
Number of observations	1,414	1,414	1,414	1,414

the probit model regressions, we find that both valuation multiples have significant and positive effects on the probability of an IPO receiving CVC backing, consistent with strategic CVCs possessing superior project selection ability. More importantly, we discover that strategic CVC backing has a significantly positive effect on IPO valuation measured by either price multiple, indicating that the higher valuations of strategic CVC-backed IPOs reported in Section IV.A are not entirely due to the CVCs' project selection ability.

C. Strategic CVC Backing versus General Corporate Alliance

So far, our results suggest that entrepreneurial firms benefit from CVC backing when they have strategic relationships with CVC parents. CVC backing is not the only way in which

start-ups develop such relationships with other companies. In fact, Hsu (2006) and Lindsey (2008) demonstrate that VC backing in general facilitates the formation of strategic alliances either among start-ups or between start-ups and more established companies. Such associations also appear to be beneficial to the parties involved. For example, Allen and Phillips (2000) find that alliances, joint ventures, and other product market relations, combined with corporate block ownership, lead to significantly improved stock price and operating performance at target firms. In light of the evidence from these studies, an interesting question emerges as to whether the value added by strategic CVC backing is beyond that added by general corporate alliances. In other words, we want to see if the effect of strategic CVC backing documented earlier is simply a corporate alliance effect or if there is more to it.

Toward that end, we compare the offer-day valuations of strategic CVC-backed IPOs and TVC-backed IPOs with general corporate alliances. Since we only have information on strategic alliances of TVC-backed IPOs starting from 1991, the sample period for this analysis is from 1991 to 2000. Our sample consists of 168 TVC-backed IPOs with alliances and 102 strategic CVC-backed IPOs. To control for the endogeneity of CVC financing, we use an instrumental variable approach where we predict strategic CVC backing in a first stage and estimate regressions of valuation multiples with the instrumented version of strategic CVC backing as an explanatory variables in a second stage. The instruments for strategic CVC backing are *Location* and *Early Stage* as defined in the simultaneous equations system estimation in Section IV.B. We drop *CVC Activity* as an IV since in this smaller sample it is no longer significantly correlated with strategic CVC backing. In the valuation multiple regressions, we also control for a number of firm and issue specific characteristics as well as year and industry fixed effects.

In Table V, we present the results from the second-stage regressions. We find that strategic CVC-backed IPOs receive significantly higher valuations than the TVC-backed IPOs with corporate alliances as evidenced by the significant and positive coefficients of the instrumented strategic CVC dummy. This suggests that CVCs that make strategic investments add value to their portfolio companies beyond that added by general corporate alliances. This reinforces our previous results and provides additional support for the CVC value-added hypotheses. One possible explanation for this finding is related to the level of CVC involvement with start-ups. As venture investors, CVCs hold equity stakes and often participate in the governance of their portfolio firms (Ivanov and Masulis, 2007). In some of the alliances involving TVC-backed IPOs, corporate partners also hold equity of the IPO firms. However, there is a significant difference in ownership stakes held by CVCs and other corporate partners. The average equity ownership by strategic CVCs in their portfolio companies is 21%, whereas other alliance partners, on average, hold only 2% of the stock of the start-ups. As a result, CVCs have stronger incentives to develop and nurture their portfolio firms. The higher equity stakes may also help resolve potential hold-up problems between partners in a strategic relationship (Klein, Crawford, and Alchian, 1978; Grossman and Hart, 1986; Hart 1988, 2001), which, given the nature of the industries in which CVCs invest, could further contribute to the higher valuations of CVC-backed IPOs.

D. Robustness Tests

Our finding of higher valuations of strategic CVC-backed IPOs is robust to an alternative approach in dealing with the endogeneity of CVC backing. Specifically, we employ the procedure used by Comment and Schwert (1995) in their study of the takeover deterrence effect of poison pills. First, we estimate a probit model to predict whether a start-up has CVC backing using the same specification as in the propensity score matching procedure. We then decompose the CVC backing dummy into two components: 1) the predicted component and 2) the surprise

Table V. Strategic Corporate Venture Capitalists (CVC) Backing versus General Corporate Alliances

The sample used in this table consists of 168 traditional venture capitalists (TVC)-backed IPOs with corporate alliances and 102 strategic CVC-backed IPOs from 1991 to 2000. The dependent variable is the logarithmic transformation of the Price/Sales valuation multiple in the first column and the logarithmic transformation of the Enterprise Value/Sales valuation multiple in the second column. In parentheses are two-sided *p*-values based on heteroskedasticity-consistent standard errors. *Strategic CVC** is the instrumented version of the strategic CVC dummy.

