Strategic Investing and Financial Contracting in Start-ups: Evidence from Corporate Venture Capital

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Abstract: This paper provides an empirical analysis of venture investments by strategically inclined corporate venture capitalists (CVCs). A strategic investor's quest for synergies can be economically damaging to the start-up because the wealth gains for the strategic investor are not always aligned with the economic benefit to the start-up. Consistent with this argument, we find that the start-ups are more likely to involve complementary firms as venture investors. Second, the founders/entrepreneurs of the start-ups are likely to limit CVC influence by awarding them lower board power if the CVCs' parent corporations are potential competitors. Furthermore, we find that insiders in start-ups have greater board power when faced with competitive strategic investments. Third, we find that the lead CVCs have lower board representation relative to lead traditional venture capitalists and this is consistent with entrepreneurs' desire to limit the influence of these CVCs, particularly at the earliest stages of the start-ups' lifecycle. Finally, insiders in start-ups are able to extract higher valuations from CVC investors when the CVC parents are potential competitors of the start-up firms, which is consistent with the predictions of standard bargaining models. Overall, the results indicate that the potential synergies that strategic CVC investors offer raise their likelihood of participation in VC syndicates and that their board representation and share pricing are related to the nature of their strategic relationship with the start-ups.

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I. Introduction

Corporations have pumped in billions of dollars in funding young entrepreneurial companies (start-ups) in the past decade alone. At the height of their investment activity in the late nineties, corporate venture capital (CVC) accounted for nearly 15% of the total venture investment in the US economy. Corporations can be thought of as natural candidates to engage in venture investing activity given that they are often active players in technology and/or product space that start-ups are positioned in. Since many start-up companies innovate in existing markets, established firms in these markets may be particularly keen to obtain participating stakes in these start-ups. These start-ups can appear to be attractive investment opportunities for such corporations, both for financial and strategic reasons.[1] However, CVCs' strategic objectives, which can often be at the expense of start-ups' well-being, are likely to be in conflict with the interests of both the entrepreneurs and traditional venture capitalists (TVC) investing in these start-ups. This study empirically analyzes the effects of CVC strategic objectives on the venture capital process, particularly the nature of strategic relationship between the start-ups and their CVCs and its impact on CVC participation and contracting in venture syndicates.

Hellmann (2002) provides a theoretical foundation for analyzing the competitive advantages and disadvantages of strategic venture investors. A central insight of this analysis is that a strategic investor's quest for synergies can turn into a competitive disadvantage for start-ups because the wealth gains for the strategic investor are not always aligned with the economic benefits to the start-up and as a consequence can be economically damaging to the start-up. Hellmann also discusses conditions under which entrepreneurs prefer CVC investors whose parent corporations operate in related segments (thus having strategic objectives), and contrasts

[1] In a survey of corporate venture capitalists, Yost and Devlin (1993) report that 93% of respondents considered realizing strategic benefits and achieving synergies with their core businesses as their prime objective.

them with circumstances when they prefer independent venture capitalists. In addition to their strategic objectives, CVCs have less experience investing in start-up companies than TVCs; furthermore, CVC managers have weaker performance incentives compared to TVCs.[2]

Given these issues, a number of important empirical questions arise. Does the type of venture capitalist matter to a start-up? In particular, under what circumstances will a start-up accept funding from strategic CVC investors? Is there evidence that the allocation of shareholdings and control rights among VC syndicate members reflects concerns of unwanted interference by strategic CVC investors in the operating decisions of start-ups? Given the strategic objectives of CVCs' parent corporations ('CVC parents' hereafter), it is important to allocate the start-ups' control and shareholding rights in ways that motivate all start-up constituents including the CVCs, TVCs and entrepreneurs to provide strong financial, technical and managerial support to the venture.[3] Finally, how different are the prices paid by strategic investors when buying start-up shares and does the pricing depend on the nature of CVC – start-up relationship? In this study, we empirically relate the nature of CVCs' strategic objectives to CVC participation in venture syndicates, the allocation of start-up shareholdings and control rights among entrepreneurs and various classes of venture investors, and differences in pricing of CVC investments.

To preview our results, we find that CVC investments in start-ups are more likely to occur when their operations are complementary to those of CVC parents than when the start-ups are potential competitors to CVC parents. The entrepreneur/founder(s) are likely to be wary of CVC investments where the CVC parent is a potential competitor of the start-up firm, given that even

[2] For example, TVC general partners are primarily compensated through 'carried interest' which is typically 20 to 30% of the profits realized by the VC fund. In contrast, CVC managers seldom receive similar compensation because corporations are typically reluctant to make large payments to their venture managers that can substantially exceed those paid to other employees of the parent corporation.

[3] Venture Capitalists that we spoke to said they often have to grapple with these issues when deciding to involve a strategic investor.

modest investments in start-up firms can lead to substantial shareholdings and control rights for the investors.[4] Second, after controlling for the size of venture investment by CVCs and their share ownership, we find that CVC board representation as a fraction of total board seats is significantly higher when the CVC parent has a complementary relationship with the start-up. A complementary strategic investor has strong financial as well as strategic incentives to provide favorable support to the start-up since the investor is not only concerned about the start-up's valuation, but is also concerned about the operational impact of start-up on the CVC parent's earnings. A higher board representation for complementary strategic investors results from CVCs offering a valuable advisory role to the venture and is likely to encourage the CVCs to provide greater support and effort. Higher board representation is also likely to reflect the greater bargaining power a complementary strategic investor wields during venture investment negotiations with the start-up.

Third, insider board representation as a fraction of board size is significantly higher when the CVC parent is a potential competitor of the start-up firm. Since syndication among VCs is quite common in the venture capital industry, insiders may fear formation of a controlling block

[4] Competitive CVC investments are an important distinction. The incentives created by competitive CVC investments are fundamentally different from those of complementary CVC investments. Anecdotal evidence suggests that established corporations often make investments in emerging technologies that may pose a threat to their own. Oftentimes, such technologies are unsuccessful; however, corporations have indirectly realized strategic benefits by hedging risk of future competition. *For example, consider the experience of Massachusetts-based semiconductor manufacturer Analog Devices. This company ran a corporate venture program in 1979 through 1985 that seemed disastrous by any financial standard: only one of its thirteen portfolio companies went public, and it did so after so many financing rounds that Analog's stake proved modest. The corporation wrote off more than half the amount it originally invested. But looking more deeply into Analog's situation, we see that this program was successful. The company specialized in developing silicon based, or CMOS, semiconductors, which dominated the industry at the time. During the early 1980s, some players in the industry searched for alternative technologies – such as Gallium Arsenide (GaAs) and bipolar semiconductors – to go head-to-head with CMOS technology. Through its corporate program, Analog Devices invested in these competing technologies. Over time, these technological threats proved far less formidable than initially believed. Accordingly, the valuations assigned to CMOS-based manufacturers spiked: Analog's value, for example, increased sevenfold during these years. For Analog, the failure of the competing firms in its portfolio was good news indeed. In a sense, Analog had purchased an insurance policy. The policy did not pay out any monetary benefits – but that's because nothing bad happened!* (Emphasis Source: 'The Money of Invention: How Venture Capital Creates New Wealth' pp 153-154, Paul Gompers and Josh Lerner, 2001, HBS Press)

of shareholders or directors dominated by a potentially unfriendly CVC parent. Other VCs may align with the CVC parent if they have other ongoing business relationships with the CVC or its parent such as joint participation in other VC syndicates, or expect to realize other future benefits from the CVC parent. Thus, insiders appear to retain more power and influence when CVCs are viewed as likely competitors with conflicted interests.

Fourth, we examine the importance of the identity of lead VCs and assess whether there is a difference in the allocation of control rights between TVCs and CVCs. Usually, the lead VC originates the deal and is among the first venture investors in the start-up firm. When VCs invest in start-ups at their earliest stages of development, it is relatively easier for strategic investors to influence the start-ups' development in a direction more to their own liking. The founder/entrepreneur(s) may be wary of strategic investors in the earliest stages of the start-up's lifecycle and especially reluctant to allocate board seats, and thus control rights to them. Consistent with this argument, we find that even after controlling for CVC shareholdings, CVCs are much less likely to be lead venture investors, and when they are lead investors, CVCs receive board seats in less than 70% of VC syndicates. By way of contrast, lead TVC investors almost always receive board seats. Overall, this evidence indicates that strategic motivations of venture investors influence whether or not they are included in VC syndicates and that their board representation is strongly related to the nature of their strategic relationships (complementary or competing) with the start-ups.

Finally, we look at the valuations offered by strategic VC investors when buying start-up shares. Existing empirical evidence suggests that because strategic investors are keen to partner with start-ups, the start-ups are able to extract higher valuations from them relative to TVCs (Gompers and Lerner, 2000). When we separate complementary CVC investors from those having competing strategic objectives, we find that start-ups are able to extract higher valuations when CVC parents are potential competitors. This is consistent with standard bargaining theory which

predicts insiders can extract higher valuations when they know that the CVC parent is a potential competitor that wants access to the start-up's technologies or information on the start-up's future development.

In our sample, nearly 40% of investing corporations are potential competitors, which is both surprising and interesting. This naturally begs the question why do start-ups decide to involve strategic investors who are potential competitors. Several justifications are plausible. First, start-ups are not only resource constrained, but they face stiff competition in the race to obtain a first mover advantage by being first to introduce their products and services to the market. Thus, timely access to funding can often be critical to a start-up's fortunes. Second, start-ups are often plagued by severe information asymmetry problems because little public information about these firms exists. Equity investment in these start-ups by reputable corporations helps to overcome the twin problems of inadequate funding and certification. As observed, start-ups are able to extract higher valuations from potentially competing investors and secondly, start-ups backed by established corporations are likely to receive greater interest from both public and private investors because of the certification provided by the equity investments of established corporations. Our analysis also reveals that after deciding to add potential competitors to the VC syndicate, start-ups appear to take purposeful steps to mitigate the potential risk of unwanted interference by these competing strategic investors, by restricting them to lower share ownership and board power when the CVC funding is negotiated.

The empirical analysis is based on a sample of 307 investments made by US-based corporations in 187 companies that went public during the sample period 1996 to 2001. The initial sample is collected from SDC's VentureXpert database. The product market relationships – complementary or competing - between the CVCs and the start-ups are coded based on contents of the CorpTech directory. The directory classifies companies into categories based on industry

and product markets and its classification is much finer and more detailed than the more conventional SIC classification.[5] We also collect detailed information on the percentage shareholdings in start-ups held by CVCs, TVCs, CEO, founders, company executives, board members and other outside investors from IPO prospectuses.[6] Other VC-specific data obtained from the VentureXpert database includes: age of the VC firms, number of companies each VC firm has taken public annually and the capital under management at each VC firm. In addition, we collected the total investment in the start-up made by each CVC, as well as the sum total of all VC firm investments in the start-up from the VentureXpert database. To address concerns about potential endogeneity, we also employ a system of simultaneous equations in our analyses; our results remain robust regardless of the estimation methods used.

This study is related to several streams of research. It offers new insights into financial contracting in the private equity market by empirically investigating some of the features of financial contracts between entrepreneurs, corporate venture investors and traditional venture investors. In a detailed analysis, Kaplan and Stromberg (2003) analyze the allocation of cash flow rights, board rights, voting rights, liquidation rights, and other control rights among the VCs and entrepreneurs and then relate these rights to existing financial contracting theories.[7] Their analysis appears to be limited to traditional VC investors and implicitly views VCs as one class of investors so that the differences in VC objectives are obscured. We introduce VC heterogeneity by analyzing the strategic objectives of CVCs and examine how these strategic motives affect the allocation of voting and board rights in start-ups.

[5] CorpTech directory has emerged as the largest directory of US-based high-technology firms with almost 100,000 entries. Lerner (2001) and Santhanakrishnan (2004) also use the CorpTech directory in their analysis to classify the relatedness of two corporations.

[6] Other outside investors include consulting firms, pension funds, investment management firms, proprietorships, trusts and retirement funds.

[7] Other studies that discuss mechanisms to solve potential agency problems between investors and entrepreneurs, particularly in the context of venture capital financing include Admati and Pfleiderer (1994), Lerner (1995), Hellmann (1998) and Kaplan and Stromberg (2001, 2004). The contractual and monitoring-based approaches for overcoming agency problems facilitate financing of early-stage ventures whose assets are largely intangible and knowledge based.

This study furthers our understanding of strategic investing and adds to the literature on corporate venture capital.[8] Previous research suggests that the presence of a strong strategic focus is critical to the success of corporate venture funds (Gompers and Lerner, 2000). Our focus is however not on performance implications of strategic objectives but rather on allocations of shareholdings and control rights to assess whether they reflect and minimize the potential conflicts of interest spawned by the involvement of strategic investors. In related studies, Anton and Yao (1994, 1995), Anand and Galetovic (2000), and Gans and Stern (2000) analyze contracting between entrepreneurs and well established corporations in the presence of weak intellectual property rights where expropriation of start-ups' intellectual property by these other corporations is possible. We extend this line of research to examine potential expropriation through corporate control of another firm. In this setting, potential expropriation of the start-ups is likely to be a function of the nature of product market relationship between the CVC parent corporations and the start-ups.

We also offer new insights into the interaction between financial decisions and product market relationships.[9] We empirically examine the effect of product market relationships on the sources of financing and the types of financial contracts that result from complementary versus competitive products. Finally, this study adds to the literature on strategic alliances and joint ventures through its examination of alternate strategic relationships between start-ups and corporations since corporations making an equity investment in start-ups also frequently create strategic alliances or joint ventures with these same start-ups (Allen and Phillips, 2000).

The remainder of the paper is organized as follows. Section II discusses the impact of corporate venturing on entrepreneurial ventures and develops testable hypotheses. Section III

[8] We briefly discuss the literature on corporate venture capital in the next section. For the evidence on positive influence of venture capitalists on their portfolio companies, see Barry et. al (1990), Brav and Gompers (1997), Gompers and Lerner (2001), Hellmann and Puri (2000, 2002), Hochberg (2002), Lerner (1994, 1995), Lindsey (2004) and Megginson and Weiss (1991).

[9] See Brander and Lewis (1986), Chevalier (1995) and Maksimovic and Titman (1991)

discusses the data collection methodology and describes the sample. Empirical results follow in Section IV. Robustness checks are presented in Section V. Finally, Section VI summarizes.

II. Hypothesis Development

Gompers and Lerner (2000) document the differences between corporate and traditional venture investments and analyze their success measured by the likelihood of exit through initial public offerings or mergers at valuations twice the value at the last round of financing. They report a higher likelihood of successful exit when CVC investments are strategic rather than financially driven. More recently, Nahata (2005) documents the outcomes of strategic investments by CVCs and finds a high frequency of both very profitable and very unprofitable outcomes. Strategically motivated CVC investments result in more frequent IPOs and write-offs, relative to financially motivated CVC investments. Santhanakrishnan (2004) studies the strategic mechanisms through which CVCs influence the likelihood of successful exits. He finds that product market support by CVC parents is the primary mechanism, through which CVCs help complementary start-ups attain successful exits. He also documents that CVC parents are more likely to provide product market support when start-ups are strategic complements. Maula and Murray (2000) examine VC-backed IPOs belonging to the telecommunications and internet sectors during the 1998-1999 period. They document that CVC-backed IPOs have higher market valuations than their TVC-backed counterparts. Overall, the evidence suggests that CVCs add value to the start-ups, particularly when their investments are strategic in nature.

Participation of a strategic investor in a start-up can however impose costs as well. When strategically motivated CVCs invest in a start-up, their interests are likely to be in conflict with those of the entrepreneurs and TVC investors. The conflict with the entrepreneur/founder is likely to be strategic in nature since the CVC parent has one eye on its own development, so she may want to influence the start-up's development in a direction supportive of her own (long-term)

strategic objectives. Furthermore, CVC's conflict with the TVC may also be rooted in the potentially adverse financial impact on TVC investment, and may stem in part from disagreement over the optimal exit strategy; for example, CVCs may oppose financially attractive acquisition bids by competitors of the CVC parent. Alternately, CVC's toe-hold in the start-up is likely to provide her parent favorable negotiating power in discussions to acquire the start-up in the future. Furthermore, the CVC's toe-hold may diminish the start-up's value to other prospective buyers, because of the equity investment and potential strategic relationships between the start-up and CVC parent. In addition, there may be a CVC-TVC conflict over the start-up's optimal development strategy. For example, a CVC may oppose profitable start-up investment in areas that directly compete with her parent.

Hellmann (2002) argues that CVCs have better incentives to provide support to start-ups whose operations are complementary to those of the CVC parents and are consistent with their strategic goals. Complementarity is defined as a start-up having a positive strategic impact on a CVC parent's asset value. On the other hand, if the start-up is a potential competitor (the start-up's operations have a negative strategic impact on CVC parent's asset value), the likelihood of strategic conflicts between the start-up and the CVC parent increases. Competing CVC parents may be particularly interested in obtaining equity stakes in start-ups to have access to potentially successful technologies or to get a window into the start-ups' future development. Thus, competing investments are more likely to suffer from moral hazard problems. To mitigate such conflicts of interest, the start-ups are more likely to select CVCs bringing complementary strategic relationships to the table. We thus have the following prediction:

H_1: *Strategic investments by CVCs are more likely to occur in start-ups, whose operations are complementary to those of CVC's parent corporation.*

Since moral hazard problems are likely to be more pronounced when CVC parents are potential competitors, the entrepreneurs and other private equity investors are likely to cede competing CVCs fewer control rights, relative to when CVCs make complementary strategic investments.[10] To the extent shareholdings go hand in hand with voting rights (participating preferred stock is a characteristic feature of venture investments), a start-up's equity ownership structure is also likely to reflect this moral hazard concern. Furthermore, allocating higher board power and share ownership in start-ups to complementary CVC parents also provides them incentives to support new ventures since they are concerned about the impact of start-up operations on their own earnings. For example, Intel invests largely in new ventures and technologies that are based on Intel's microprocessors and systems. Thus, if successful these venture investments should increase demand for Intel's own products. Finally, a larger CVC shareholding also internalizes the benefits the start-up can expect to realize from a complementary strategic relationship with the CVC. The following hypothesis captures the above discussion:

H_2: *Complementary strategic CVC investments are accompanied by higher CVC shareholdings and board representation in start-ups. Competing strategic CVC investments (CVC parents are potential competitors of start-ups) are accompanied by relatively lower CVC shareholdings and board representation.*

As discussed earlier, the entrepreneur/founder(s) are likely to be particularly cautious of strategic investments by competing CVC parents. Their wariness in accepting competing CVC investments may be augmented by the fear of formation of a controlling VC block where a competing CVC parent is an influential syndicate member. This is plausible since syndication among VCs is quite common in the venture capital industry, and other VCs may align with the

[10] A typical example from the business press which highlights the CVC moral hazard problem faced by start-up firms is: "CCBN.com, Inc., the global leader in internet-based investor communications, today charged that Thomson Corporation and its Thomson Financial Inc. subsidiary breached its fiduciary duty by using confidential information from CCBN board meetings to compete against the firm." Thomson Financial Inc. was the largest investor in CCBN at the time. Business Wire, Inc., July 30, 2002.

CVC parent if the VCs have other ongoing relationships with the CVCs in other start-ups or expect to realize other future benefits from the CVC parent such as access to deal flow.[11] To mitigate the adverse impact of a VC coalition influenced by a potentially competing CVC parent, we expect to find relatively higher board control by company insiders/entrepreneurs in these circumstances. The following hypothesis summarizes the above discussion:

H_3: For a given level of shareholdings, insiders are willing to accept lower board representation when complementary strategic CVC investors are involved, whereas they require higher board representation in the presence of competing strategic CVC investors.