Independent Variables	Coefficient Estimates (*P*-Values)	
	Log(Price/Sales)	Log(Enterprise Value/Sales)
Intercept	4.603 (0.01)	5.409 (0.01)
*Strategic CVC**	1.622 (0.04)	1.523 (0.05)
Log(*Firm Age*)	−0.488 (0.01)	−0.478 (0.01)
Log(*Assets*)	−0.445 (0.01)	−0.446 (0.01)
Log(*VC Age*)	−0.027 (0.83)	−0.038 (0.75)
Industry MTB	0.197 (0.38)	0.180 (0.42)
Profitability	3.559 (0.54)	3.811 (0.51)
Underwriter Reputation	0.122 (0.73)	0.118 (0.74)
Secondary Shares	−2.163 (0.14)	−2.258 (0.12)
Above Range	0.698 (0.01)	0.696 (0.01)
Tech	−0.553 (0.21)	−0.545 (0.22)
Industry Dummies	Included	Included
Year Dummies	Included	Included
Adjusted R^2	0.35	0.36
Number of observations	270	270

component. The predicted component is simply the predicted value from the probit model. The surprise component is equal to the difference between the CVC backing dummy and the predicted component, and it should be largely free of endogeneity. We estimate an OLS regression where log(*Price Multiple*) is the dependent variable and the predicted and surprise components of CVC backing are the key independent variables. We find that the coefficient on the surprise component is positive (0.269) and significant at the 1% level (*t*-statistics: 2.61), once again indicating that our results are not driven by the endogeneity of CVC backing.

Our results are also robust to a matching procedure similar to that used by Purnanandam and Swaminathan (2004). Specifically, we match each CVC- or TVC-backed IPO to a non-VC-backed IPO of similar size, profitability, and growth, where growth is proxied by postissue analyst earnings forecasts. Our results continue to hold if we match each VC-backed IPO to a public company of similar size, profitability, and growth.

We obtain very similar results when we repeat the IPO valuation analysis using *P/V* ratios computed based on an IPO's closing price on the first trading day or six months after the offering (Table VI). Specifically, the *P/V* ratios of strategic CVC-backed IPOs are always significantly greater than one, indicating that strategic CVC-backed IPOs obtain higher valuations relative to comparable TVC-backed counterparts. Also worth noting is that regardless of the sample period and valuation multiple, strategic CVC-backed IPOs are also valued significantly higher than nonstrategic CVC-backed ones with *p*-values (untabulated) ranging from 1% to 3%.

To the extent that the IPO market may not be efficient in the short run and stock prices at the offering and during the first several months afterward may not reflect the true value of IPO

Table VI. Tests for Differences in Valuations of Corporate Venture Capitalists (CVC)-Backed and Traditional Venture Capitalists (TVC)-Backed IPOs—*P/V* Ratios Based on First-Day and Sixth-Month Closing Prices

The sample consists of 1,510 VC-backed IPOs from 1981 to 2000, of which 1,291 are TVC-backed and 219 are CVC-backed. Of the 219 CVC-backed IPOs, 123 are strategic CVC-backed and 96 are nonstrategic CVC-backed. Panels A and B present the median *P*/*V* ratios for the three types of IPOs over the entire sample period and from 1981 to 1998, respectively. Results in Panel A are based on *P*/*V* ratios computed using first day closing prices, while those in Panel B are based on *P*/*V* ratios computed using closing prices in six months. In parentheses are two-sided *p*-values from the Wilcoxon signed-rank tests.