The board seats allocation to the *lead* VC investors is also likely to reflect their strategic behavior. Given the incentives of strategic investors and the potential conflicts they entail, the entrepreneur / founder(s) are likely to be even more concerned when allocating board seats to strategically motivated CVCs who are *lead* venture investors. When lead VCs invest, the start-ups are in their earliest stages of development and the strategic investors may find it easier to influence the start-ups' development to their own liking. The potential for opportunistic behavior by both complementary and competing CVC parents is high because the CVC - start-up relations in the earliest stages of the start-ups' lifecycle are predominantly built on technology collaborations and licensing, which are easier to expropriate.[12,13]

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[11] For example, "Venture capital trio forms a telecom 'coalition' with IBM": Venture capital firms Mayfield, 3i and Worldview Technology Partners are cozying up to IBM. Not because they want Big Blue's money. They aren't even lobbying IBM to purchase their startups. In general, IBM will get a window into complementary service-related telecom startups using Linux and funded by the well-heeled VC firms. IBM gets a chance to influence startups early on to develop IBM-friendly applications. Mayfield, 3i and Worldview get a better relationship with IBM and a look at its technology road map. (Source: Silicon Valley/San Jose Business Journal, February 14, 2003; http://www.bizjournals .com/sanjose/stories/2003/ 02/17/smallb3.html)

[12] Other relationships such as customer-supplier, marketing and advertising support or joint ventures are more likely at a relatively later stage of the start-up's lifecycle.

[13] According to Mark Heesen, president of the National Venture Capital Association (NVCA), companies that are "very early stage and cutting-edge" could be seriously hurt by people who use disclosed information to copy or otherwise appropriate the companies' intellectual property. He also notes that the information could compromise negotiations between the start-up companies and their suppliers, landlords, or banks. "Other investors," he said, "do not want to be in companies whose returns can be jeopardized by excessive disclosure."(http://www.legalaffairs.org/issues/May-June-2005/argument_bayon_mayjun05.msp)

Furthermore, since start-ups and their entrepreneurs are capital constrained, strategic investors can indulge in rent seeking behavior in return for the capital they provide. Moreover, the strategic CVCs may also delay or thwart the development of the start-up by not involving reputable traditional VCs over the following financing rounds, should they want to retain control in order to influence the start-ups' development and strategic direction. Consequently, the start-up managers and particularly, the founders are likely to be wary of potential interference by strategic investors, particularly at the earliest stages of the start-ups' lifecycle. Therefore, for the same level of investment / shareholdings, insiders are less likely to award lead CVCs board representation relative to lead TVCs. The following hypothesis captures this intuition:

H_4: Lead CVCs are likely to have lower board representation relative to lead TVC investors for the same level of investment / shareholdings.

The discussion so far has focused on the circumstances under which the start-ups are willing to accept funding from strategic CVC investors and the allocation of control rights among the VC syndicate members and start-up insiders to mitigate the unwanted interference of potentially competing CVC investors. We now turn our analysis to the valuations offered by strategic investors when buying start-up shares. Because the strategic investors are keen to influence the start-ups, the start-ups can extract higher valuations. The start-up can extract even higher valuations when a CVC parent is a potential competitor, who desires access to sensitive intellectual property or to influence the direction of a startup's technological and product development.[14] Standard bargaining models also predict that in the case of competing strategic investments, CVC parents are likely to share a higher fraction of the value created by their investments with the start-up firm owners, relative to complementary or financially-motivated CVC investments. The following hypothesis captures this idea:

[14] Proposition 3 in Hellmann (2002) has a similar prediction.

H_5: *For the same level of shareholdings, the competing strategic CVC investors are likely to pay higher prices when funding the start-ups.*

For the purpose of testing these predictions, we exclude parent corporation spin-offs or internally generated start-ups because CVC parents have much greater influence over such start-ups and these transactions involve very different incentives and raise a very different set of issues. However, our analysis does include CVC led venture capital syndicates in the case of start-ups unaffiliated with CVC parents.

III. Data and Sample Characteristics

The sample comprises venture investments by corporations in US-based portfolio companies that went public between 1996 and 2001. The data is taken from the SDC VentureXpert database, which identifies venture investments made by corporate divisions, subsidiaries and venture capital funds directly affiliated with corporations. The nationality of CVCs is also restricted to U.S. companies, since the CVC parent's classification as a complementary or competitive firm is based on the CorpTech directory which covers only the US-based corporations. The sample is limited to 187 start-ups receiving CVC investments. Some start-ups receive financing from more than one CVC, resulting in 307 unique CVC - start-up pairs. In the analyses, a unique CVC – start-up pair is included only once in the sample, even though the CVC may have participated in multiple rounds of financing.

The VentureXpert database is also used to obtain for each VC firm in the syndicate, the age, the number of companies each VC firm has taken public annually and the capital under management at each VC firm. In addition, we collect the total investment made by each CVC in the start-up as well as the sum total of all VC firm investments in each start-up. Start-up specific information is largely hand-collected from IPO prospectuses and includes founder(s)

shareholdings, whether the CEO is a founder, CEO shareholdings, management shareholdings, TVC shareholdings, CVC shareholdings, aggregate outsider shareholdings and number of board seats allocated to company insiders, TVCs, CVCs and other outside investors.[15] Dates of initial rounds of venture investments by each TVC and CVC are also extracted to determine the lead member of each VC syndicate and whether the syndicate lead is a TVC or a CVC. If two or more VCs initiate the funding at the same time, the lead VC is considered the one with the higher shareholdings.[16]

Measure of Complementarity

The literature on strategic alliances, joint ventures and knowledge transfers between companies uses proxies for complementarity based on SIC codes. Specifically, two companies are defined as substitutes if they are in the same 4-digit code. In contrast, two companies are defined as complements, if they are in the same 2-digit or 3-digit SIC code, but not in the same 4-digit SIC code. The SIC-based measure of relatedness has several limitations with the most important being it does not provide detailed description of the two companies' relatedness.[17] Furthermore, VC-backed start-ups are often concentrated in a few SIC codes making it prudent to use a finer industry or product classification than a 4 digit SIC code.

[15] Start-up insiders include the CEO, founders and other management whose shareholdings are available. Aggregate outsider shareholdings include share ownership held by TVCs, CVCs and other investors. Examples of other outside investors include consulting firms, pension funds, investment management firms, proprietorships, trusts and retirement funds.

[16] Other studies have looked at a variety of lead-VC classifications, based on the aggregate VC shareholdings, aggregate VC investment and the time of initiation of VC funding. Usually, the lead venture capitalist originates the deal and would be among the first venture investors in the start-up firm. Since we have detailed information about the identity of the VC initiating the investment and her aggregate shareholdings, the time-based classification of the lead-VC is the most appropriate. Moreover, the entrepreneur/founder(s) reservations about CVC investment are likely to be the most stark when CVCs are to be involved at the earliest stages of start-ups' development, particularly when CVCs are to be allocated board seats as well in return for their investment.

[17] See Fan and Lang (2000) for the detailed arguments and application of an alternative methodology to the phenomenon of corporate diversification.

The CorpTech directory is used to classify the relatedness of a start-up and a CVC parent. CorpTech directory has emerged as the largest directory of high-technology firms, with almost 100,000 entries. The directory classifies companies into broad categories such as telecommunications & internet, software, hardware, biotechnology, pharmaceuticals etc. These broad industries are classified further into sub-categories such as internet search services, internet multimedia services, internet data aggregation services etc. providing a second level of characterization of companies. The third level denotes the specific niche in which the firm operates and gives product level characterizations.[18] Multiple industry and product codes may be assigned to the same company.

We hand collect from the CorpTech directory the industry and product codes for all the start-ups and their corporate investors. These industry and product codes are used to measure the degree of complementarity between the start-up and the CVC investor. A start-up and the CVC parent are defined as potential competitors if any of the start-up and CVC parent product codes match at all three levels of the industry code. A start-up and a CVC parent are defined to be strong complements if their product codes match only at the first two levels. If the companies' product codes match only at the first level, they are defined to be weak complements. If the product codes do not match at any of the levels, we impose a second check based on SIC codes. We classify relationships as weakly complementary, complementary and competing based on matches at 2-digit, 3-digit and 4-digit levels respectively. We are able to classify their strategic relationships for 6 such CVC – Start-up pairs. Finally, if CVC - Start-up relationships remain yet unclassified, we read the IPO prospectuses for each of the start-ups and determine the operating relationship between the two parties. For instance, if the CVC parent is a customer of, a supplier to or a technology licensor to the start-up, we classify such relationships as weakly complementary in

[18] Lerner (2001) gives a detailed overview of the information and classification contained in the CorpTech directory and Santhanakrishnan (2004) uses the product level characterizations to classify the relatedness of the start-up and the CVC parent.

nature. We are thus able to classify the nature of their strategic relationship for another 6 CVC - Start-up pairs. In addition, if the IPO prospectuses explicitly mention a CVC parent as a potential competitor, we code the relationship between the start-up and the CVC parent as such, overriding our earlier classifications based on the CorpTech directory, SIC codes and IPO prospectuses.[19]

Sample selection issues

CVC-backed start-ups that have IPOs are not a random sample since the start-ups that go public are the most successful of all VC-backed firms and the most infrequent as well.[20] However, any selection bias that is induced as a result of analyzing such start-ups that go public is less of a concern since performance or exit outcomes are not the focus of this study. Instead, we examine the allocation of shareholdings and control rights to assess whether they reflect and minimize the potential conflicts of interest with start-up insiders and traditional VCs, when investments are syndicated with strategic CVCs. Second, the allocation of shareholdings and control rights would remain unaltered whether or not these start-ups eventually go public. Finally, the study is more likely to identify those syndicate structures that result in successful start-ups and this may serve to further our understanding of factors influencing the success of start-ups.

Sample Description

Table 1, Panel A provides information on CVC-backed start-ups that went public between 1996 and 2001. Over this six year period, the average number of CVCs investing in one of our start-ups is 1.64. The average number of CVCs per start-up shows an upward trend through the

[19] In our analyses, we also include indicator variables denoting whether the CVC parent is a customer of, a supplier of or a technology licensor to the start-up. None of these indicator variables are statistically significant and all other results remain qualitatively similar.