Multiple	CVC IPOs		Strategic CVC IPOs		Nonstrategic CVC IPOs	
	No. of Issues	Median *P/V* Ratio (*P*-Value)	No. of Issues	Median *P/V* Ratio (*P*-Value)	No. of Issues	Median *P/V* Ratio (*P*-Value)
Panel A. P/V Ratios Based on First-Day Closing Prices						
Panel A-1. Full Sample						
Price/Sales	219	1.33 (0.01)	123	1.48 (0.01)	96	1.06 (0.17)
Enterprise Value/Sales	219	1.25 (0.02)	123	1.43 (0.01)	96	1.04 (0.18)
Panel A-2. 1981-1998						
Price/Sales	117	1.17 (0.05)	59	1.55 (0.01)	58	0.74 (0.13)
Enterprise Value/Sales	117	1.09 (0.07)	59	1.64 (0.01)	58	0.75 (0.13)
Panel B. P/V Ratios Based on Closing Prices in Six Months						
Panel B-1. Full Sample						
Price/Sales	219	1.37 (0.01)	123	1.52 (0.01)	96	1.26 (0.03)
Enterprise Value/Sales	219	1.25 (0.02)	123	1.51 (0.01)	96	1.04 (0.72)
Panel B-2. 1981-1998						
Price/Sales	117	0.92 (0.95)	59	1.51 (0.01)	58	0.67 (0.07)
Enterprise Value/Sales	117	0.91 (0.94)	59	1.48 (0.01)	58	0.69 (0.07)

companies, we also take a longer term perspective to examine the three-year post-IPO abnormal stock returns of our sample firms. The methodological difficulties in carrying out long-run event studies are well documented. As Fama (1970) points out, any event study represents a joint test of market efficiency and the underlying model for expected stock returns. However, all asset pricing models have problems in describing average returns and the problem is more serious in long-term returns (Fama, 1998). Barber and Lyon (1997) and Lyon, Barber, and Tsai (1999) demonstrate through simulations that "analysis of long-run abnormal returns is treacherous" due to the pervasive misspecification of test statistics for nonrandom samples.

With these caveats in mind, we apply the calendar-time portfolio approach suggested by Fama (1998) to the three types of VC-backed IPOs in our sample. Specifically, in every month starting from January 1981, we form equal-weighted and value-weighted portfolios for each type of VC-backed companies that went public within the past three years. The portfolios are rebalanced on a monthly basis. We then regress the monthly excess returns of these portfolios (the raw portfolio return minus the one-month Treasury bill yield) using the Fama and French (1993) three-factor model where the three factors are a market factor, a size factor, and a book-to-market equity factor. All factor returns are from Kenneth French's website.

We find that portfolios of strategic CVC-backed IPOs, financial CVC-backed IPOs, and TVC-backed IPOs all earn positive and significant alphas (Table VII).[11] In addition, there is no significant difference among the three types of IPOs in long-run return performance. A zero-investment strategy that is long in strategic CVC-backed IPOs and short in TVC-backed IPOs does not generate significant alpha, and neither does a zero-investment strategy that is long in strategic CVC-backed IPOs and short in financial CVC-backed IPOs or that is long in financial CVC-backed IPOs and short in TVC-backed IPOs. These results imply that the higher offer-day valuations received by strategic CVC-backed IPOs do not appear to be reversed in the long run.

We also explore another dimension of the CVC value-added hypothesis by examining the underpricing of IPOs in our sample. The conjecture is that strategic CVC backing could mitigate the information asymmetry surrounding an IPO thus leading to lower underpricing. However, we do not find any significant results.

V. Analysis of Acquisitions of VC-Backed Targets

In addition to IPOs, acquisitions by other companies are another successful exit outcome for entrepreneurial firms. Takeover premiums offered to start-ups in these transactions provide a valuation metric that is parallel to IPO price multiples. We take advantage of this feature and examine the effect of CVC backing on the valuation received by start-ups in the market for corporate control.

Our analysis is limited by the fact that unlike public targets, private targets do not have stock prices available for us to compute takeover premiums. As a result, we follow Masulis and Nahata (2007) and construct the ratio of Purchase Price/Book Value of Assets (the *P/B* ratio) as a measure of takeover premium. We obtain the purchase price information from the SDC, but the financial information such as the book value of assets of private targets is generally not available as private companies are not required to file financial statements with the SEC. We have to gather this information from the regulatory filings by acquirers, which are required to disclose targets' financial information when the deal size is at least 10% of the acquirer market value.

We extract acquisitions of VC-backed private targets by US public bidders during the period from 1996 to 2000 from the SDC's Mergers and Acquisitions (M&A) database.[12] We require that bidders acquire 100% of targets, and we exclude targets from financial and utility industries. We hand collect data on the book value of total assets for each VC-backed target from various SEC filings (8-K, 8-K/A, S-3, and S-4) by acquirers around the deal announcement date and the

[11] Chemmanur and Loutskina (2006) also document significant outperformance by CVC- and TVC-backed IPOs relative to benchmark.

[12] The sample period starts from 1996 since that is when we have electronic SEC filings available through Edgar.

Table VII. Long-Run Stock Return Analysis of Corporate Venture Capitalists (CVC)-Backed and Traditional Venture Capitalists (TVC)-Backed IPOs

The table presents the results from Fama-French (1993) three-factor model regressions of monthly returns of calendar-time portfolios of venture capitalists (VC)-backed IPOs from January 1981 to December 2000. In each month, we form equal-weighted and value-weighted portfolios for each type of VC-backed companies that went public within the past three years. We also form equal- and value-weighted zero-investment portfolios across the three types of VC-backed companies. All portfolios are rebalanced on a monthly basis. Panels A and B are based on equal- and value-weighted portfolio returns, respectively. a is the intercept estimate, and β, s, and h are coefficient estimates of the market factor, size factor, and book-to-market factor, respectively. In parentheses are t-statistics based on heteroskedasticity-consistent standard errors.

	α	β	s	h	Adjusted R^2
Panel A. Equal-Weighted Portfolio Returns					
Strategic CVC	1.358**	1.306***	1.198***	−1.450***	0.64
	(2.46)	(9.32)	(6.80)	(−6.90)	
Financial CVC	1.695***	1.236***	1.291***	−1.198***	0.54
	(2.81)	(8.07)	(6.56)	(−5.09)	
TVC	0.909***	1.336***	1.132***	−0.838***	0.83
	(3.30)	(19.21)	(12.65)	(−7.84)	
Long strategic CVC/ short financial CVC	−0.154	0.009	−0.051	−0.197	0.00
	(−0.22)	(0.05)	(−0.23)	(−0.73)	
Long strategic CVC/short TVC	0.632	−0.053	0.104	−0.607***	0.05
	(1.23)	(−0.41)	(0.64)	(−3.11)	
Long financial CVC/short TVC	0.8747	−0.102	0.168	−0.352*	0.01
	(1.64)	(−0.76)	(0.97)	(−1.69)	
Panel B. Value-Weighted Portfolio Returns					
Strategic CVC	4.063***	1.251***	0.922***	−2.122***	0.52
	(5.29)	(6.42)	(3.76)	(−7.26)	
Financial CVC	4.489***	1.143***	0.888***	−1.711***	0.45
	(5.98)	(6.01)	(3.63)	(−5.85)	
TVC	4.159***	1.484***	0.871***	−1.390***	0.80
	(11.95)	(16.89)	(7.71)	(−10.30)	
Long strategic CVC/ short financial CVC	−0.506	0.034	0.073	−0.375	0.01
	(−0.50)	(0.13)	(0.23)	(−0.98)	
Long strategic CVC/short TVC	0.047	−0.252	0.102	−0.674***	0.03
	(0.07)	(−1.48)	(0.47)	(−2.64)	
Long financial CVC/short TVC	0.418	−0.339*	0.028	−0.309	0.01
	(0.58)	(−1.85)	(0.12)	(−1.10)	

***Significant at the 0.01 level.
**Significant at the 0.05 level.
*Significant at the 0.10 level.

completion date.[13] For CVC-backed targets, we also identify the existence of strategic relationships between start-ups and CVC parents based on various news reports from Factiva. We end up

[13]We also tried to collect data on the book value of equity for targets, but they are often negative, making premium computation infeasible.