[20] Gompers and Lerner (2001) report that the most profitable exit for a VC firm is the IPO; Cochrane (2005) and Peng (2004) extract data on VC-backed firms from VentureOne database and report that roughly 20% of the VC-backed firms result in IPOs.

year 2000, which is consistent with other studies that show rising CVC investments over the 1996-2000 period. The number of CVC-backed IPOs peaks in 1999-2000 and is markedly higher than other sample years. Equally notable is their drop in the year 2001, when only 3 CVC-backed IPOs are completed.[21] Panel B of Table 1 shows that the average number of CVC investments per start-up peaked in the 1999-2000 period, when 124 corporate investors invested in 85 start-ups.

Note that although 74% of all CVC-backed firms went public in the years 1999 and 2000, only about 40% of all CVC investments occurred in those years (Panel B). The empirical results are therefore not an artifact of the 1999-2000 period. Furthermore, the focus is on the CVC investment dates in start-ups, rather than their exit dates, which are more likely to be affected by the late 1990's boom. However, if the increased CVC investments in 1999 is a response to the boom, there is no ex ante reason to expect that incentives of various private equity investors or the potential conflicts of interest induced by CVC participation are likely to be fundamentally different in this period.

Table 2 Panel A reports descriptive statistics on the percentages of shareholdings in CVC-backed companies by major private equity investor categories. On average, the CVC shareholding is 9.89%. This is lower than TVC shareholdings of 12.39% when the TVC has a board seat, but higher than TVC shareholdings of 8.34% when TVC doesn't have a board position. Since there are 307 CVCs investing in 187 companies, the top row in each of the panels of Table 2 refers to CVC investments in IPOs, while the other rows refer to the number of IPOs. Total outsider shareholdings average 57.83%, while insider shareholdings average 19.68%.[22]

Total reported shareholdings doesn't add up to 100% for a majority of the observations, because prospectuses only report shareholdings levels of 5% or more as well as shares owned by

[21] The year 2001 accounted for 4.20% of all VC-backed IPOs that occurred between 1996 and 2001 (Source: Thomson Financial Venture Economics).

[22] In more than 95% of the cases, there is hardly any non-VC private equity investment. Therefore, we do not report it separately. If any, it is reflected in the 'total outsiders shareholdings' variable.

officers on the board. Among insiders, the entrepreneur/founder(s) hold the largest stake. Founder shareholdings average 15.87%. In 41% of the start-ups, founders are no longer CEO, although they continue to occupy board seats in a majority of companies. This is consistent with earlier evidence that VCs exert considerable board control and frequently exercise their power to replace founders with professional CEOs in order to professionalize the firms and bring in more experienced managers prior to the IPO. Of course, floundering start-ups frequently experience CEO turnover as well. As expected, non-founder CEO shareholdings are considerably lower, averaging only 5.54%.

Table 2, Panel B reports board allocations in CVC-backed companies. For the median firm, no board seats are allocated to CVCs. At the same time, TVCs hold two seats. Of the 7 board seats in the median firm, a majority of 5 seats are held by outsiders, who include venture capitalists. This is also consistent with existing empirical evidence that the proportion of outsiders on board of VC-backed firms is significantly higher than that for non-VC-backed firms. Prior research shows that this has important implications for corporate governance practices in these firms (Baker and Gompers (2003), Hochberg (2005)). We discuss empirical results pertaining to each of our hypotheses in the next section.

IV. Empirical Results

4.1 Allocation of Board Seats to Strategic Investors

Table 3 reports the distribution of shareholdings and board seats across strategic categories of CVC investments. In 40% of all CVC investments, the strategic relationship between CVCs and start-ups is potentially competing. About 56% of corporate venture investors are in complementary relationships with start-ups. This evidence is consistent with Hypothesis 1 which states that strategic investments are more likely to occur in start-ups that share complementarities with the investing corporations. However, a large number of strategic investors

are potential competitors, which is interesting. An overwhelming 96% of CVC investments are strategic, which mirrors the evidence reported by Yost and Devlin (1993).

Comparing median shareholdings across investor groups, we see that complementary investors have the highest shareholdings, followed by weakly complementary investors, while potential competitors have the fewest shares. This evidence is consistent with Hypothesis 2, which predicts that shareholdings of complementary CVC investors should exceed those of competing CVC investors, though the difference in shareholdings is not statistically significant. In contrast, board seats held by CVCs do show significant variation across types of investments. Complementary CVC investors receive the most board seats, followed by weakly complementary CVCs, and then competing CVCs in that order. A similar monotonic pattern is observed for the ratio of CVC board seats to total board seats. The difference in CVC board seats and CVC board representation (ratio of CVC board seats to total board seats) across complementary and competing CVC investments is statistically significant at conventional levels. This evidence is consistent with Hypothesis 2, which predicts that the extent of board representation should depend on the type of strategic investment involved.

To test Hypothesis 2 in a multivariate framework, the number of board seats occupied by the CVC Directors is regressed on a set of explanatory variables including a 'Strategic Competitor' indicator variable which takes a value of one if the CVC's strategic relationship is classified as competing and is zero otherwise (for complementary, weakly complementary and financial relationships). Since a startup can have several CVC investors, it can be represented multiple times in the estimation framework, reflecting each unique CVC-startup pair. The other control variables include CVC shareholdings, lead VC reputation, size of the TVC syndicate defined as number of TVCs that have invested in the start-up, an indicator variable denoting that the CVC is a lead investor in the VC syndicate, an indicator denoting that the CEO is also a founder and the start-up's age. VC reputation is proxied by the number of start-up companies a

VC has brought public in the year prior to the IPO, which tends to give greater weight to older VCs.

In the TOBIT regression reported in Table 4, the coefficient on the 'Strategic Competitor' indicator is negative and significant, which is consistent with a startup offering a lower number of board seats to a potentially competitive investor. The coefficient on the CVC shareholdings variable is positive and significant. It is noteworthy, but not surprising, that after controlling for shareholdings and the type of strategic investment, board seats allocated to a CVC is affected by whether or not it is a lead investor in the VC syndicate. We find that when CVCs act as syndicate lead investors, they are allocated more seats on the board relative to non-lead CVCs. In two of the three models, the coefficient on lead VC reputation is significantly positive, which indicates that in companies led by more reputable VCs, the CVCs retain a greater board power. The negative coefficient on the variable denoting TVC syndicate size suggests that the larger the TVC syndicate, the lower is CVC board representation. However, this variable is not statistically significant at conventional levels of significance. Finally, the negative coefficient on start-up's age suggests that insiders in relatively well established start-ups may have greater leverage in their negotiations with CVCs about the allocation of board seats.

Since the dependent variable, CVC Directors takes only discrete non-negative values and is likely to exhibit concentration at zero, we re-estimate the equation using a Poisson Count model that assumes the data follows a Poisson distribution, a distribution frequently encountered when counting numbers of events. The Poisson regression implicitly uses a log transformation that adjusts for skewness and prevents the model from producing negative predicted values. The qualitative results are robust to this estimation method as seen in the second column of Table 4.

Although the model's explanatory power is reduced, the coefficient on 'Strategic Competitor' continues to be negative and significant.[23]

A further concern with prior results may be the potential endogeneity between CVC shareholdings and CVC board seats. In order to suitably address this issue, a simultaneous two equation system is specified and estimated:

CVC Directors = $c_0 + c_1$CVC Shares + c_2Strategic Competitor + c_3Strategic Investor Indicator + c_4VC Reputation + c_5TVC Syndicate Size + c_6Lead CVC + c_7Founder CEO + c_8Startup Age + ϵ

CVC Shares = $d_0 + d_1$CVC Directors + d_2Strategic Competitor + d_3Aggr. VC Investment + d_4TVC Syndicate Size + d_5Lead CVC + d_6CVC Investment + d_7Startup Age + d_8(Strategic Competitor * Aggr. VC Investment) + η

The variables in the first equation were previously defined. The second equation contains several additional explanatory variables. We include monthly aggregate VC investment activity in the industry ('Hotness' of VC industry) at the time a CVC makes its first investment in the start-up, denoted as Aggr. VC Investment, to reflect market conditions in the VC industry. CVC investment levels can be affected by market conditions since CVCs can have better access to capital in cold VC markets than TVCs by virtue of their affiliations to corporate parents, who can have large liquid asset holdings and access to the public security markets. As a consequence, we expect CVC shareholding to be higher in 'cold' markets than 'hot' markets. Furthermore, strategic competitive investments are likely to be relatively more active in cold market conditions, but in hot VC market conditions when TVC investors and complementary CVC investors are willing to invest, strategic competitors are likely to be relatively less attractive to startups. To capture this latter effect, we interact the Strategic Competitor indicator with the monthly aggregate VC investments.

[23] Estimation of the regression equation in a OLS framework yields similar qualitative results.

CVC Investment denotes total investment made by a CVC across all financing rounds divided by total VC investment in the start-up. This variable is expected to have a positive coefficient indicating that higher investment levels lead to higher shareholdings. Startup age is defined as the log of the startup's age. CVC shareholdings may be higher in older start-ups since we expect CVCs to invest in older, more established firms.

Turning to the results on the right hand side of Table 4, we find that estimation of the CVC board seats equation yields a significantly negative coefficient on the Strategic Competitor indicator, even after controlling for potential endogeneity. As expected, CVC shareholdings remain a significant determinant of CVC board representation. Also, lead CVCs attain higher board representation in start-ups relative to non-lead CVCs. Overall the results are qualitatively similar to those estimated earlier using the TOBIT and Poisson frameworks and support the predictions of Hypothesis 2 concerning the relationship between CVC board representation and its type of strategic investment.

Estimates of the CVC shareholding equation in column 4 of Table 4 shows that CVC board seats have an insignificant coefficient, which suggests that board representation is not a significant determinant of CVC shareholdings. However, the coefficient on Strategic Competitor indicator is positive and significant. Taken together, the estimates from the two equations suggest that competing strategic investors receive less board representation, even though they have higher shareholdings relative to complementary strategic investors. The coefficient on aggregate monthly VC investment in the industry (Aggregate VC Industry Investment) is negative, though insignificant. This is consistent with our conjecture regarding a higher CVC shareholding percentage in cold VC market conditions. Interestingly, the significantly negative coefficient on the interaction of the Strategic Competitor indicator and aggregate VC investment variables suggests that CVC shareholdings are relatively larger when the VC industry is 'cold' and when CVCs make complementary investments. Put another way, competing strategic investors are not

favored when VC industry conditions are 'hot' and several other venture investors are willing to fund the startup. These conditions result in lower shareholdings for CVCs, who are competitive strategic investors. The coefficient on the lead CVC indicator is positive and significant, supporting the prediction that CVC shareholdings rise when it is a lead investor in the VC syndicate. It is also interesting to observe that larger TVC syndicates are associated with higher CVC shareholdings. If TVC syndicates operate as coalitions and have relatively greater control over start-ups, then TVCs may be less concerned about selling larger equity stake to CVCs. On the other hand, if entrepreneurs are averse to relinquishing their equity stakes to outside investors, then this could result in smaller TVC syndicates and lower CVC shareholdings. The coefficient on CVC investment relative to total VC investment is positive and significant as expected. Finally, startup's age seems to have no bearing on CVC shareholdings in start-up companies.

Analysis of a CVC's Proportional Board Representation

In Table 5, we re-estimate the prior models after normalizing a CVC's board seats by the board size. In the earlier analysis of CVC's board representation, the dependent variable is the number of board seats allotted to an individual corporate investor. However, there can be significant heterogeneity in board size across the start-ups, which can have important implications for the amount of board power that a CVC wields. Thus, the dependent variable is redefined to be the ratio of a CVC's board seats to total board seats, which we term CVC board power. The explanatory variables are identical to the ones used in Table 4. To further test Hypothesis 2, which predicts a relationship between CVC board power and type of CVC strategic investment, we use three alternate model specifications: OLS, a two boundary Tobit and a two equation simultaneous system. We estimate a two boundary Tobit model since the dependent variable is constrained to lie between 0 and 1. The results presented in Table 5 remain qualitatively similar

under all three alternative specifications.[24] A notable difference from the earlier results is that the coefficient on VC reputation becomes insignificant, suggesting it is not an important determinant of a CVC's proportional board representation.

Analysis of Total CVC Board Representation

In the earlier analysis presented in Tables 4 and 5, each observation is a unique CVC - start-up pair. As a result, multiple observations from the same start-up are used when more than one CVC is a venture investor, but these observations could exhibit some dependence. Such dependence would overstate the model estimate's degrees of freedom and downward bias the estimated standard errors. To address this concern, multiple CVC investors in a start-up are aggregated into a single observation. The dependent variable is the ratio of board seats held by all CVCs divided by board size. The explanatory variable of primary interest is defined as the 'Net Strategic Competitor'. This discrete variable is defined as the sum of the strategic relationships across all CVCs investing in the same start-up firm. For each CVC, its strategic relationship is given a value from one to minus one. A competitive strategic relationship is given a weight of one, a purely financial relationship has a weight of zero and a complementary or weakly complementary strategic relationship has a weight of minus one. For example, if two different CVCs invest in the same start-up and the strategic relationship with the first CVC is complementary, while the relationship with the second CVC is competitive, then the indicator variable 'Net Strategic Competitor' takes a value of zero.[25] The higher the value of 'Net Strategic

[24] In the analysis of CVC board seat allocation and board control allocation (Tables 4 and 5 respectively), we also include a variable that denotes the ratio of the time between when CVC first invested in the start-up and the IPO date relative to the time between when a TVC first invested in the start-up and the IPO date. This variable captures the length of association of CVCs with the start-up relative to TVCs' association with the start-up. The mean (median) length of time between initial CVC investment and IPO is 511 (353) days. In contrast, the mean (median) length of time between initial TVC investment and IPO is 1045 (947) days. However, this variable doesn't significantly affect the CVC board representation and the other results remain qualitatively similar.

[25] As a robustness check, we also weight multiple CVCs strategic relationship by their relative shareholdings in the start-up. The results remain qualitatively unaltered.

Competitor', the greater is the potential for competition between the start-up and its CVC syndicate.

The other explanatory variables are the aggregate shareholdings of all CVCs, the reputation of the lead VC, TVC syndicate size, an indicator variable denoting whether one of the CVCs is a lead manager in the VC syndicate, another indicator denoting whether the CEO is also a founder and the start-up's age. Three alternative model specifications are estimated: OLS, Tobit and a two equation simultaneous system, so as to assess the robustness of the results. The specification of the simultaneous equations system is formally presented below, where the variables are as defined earlier. We aggregate all corporate venture investments in the same start-up and normalize it by the startup's total VC investment and denote this variable as 'Aggr. CVC Investment'.

$$\text{CVC Board Power} = c_0 + c_1\text{CVC Shares} + c_2\text{Net Strategic Competitor} + c_3\text{VC Reputation} + c_4\text{TVC Syndicate Size} + c_5\text{Lead CVC} + c_6\text{Founder CEO} + c_7\text{Startup Age} + \varepsilon$$

$$\text{CVC Shares} = d_0 + d_1\text{CVC Board Power} + d_2\text{Net Strategic Competitor} + d_3\text{VC Reputation} + d_4\text{TVC Syndicate Size} + d_5\text{Lead CVC} + d_6\text{Aggr. CVC Investment} + d_7\text{Startup Age} + \eta$$

As observed in Table 6, the 'Net Strategic Competitor' coefficient is negative and significant across all three specifications. Higher competition between the start-up and its CVC syndicate is associated with a lower CVC board power. This is consistent with our earlier results in tables 4 and 5. The coefficient on total CVC shareholdings is significant across all the model specifications and as expected, higher CVC shareholdings is associated with higher CVC board power. The coefficient on the lead CVC indicator is significant in all three model specifications and its positive sign indicates that lead CVCs are rewarded with higher board representation compared to non lead CVCs. This also is in line with the earlier evidence. Overall, the results are robust to aggregating across the strategic relationships of multiple CVCs in the same startup.

4.2 Retention of Board Seats by Start-up Insiders

We turn next to Hypothesis 3 which relates insiders' board power to the type of strategic investments made by CVCs. Table 7 reports the distribution of insider shareholdings and board power based on the type of strategic relationship that exists between the start-up and its CVC syndicate as captured by the 'Net Strategic Competitor' variable. Recall that this discrete variable is defined as the sum of the strategic relationships across all CVCs investing in the same start-up firm. For strictly negative values of the variable, the CVC syndicate (in aggregate) is a potential competitor of the start-up, whereas if the variable has strictly positive values, then the CVC is a complementary player in the industry. We see that insider shareholdings and board power are significantly higher when CVC investors are viewed as potential competitors. Thus, insiders appear to retain more power and influence when CVCs are viewed as likely competitors with conflicted interests, which is consistent with the prediction of Hypothesis 3.

To test Hypothesis 3 in a multivariate framework, we use the same methodology as in the previous section. The dependent variable is the insider board control defined as the ratio of insiders' board seats divided by total board seats.[26] The explanatory variables are defined previously. In addition to the OLS and Tobit specifications, we also estimate a two-equation simultaneous system whose specification is as follows:

$$\text{Insider Control} = c_0 + c_1\text{Insider Shares} + c_2\text{Net Strategic Competitor} + c_3\text{VC Reputation} + c_4\text{VC Syndicate Size} + c_5\text{Lead CVC} + c_6\text{Founder CEO} + c_7\text{Startup Age} + \varepsilon$$

$$\text{Insider Shares} = d_0 + d_1\text{Insider Control} + d_2\text{Net Strategic Competitor} + d_3\text{VC Reputation} + d_4\text{VC Syndicate Size} + d_5\text{Lead CVC} + d_6\text{VC Investment} + d_7\text{Startup Age} + \eta$$

[26] Since the analysis of insiders' board representation closely resembles that of CVC board representation, we also evaluate the correlation between the CVC and insider variables. The correlation between CVC board representation and insider board representation is -0.18 whereas the correlation between CVC shareholdings and insider shareholdings is -0.22. The low correlations suggest that the results received from the estimation of CVC board representation do not automatically lead to inferences about insider board representation and that each analysis is non-trivial and independent of the other.

In the second equation of the simultaneous system, the variable 'VC Investment' denotes total VC investment by all the syndicate members across all rounds of financing. Three notable results can be gleaned from the estimates of the three models in Table 8. First, a significant intercept of 0.32 suggests that on average, 32% of the board is controlled by the insiders, without accounting for the effect of other explanatory variables. Second, the coefficient on the 'Net Strategic Competitor' is significantly positive, indicating that a higher degree of potential competition between the start-up and its CVC investors is associated with higher insider control of the board. This result is robust across all model specifications and supports Hypothesis 3 that ceteris paribus, insider representation on a start-up's board is relatively higher when a CVC parent is seen as a potential competitor. Finally, higher insider shareholdings lead to higher insider board control.

The second equation of the simultaneous system in Table 8 seeks to explain the determinants of insider shareholdings. The estimated coefficient on insider board control is positive and significant, suggesting that a higher degree of board control by the insiders leads to higher shareholdings. The coefficients on VC syndicate size and aggregate VC investment are both negative and significant. This is not surprising because higher VC investment should result in higher VC shareholdings if VC funding occurs primarily through equity purchases and as a result insider shareholdings should generally fall.

4.3 Lead Corporate VCs versus Lead Traditional VCs

So far, we have discussed the allocation of board seats to corporate investors and start-up insiders and related them to the type of strategic investment. In Table 9 we contrast the allocation of board seats and shareholdings between lead CVCs and lead TVCs. As discussed earlier, when lead VCs initially invest start-ups are often in their earliest stages of development and it can be relatively easy for strategic investors to influence the start-ups' development to their own liking. Therefore CVC moral hazard is likely to make the insiders more concerned about possible adverse

behavior by CVCs when their venture investments occur in the earlier stages of a firm's lifecycle and CVCs are lead investors. As such, the board representation by lead CVCs is likely to reflect such concerns.