Table VIII. Corporate Venture Capitalists (CVC) Backing and Takeover Premiums of Venture Capitalists (VC)-Backed Targets

The sample used in this table consists of 187 traditional venture capitalists (TVC)-backed targets, 22 CVC-backed targets with strategic CVC investments, and 30 CVC-backed targets with financial CVC investments from 1996 to 2000. The dependent variable is the logarithmic transformation of the *Purchase Price/Book Value of Assets*. *Stock Acquisition* is a dummy variable equal to one if the deal is financed entirely with common stock, and zero otherwise. *Relative Deal Size* is the ratio of deal size to the acquirer market value of equity at the end of the month prior to the announcement date. *Target Industry MTB* is the median target industry market-to-book ratio during the year of the deal, where industry is defined using two-digit SICs. *IntraIndustry Deal* is a dummy variable equal to one if the target and the acquirer share a two-digit SIC code. In parentheses are two-sided *p*-values based on heteroskedasticity-consistent standard errors. In Column 3, *Strategic CVC* is the instrumented version of the *Strategic CVC* dummy

Independent Variables	Dependent Variable: Log(*Purchase Price/Book Value of Assets*)		
	(1) OLS	(2) OLS	(3) IV Approach
Intercept	−1.06 (0.14)	−0.99 (0.16)	0.15 (0.68)
CVC	0.07 (0.24)	−0.26 (0.43)	
Strategic CVC		0.88 (0.05)	2.51 (0.06)
Stock Acquisition	0.70 (0.01)	0.68 (0.01)	0.69 (0.02)
Relative Deal Size	0.04 (0.01)	0.04 (0.01)	0.04 (0.01)
Target Industry MTB	0.87 (0.03)	0.88 (0.02)	0.76 (0.01)
Intraindustry Deal	0.15 (0.54)	0.15 (0.59)	−0.11 (0.61)
Industry Fixed Effects	Included	Included	Included
Year Fixed Effects	Included	Included	Included
Adjusted R^2	0.40	0.42	0.16
Number of observations	239	239	209

with 187 TVC-backed targets and 52 CVC-backed targets, 22 of which are strategic CVC-backed ones.

We estimate regressions where the dependent variable is the log of the *P/B* ratio. The independent variables includes a CVC dummy, a strategic CVC dummy, and a number of control variables used by Masulis and Nahata (2007) such as relative deal size (deal value divided by the market value of the acquirer's equity in the month prior to the announcement date), target industry market-to-book ratio, whether a deal is financed with stock, and whether a deal is diversifying. Table VIII presents the regression results. In Column 1, we examine whether CVC backing in general results in higher acquisition premiums and find that the coefficient of the CVC dummy is positive, but not significant. In Column 2, where we add the *Strategic CVC* dummy as an additional regressor, we find that it has a significant and positive coefficient, whereas the coefficient of the CVC dummy remains insignificant. The sum of the two coefficients is positive and significant with a two-sided *p*-value of 0.07. Our results indicate that only strategic CVC-backed targets receive higher valuations in M&As than their TVC-backed counterparts. This is consistent with our inference based on IPO valuations and lends further support to the CVC value-added hypothesis.

We also try to correct for the endogeneity of strategic CVC backing. As in Section IV, we employ an IV approach where we use *Location*, *CVC Activity*, and *Early Stage* as instruments for *Strategic CVC*. We find in Column 3 that the strategic CVC dummy continues to have a significant

and positive effect on takeover premium suggesting that our results are robust to endogeneity corrections.

VI. Conclusion

In this paper, we examine whether CVCs add value to entrepreneurial companies. We demonstrate that CVCs often leverage the resources of their parent corporations to provide a variety of services and support that appear to suit the specific needs of start-ups operating in different industries. We find that CVC-backed start-ups are able to obtain higher valuations than TVC-backed ones at the IPO, and that the higher valuations concentrate in start-ups that have a strategic fit with the CVC parent corporation. This positive effect of strategic CVC backing is robust to correcting for the endogeneity of CVC backing, is not driven by the superior project selection ability of CVCs, is over and beyond the effect of general corporate alliances, and is not reversed in the long run.

An analysis of acquisitions of VC-backed targets yields evidence highly consistent with that based on IPO valuations; CVC-backed targets receive higher takeover premiums than TVC-backed ones only when there is a strategic relationship between the targets and the CVC parents. Overall, our findings support the conclusion that CVCs can add value when they make strategically oriented investments in entrepreneurial companies. ■

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