Panel A in Table 9 presents summary statistics on shareholdings and board representation of CVCs in solo lead investment positions and contrasts them with shareholdings and board representation of lead TVCs. The earliest developmental stages in a start-up's lifecycle are the riskiest and most time consuming stages for venture investments and these investors should be rewarded with substantially more shares and control rights. About 10% of start-ups have CVCs as the only lead VC. Investments in the other 90% of start-ups are led by TVCs. The average shareholding of a lead TVC is close to 17.50% whereas the average shareholding of a CVC in solo lead role is about 15.50%. It is notable that although shareholdings across lead TVCs and solo-lead CVCs do not differ significantly, there is a large difference in board seat allocations. It is noteworthy that lead TVCs to obtain board seats in nearly 99% of their venture investments, whereas less than 70% of solo-lead CVCs have board representation.

In Panel B of Table 9, we present summary statistics for all VCs that invested in the first round of financing. We do so since there are many CVCs that invest in the first round alongside TVCs. In this analysis, we are able to capture the board representation and shareholdings for all the first round investors. In our sample of 187 start-ups, there are 351 investors that participated in the *first* round of financing. Nearly 82% of these investors are TVCs while 18% are CVCs. We observe that while the average shareholdings are not statistically different across the two investor types, board representation is markedly so. Of all the TVCs that invested in the first round of funding, 84% are allocated board seats. However, only 56% of the CVCs are allocated board seats in return for their investments. In sum, the results in Table 9 are consistent with Hypothesis 4 and indicate that CVC conflicts of interest are likely to make the insiders particularly wary when

strategic investments occur in the earlier stages of the start-up's lifecycle and CVCs are the lead investors.

4.4 Pricing Strategic Investments in the Start-ups

Finally, we analyze the valuations placed on firms by the strategic investors when they buy start-up shares. The start-up's insiders are likely to extract higher valuations when the CVC parent is a potential competitor and is interested in investing in the start-up, a prediction consistent with standard Nash bargaining models. We have for each corporate investor, the total investment made by the CVC in the start-up and CVC shareholdings. While the VentureXpert database identifies the CVC investments in different rounds of start-up funding, it does not track the price paid per share in any of the funding rounds. We therefore employ a measure of valuation which measures the price paid by the corporate investor for each percent of the outstanding shares. This is akin to start-up's implied "post-money" valuation, a ubiquitous measure of valuation used in the VC industry. The so-called post-money valuation calculates the value of the start-up on the basis of the equity stake purchased by the investor, which is what our variable captures, albeit across all rounds of funding.

In Table 10, we observe that the price paid for a 1% shareholding is significantly higher for a competing CVC relative to a complementary CVC. On average a competing CVC parent invests $1.66 million for each shareholding percentage, whereas a complementary CVC investor pays $1 million for each additional 1% shareholding. Interestingly, the average price paid by TVC syndicates is not significantly different across the two sets of start-ups (start-ups with competitor or complementary CVC investors).[27] This evidence is consistent with Hypothesis 5 that insiders in

[27] We use the information on total investment in the start-up made by all TVCs in the investment syndicate and their total shareholdings to compute this measure.

start-ups are able to extract higher valuations when a CVC parent is a potential competitor, a scenario reflecting greater expected costs of VC funding for the insiders of these start-ups.

We present the multivariate analysis for pricing of strategic investments in Table 11. We present three different models to estimate the pricing and the results obtained remain robust regardless of the estimated model. The explanatory variables are the CVC shareholdings, an indicator variable denoting whether or not the strategic investor is a potential competitor, a proxy for the reputation of the lead VC, TVC syndicate size, an indicator variable denoting whether the CVC is a lead VC, another indicator variable for whether the founder is also the CEO, aggregate investment in the VC industry at the time of first CVC investment in the start-up, total VC funding available to the start-up, and the start-up's age.

In the first specification, the dependent variable is the ratio of a CVC's total investment in the start-up divided by the CVC's shareholdings. In the second specification, the log value of this ratio is employed as the dependent variable. In the third specification, we employ a two-equation simultaneous system where CVC pricing and shareholdings are jointly determined. In all these specifications, higher valuations for competing strategic investments would suggest that such CVCs not only place higher valuations on these start-up firms, but also that these startups are able to extract higher values for their shares reflecting their stronger bargaining position in negotiations with potential competitors.

In all three specifications, the coefficient on the 'Strategic Competitor' variable, which denotes that a CVC parent is a potential competitor, is positive and statistically significant. This indicates that a start-up's insiders are able to extract higher valuations from CVCs when their parent corporations are seen as potential competitors. The coefficient on CVC shareholdings is significantly negative suggesting that all else equal, higher CVC shareholdings and therefore higher CVC control results in lower per share prices paid by CVCs. One interpretation of this result is that when CVCs make proportionally larger investments in start-ups, this reflects a

proportionally weaker demand by other venture investors and as a consequence the CVCs can demand more favorable prices. We also see that in two out of three models, the indicator for a lead CVC investor has a significantly negative coefficient estimate. This suggests that lead CVCs, who are likely to wield more bargaining power than other CVCs in the syndicates, pay less for their shares. Also, the significant positive coefficient on the founder-CEO indicator suggests that these entrepreneurs are able to extract higher prices from CVCs, perhaps reflecting their greater bargaining power.

Interestingly, when aggregate investment in the VC industry is relatively high at the time of a CVC's initial investment in a start-up, the CVC pays more for its shareholdings. This could be explained by increased competition among VC investors to place their funds, which drives up VC purchase prices. Finally, we find that higher investments in start-ups by VC syndicates are associated with higher purchase prices paid by CVCs for their shareholdings. This is not surprising given that total VC investment in a start-up may serve as a good proxy for its investment quality.

In the CVC shareholding equation in column 4 of Table 11, we observe that higher prices paid by CVCs are associated with significantly lower CVC shareholdings. Thus, the pricing and shareholding decisions appear to be jointly determined as expected. CVC board power has a significant positive coefficient, which suggests that board representation is a significant determinant of CVC shareholdings. However, the coefficient on the Strategic Competitor indicator is insignificant, which is somewhat surprising. The coefficient on Aggregate VC Industry Investment is negative and marginally significant. This result is in line with our earlier findings that cold VC market conditions lead to higher CVC shareholdings.

V. Robustness Checks

Controlling for Endogeneity using the Heckman Correction

If factors that cause a competing (or complementary) CVC parent to fund the start-up also lead to differences observed in contracting features such as board power and investment pricing, potential selection bias could result leading to inconsistent model estimates. To address concerns about selection bias, we use the Heckman correction procedure to first model the likelihood of start-ups backed by competing CVC parents using a logistic regression framework. In the second-step linear regression, we include the inverse Mills ratio, *Lambda*, obtained from the first-step estimation as an additional regressor in our earlier models explaining CVC board power (Table 5) and investment pricing (Table 11):

1st Step (Logit): $Prob\ (Strategic\ Competitor) = a_0 + a_1\ Control\ Variables + \varepsilon$

2nd Step: $CVC\ Board\ Power = b_0 + b_1\ Strategic\ Competitor + b_2\ Control\ Variables + b_3\ Lambda + \eta$

or

2nd Step: $CVC\ Investment\ Pricing = b_0 + b_1\ Strategic\ Competitor + b_2\ Control\ Variables + b_3\ Lambda + \eta$

The first step estimates a predictive model for competing CVC investments in our sample of CVC backed start-ups. The instruments used in the selection equation include the start-up age, an indicator denoting whether the CVC is in the lead, reputation of the lead VC, and industry indicator variables. The younger the start-up, the more financially constrained she is likely to be. As a result, she could be more flexible in seeking investments from competing CVC parents as timely access to funding can be critical to her future performance. Furthermore relationships with complementary CVC investors involving customer-supplier arrangements, marketing and advertising support or joint ventures are more likely at a relatively later stage of the start-up's lifecycle. The start-up founders may be cautious in involving competing CVCs as lead VCs. However, if the lead VC is reputable, the likelihood of a competing CVC being part of the VC syndicate is higher since insiders can derive comfort from the lead VC's incentives to see the start-up succeed in order to preserve and enhance reputation in the VC industry.

We also include the aggregate VC industry investment in the most recent month prior to the CVC investment. The higher the industry activity, the lower is the likelihood of involving a potentially competing strategic investor. Finally, in the spirit of Gompers and Lerner (2000b) and Hochberg et al (2006), I control for investment environment available to VCs using the market to book ratios of all public firms that belong to the high-tech industry.[28] High market to book ratios in an industry is an indication of a favorable investment climate. It is plausible the investment opportunities available to investors affect their investment decisions. We use the median market to book ratio in the high-tech industry in the year of the initial CVC investment in the portfolio company.

Table 12 reports the effect of the type of strategic investment on CVC board power after controlling for selection bias. The first column of Table 12 indicates that the likelihood of a start-up backed by a competing CVC parent is significantly related to the age of the start-up and indicator variables denoting start-ups belonging to the biotechnology/pharmaceuticals/healthcare and electronic/semiconductor industries. As expected, the older the start-up, the less likely it is to involve a competing CVC parent as an investor. Surprisingly, the lead CVCs are more likely to be potential competitors which is however consistent with a larger potential for expropriation in the earlier stages of the start-ups' lifecycle which largely features technology collaborations and licensing among the parties involved.

The second-step estimates analyzing the determinants of CVC board power, presented in the next three columns of Table 12, are similar to those reported in Table 5. Most importantly, the strategic competitor indicator continues to be significantly and negatively related to CVC board power. The inverse Mills ratio derived from the first-step estimation is insignificant. In Table 13, we replicate the analyses on pricing of CVC investments after controlling for selection bias. The results

[28] The firms are drawn from the Compustat universe and their industry is classified by their primary 3 digit SIC codes. High-tech industries are classified as belonging to SIC codes 283 (biological products, genetics and pharmaceuticals), 481 (high-tech communications), 365-369 (electronic equipment), 482-489 (communication services), 357 (computers) and 737 (software services).

are qualitatively similar to those reported in Table 11 and indicate that the start-up insiders are able to extract higher valuations from CVCs when their parent corporations are seen as potential competitors. In summary, our results do not appear to be caused by selection bias arising from a common set of CVC investment criteria.

Post-IPO Performance of CVC backed Start-ups

As mentioned earlier, CVC-backed IPOs are not a random sample since the start-ups that go public are the most successful of all VC-backed firms and the most infrequent as well. A possible concern is that the relationships observed between the CVC investment type and the nature of their financial contracts – allocation of control and ownership rights to CVCs, insider board power and CVC investment pricing – could be a function of the start-up performance. For example, the competing CVCs may want to associate with start-ups that are likely to perform better and that may explain the higher prices they pay for their shareholdings. While it is extremely difficult to analyze the performance of privately-held start-ups when they receive CVC funding, we do evaluate their post-IPO performance as an additional robustness check.

Table 14, Panel A presents the statistics on post-IPO financial performance (at the end of the third year) of the start-ups characterized by their relationship with the corporate venture investors. The median Tobin's Q of start-ups backed by complementary (competing) strategic investors is 2.01 (1.79); however the difference is statistically insignificant. A similar pattern emerges when analyzing return on assets and return on equity for the two sets of start-ups.[29] It is notable that even though post-IPO performance of start-ups backed by potentially competing CVC parents is somewhat lower relative to other firms, such start-ups manage to extract significantly higher prices at the time of CVC funding. This further supports our hypotheses that the start-up

[29] Tobin's Q is defined as (item6 - item60 + item25*item199) / item6; Return on Assets as item18/(item6 - item60 + item25*item199); and Return on Equity as item18/(item25*item199). All items are sourced from Compustat.

insiders, being aware of the misaligned incentives of competing CVC parents, take purposeful steps to structure the financial contracts between the start-ups and CVCs accordingly.

Finally in Panel B of Table 14, we present statistics on start-ups that were merged / acquired or went out of business. Nine start-ups that were backed by complementary CVC investors were acquired / merged during the three years after the IPO. Twenty eight (twelve) start-ups backed by complementary (competing) CVC investors appear to have gone out of business during the three years post-IPO. In normalized terms, net of merged / acquired start-ups (that are being characterized as existent), an identical twenty percent start-ups appear to have gone out of business from each sub-sample. Overall, the evidence on post-IPO performance suggests that the relationships observed between the CVC investment type and the nature of their financial contracts – allocation of control and ownership rights to CVCs, insider board power and CVC investment pricing – do not appear to be caused by the start-up performance.

VI. Concluding Remarks

Corporations have significantly increased VC funding to entrepreneurial companies in the last decade. At its peak in the 1999-2000 period, corporate venture capital's share of the aggregate venture investment was nearly 15%. A primary incentive for investment by CVCs is the strategic benefits that can accrue to their parent corporations. Given this perspective, CVCs could pursue strategies that benefit parent corporations at the expense of start-ups' economic well being. This is likely to result in significant CVC conflicts of interest with both the entrepreneurs and other traditional VC investors. Nevertheless, CVCs are included as syndicate members in many VC backed start-ups. The effect of including corporate venture capitalists in VC syndicates is the primary focus of this study.

This study focuses on VC syndicate structure and addresses several important questions. Does the type of venture capitalist matter to a start-up? Under what circumstances would a start-

up agree to include a CVC in its VC syndicate? What benefits do CVCs offer and what problems do they create? How can the conflicts of interest between the various private equity investors, including the founders, be managed or minimized? More specifically, do certain syndicate structures and distributions of shareholdings & control rights occur more frequently, suggesting that they help reduce the conflicts of interest among these private investors? Finally, do start-ups extract prices from CVCs consistent with the strategy they appear to be pursuing?

The main findings of this study are as follows. First, CVC investments in start-ups are more common when the start-ups' operations are complementary to those of CVCs' parent corporations, compared to situations where the parent corporations are potential competitors of the start-ups. Second, founders/entrepreneurs of start-ups are likely to limit CVC influence by awarding them lower board representations if the CVC parent corporations are potential competitors. Furthermore, start-up insiders retain higher board representation when faced with competitive strategic investors. Third, there are significant differences between the board representation of lead investors depending on whether they are CVCs or TVCs. Lead investors that are CVCs have lower board representation than if they are TVCs. This result is consistent with the entrepreneur's desire to limit the CVC influence, particularly at the earliest stages of the start-ups' lifecycle. Finally, start-up insiders are able to extract higher valuations when the CVC parents are potential competitors, which is consistent with the predictions of standard Nash bargaining models. Overall, the results indicate that the potential synergies that strategic CVC investors offer raise their likelihood of participation in VC syndicates and that their board representation and share pricing are related to the nature of their strategic relationship with the start-ups.

These results raise some interesting questions. First, what is the impact of shareholdings and control right allocations on the performance of the company? Second, do some syndicate structures influence the likelihood of a start-up's success? Although previous research suggests

that a complementary strategic relationship between a CVC and a start-up significantly influences the likelihood of successful exit, in this sample of CVC-backed IPOs, there are a significant number of start-ups that had potentially competing relationships with CVCs. Perhaps, limiting the moral hazard problems and creating good management and VC incentives through proper allocation of shareholdings and control rights hold the key to the eventual success of these start-ups. These interesting questions are worthy of further research.

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Appendix

List of Variables

Variable	Explanation	Data Source
Aggr. VC Industry Investment	Monthly Aggregate investment in the VC industry	VentureXpert Database
Aggr. CVC Investment	Total dollar investment by all CVCs in the VC syndicate normalized by total VC investment in the start-up	IPO Prospectus, VentureXpert Database
CVC Board Power (CVC Board Representation)	Ratio of CVC board seats to total board seats	IPO Prospectus
CVC Directors (CVC Board Seats)	Number of board seats held by CVCs	IPO Prospectus
CVC Shares	CVC shareholdings (%)	IPO Prospectus
CVC Investment in Start-up	Total dollar investment by the CVC across all rounds of financing, normalized by the total VC investment in the start-up	IPO Prospectus, VentureXpert Database
CVC Syndicate Investment	Total dollar investment by all the CVCs, normalized by the total VC investment in the start-up	IPO Prospectus, VentureXpert Database
Founder CEO	An indicator variable denoting whether the founder is also the CEO	IPO Prospectus
High-Tech Market to Book	Median market to book in the high-tech industry at the time of initial CVC investment in the start-up	Compustat
Insider Control	Ratio of insider board seats to total board seats	IPO Prospectus
Insider Shares	Insider shareholdings (%)	IPO Prospectus
Lead CVC	An indicator variable denoting whether the CVC is lead VC	IPO Prospectus
Net Strategic Competitor	A discrete variable that aggregates all the individual CVC strategic relations with the same start-up into a single observation by summing up these individual strategic relationships (The individual strategic relationship is one if the CVC–Startup relationship is competing, zero if financial and minus one if complementary or weakly complementary).	Corporate Technology Directory
Startup Age	Age of the start-up	IPO Prospectus
Strategic Competitor	An indicator variable denoting whether CVC is a potential competitor of or shares a complementary / financial relationship with the start-up.	Corporate Technology Directory
TVC Syndicate Size	Size of the traditional VC syndicate	IPO Prospectus
VC Investment in Start-up	Total dollar investment by the VC	VentureXpert Database

	syndicate across all rounds of financing	
VC Reputation	Reputation of the lead VC proxied by the cumulative number of companies that VC has brought public until the start-up's IPO year	VentureXpert Database

TABLE 1
Annual Frequency of CVC-Backed Firms IPOs and CVC Investments

Panel A: Annual Frequency of IPOs by CVC-Backed Companies

Year	Number of CVC backed IPOs	Number of CVCs in VC Syndicates	Average number of CVCs per IPO
1996	16	21	1.31
1997	18	26	1.44
1998	12	18	1.50
1999	73	122	1.67
2000	65	115	1.77
2001	3	5	1.67
Total	187	307	1.64

Panel B: CVC Investors in Portfolio Companies by Year

Year	Number of Portfolio Companies Receiving CVC Investment	Number of CVCs Making Investment	Average number of CVCs Making Investment per Portfolio Company in Any Given Year
1985-1990	1	2	0.50
1991	1	1	1.00
1992	2	2	1.00
1993	4	4	1.00
1994	12	12	1.00
1995	16	17	1.06
1996	30	33	1.10
1997	44	53	1.20
1998	46	50	1.09
1999	68	96	1.41
2000	17	28	1.65
Indeterminable	9	9	
Total	250	307	1.23

TABLE 2

Shareholdings and Board Power at the IPO in CVC-Backed Companies

Panel A: Shareholdings of Major Investors in CVC Backed Companies

	Mean	Median	Minimum	Maximum	Standard Deviation	Obs.
CVC Shareholdings	9.89	8.27	0.50	46.40	6.70	288
TVC Shareholdings / Number of TVCs when VC has a Board Seat	12.39	11.75	2.80	41.60	5.60	173
TVC Shareholdings / Number of TVCs when VCs have no Board Seats	8.34	7.60	1.14	27.07	3.80	87
Total TVC Shareholdings	33.65	32.60	0.00	81.00	18.93	187
Total Outsiders Shareholdings	57.83	58.90	8.40	89.40	20.25	187
Founder(s) Shareholdings	15.87	11.20	1.80	63.30	13.60	156
CEO Shareholdings when the Founder is not the CEO	5.54	4.00	1.00	56.10	6.90	77
Total Insiders Shareholdings	19.68	15.00	1.00	91.60	15.25	186

Panel B: Board Representation in CVC Backed Companies

	Mean	Median	Minimum	Maximum	Standard Deviation	Obs.
CVC Board Seats	0.45	0	0	2	0.55	307
Traditional VC Board Seats	2.33	2	0	6	1.14	187
Outsiders Board Seats	4.95	5	1	11	1.71	187
Insiders Board Seats	1.85	2	1	5	0.79	187
Total Board Seats	6.81	7	3	13	1.72	187

TABLE 3

CVC Shareholdings and Board Power at the IPO Categorized by the CVC's Strategic Relationship

The CorpTech Directory, used to classify strategic relations between CVC parents and start-ups, lists the industry and product codes for 100,000 high-tech companies based in the US. These industry and product codes are used to measure the degree of complementarity between start-ups and CVC parents. A start-up and a CVC parent are defined as potential competitors if any of the start-up and CVC parent product codes match at all three levels of the industry code. A start-up and a CVC parent are defined to be strong complements if their product codes match only at the first two levels. If the companies' product codes match only at the first level, they are defined to be weak complements. If the product codes do not match at any of the levels, we impose a second check based on SIC codes. We classify relationships as weakly complementary, complementary and competing based on matches at 2-digit, 3-digit and 4-digit levels respectively. Finally, if CVC - Start-up relationships remain yet unclassified, we read the IPO prospectuses for each of the start-ups and determine the operating relationship between the two parties. For instance, if the CVC parent is a customer of, a supplier to or a technology licensor to the start-up, we classify such relationships as weakly complementary in nature. In addition, if the IPO prospectuses mention a CVC parent as a potential competitor, we code the relationship between the start-up and the CVC parent as such, overriding our earlier classifications based on the CorpTech directory, SIC codes and IPO prospectuses.

	Corporate VC Shareholdings			**CVC Board Seats**			**Ratio of CVC Seats to Total Board Seats**	
CVC-Startup Strategic Relationship	**Mean**	**Median**	**Obs.**	**Mean**	**Median**	**Obs.**	**Mean**	**Median**
Complementary	10.61	9.45	54	0.603	1.00	58	0.087	0.095
Weakly Complementary	9.56	8.20	107	0.487	0.00	115	0.067	0.000
Potentially Competing	9.74	7.61	117	0.371	0.00	124	0.051	0.000
Financial	12.11	8.60	10	0.200	0.00	10	0.029	0.000
Total	9.92	8.27	288	0.453	0.00	307	0.064	0.000
Tests of Equality (p-value)								
Complementary and Potentially Competing	0.442	0.173		0.009	0.022		0.004	0.022
Weakly Complementary and Potentially Competing	0.843	0.505		0.098	0.096		0.093	0.096

TABLE 4

Determinants of CVC Board Seats

Three model specifications are employed: OLS, Poisson Count and simultaneous equations framework. The specification of the simultaneous equations system estimated using OLS is as follows:

CVC Directors = $c_0 + c_1$CVC Shares + c_2Strategic Competitor + c_3VC Reputation + c_4TVC Syndicate Size + c_5Lead CVC + c_6FounderCEO + c_7Startup Age + ε

CVC Shares = $d_0 + d_1$CVC Directors + d_2Strategic Competitor + d_3Aggr. VC Investment + d_4TVC Syndicate Size + d_5Lead CVC + d_6CVC Investment + d_7Startup Age + d_8(Strategic Competitor * Aggr. VC Investment) + η

The dependent variable is the number of board seats that the CVC holds in the start-up The explanatory variables are corporate venture capitalist shareholdings, an indicator variable denoting that the CVC parent is a potential competitor of the start-up, lead VC reputation, traditional VC syndicate size, an indicator variable denoting that the CVC is also a lead VC, another indicator denoting that the CEO is also a founder and the age of the start-up. Additional explanatory variables used in the simultaneous two equation system are the monthly aggregate VC investment in the industry ('Hotness' of VC industry) at the time the CVC makes its first investment in the start-up, relative dollar investment by the CVC and age of the start-up. Robust p-values are in brackets beneath the parameter estimates.

	TOBIT	**Poisson Count**	**Simultaneous Equations**	
	CVC Directors		**CVC Directors**	**CVC Shares**
Intercept	1.675	0.164	0.980*	9.628
	[0.138]	[0.884]	[0.075]	[0.216]
CVC Shares	0.053***	0.042***	0.019**	
	[0.000]	[0.000]	[0.050]	
CVC Directors				2.112
				[0.400]
Strategic Competitor	-0.379***	-0.374**	-0.153***	11.851**
	[0.007]	[0.014]	[0.024]	[0.040]
VC Reputation	0.081*	0.195*	0.029	
	[0.071]	[0.060]	[0.196]	
Aggr. VC Industry Investment				-0.674
				[0.203]
Strategic Competitor * Aggr. VC Industry Investment				-1.638**
				[0.034]
TVC Syndicate Size	-0.014	-0.021	-0.003	0.494**
	[0.768]	[0.643]	[0.910]	[0.045]
Lead CVC Indicator	0.313*	0.314**	0.191**	2.293**
	[0.061]	[0.032]	[0.028]	[0.034]
Founder CEO Indicator	0.054	0.039	0.034	
	[0.705]	[0.779]	[0.618]	
CVC Investment in Start-up				20.930***
				[0.000]
Start-up Age	-0.248*	-0.198	-0.111	-0.124
	[0.066]	[0.159]	[0.106]	[0.873]
Industry Fixed Effects	Present	Present	Present	Present
Observations	288	288	288	288
Log Likelihood / Adj. / Pseudo R^2	-275.37	6.43%	12.63%	30.23%

TABLE 5

Determinants of CVC Board Power

Three model specifications are employed: OLS, two-boundary TOBIT and simultaneous equations framework. The specification of the simultaneous equations system estimated using OLS is as follows:

CVC Board Power = c_0 + c_1CVC Shares + c_2Strategic Competitor + c_3VC Reputation + c_4TVC Syndicate Size + c_5Lead CVC + c_6Founder CEO + c_7Startup Age + ε

CVC Shares = d_0 + d_1CVC Board Power + d_2Strategic Competitor + d_3Aggr. VC Investment + d_4TVC Syndicate Size + d_5Lead CVC + d_6CVC Investment + d_7Startup Age + d_8(Strategic Competitor * Aggr. VC Investment) + η

The dependent variable is the relative board power (CVC board seats normalized by board size) of each CVC in the start-up. The explanatory variables are the shareholdings of the corporate venture capitalist, an indicator variable denoting that the CVC parent is a potential competitor of the start-up, lead VC reputation, traditional VC syndicate size, an indicator variable denoting that the CVC is also a lead VC investor, another indicator denoting that the CEO is also a founder and the age of the start-up. Additional explanatory variables used in the simultaneous two equation system are the monthly aggregate VC investment in the industry ('Hotness' of VC industry) at the time CVC makes its first investment in the start-up, the relative dollar investment by the CVC and age of the start-up. Robust p-values are in brackets beneath the parameter estimates.

	OLS	**TOBIT**	**Simultaneous Equations**	
	CVC Board Power		**CVC Board Power**	**CVC Shares**
Intercept	0.154***	0.221	0.118	10.239
	[0.003]	[0.162]	[0.119]	[0.147]
CVC Shares	0.004***	0.008***	0.004***	
	[0.000]	[0.000]	[0.002]	
CVC Board Power				23.662***
				[0.000]
Strategic Competitor	-0.024***	-0.055***	-0.022***	10.177*
	[0.009]	[0.006]	[0.021]	[0.071]
VC Reputation	0.003	0.009	0.003	
	[0.245]	[0.147]	[0.377]	
Aggr. VC Industry Investment				-0.751
				[0.152]
Strategic Competitor *				-1.398*
Aggr. VC Industry Investment				[0.061]
TVC Syndicate Size	-0.003	-0.006	-0.003	0.628***
	[0.265]	[0.376]	[0.337]	[0.009]
Lead CVC Indicator	0.024*	0.046**	0.025**	1.545*
	[0.059]	[0.047]	[0.032]	[0.089]
Founder CEO Indicator	0.002	0.007	0.004	
	[0.798]	[0.738]	[0.708]	
CVC Investment in Start-up				19.244***
				[0.000]
Start-up Age	-0.011	-0.029	-0.013	-0.206
	[0.198]	[0.120]	[0.174]	[0.769]
Industry Fixed Effects	Present	Present	Present	Present
Observations	288	288	288	288
Log Likelihood / Adj. / Pseudo R^2	17.76%	-20.76	16.56%	30.55%

TABLE 6

Determinants of Aggregate Board Power of *all* CVCs

Three model specifications are employed: OLS, two-boundary TOBIT and simultaneous equations framework. The specification of the simultaneous equations system estimated using OLS is as follows:

CVC Board Power = $c_0 + c_1$CVC Shares + c_2Net Strategic Competitor + c_3VC Reputation + c_4TVC Syndicate Size + c_5Lead CVC + c_6Founder CEO + c_7Startup Age + ε

CVC Shares = $d_0 + d_1$CVC Board Power + d_2Net Strategic Competitor + d_3VC Reputation + d_4TVC Syndicate Size + d_5Lead CVC + d_6Aggr. CVC Investment + d_7Startup Age + η

The dependent variable is the *aggregate board representation* (normalized by the board size) of *all* CVCs in the start-up. The explanatory variables are the shareholdings of the corporate venture capitalist (CVC), 'Net Strategic Competitor', lead VC reputation, traditional VC syndicate size, an indicator variable denoting that the CVC is also a lead VC, another indicator denoting that the CEO is also a founder and the age of the start-up. Net Strategic Competitor is a discrete variable that aggregates all the individual CVC strategic relations with the same start-up into a single observation by summing up these individual strategic relationships (The individual strategic relationship is one if the CVC–Startup relationship is competing, zero if financial and minus one if complementary or weakly complementary). Additional explanatory variables used in the simultaneous two equation system are the relative dollar investment by all the CVCs in the VC syndicate and age of the start-up. Robust p-values are in brackets beneath the parameter estimates.

	OLS	**TOBIT**	**Simultaneous Equations**	
	CVC Board Power		**CVC Board Power**	**CVC Shares**
Intercept	0.104 [0.266]	0.017 [0.940]	0.108 [0.341]	1.607 [0.891]
CVC Shares	0.004*** [0.000]	0.006*** [0.000]	0.004*** [0.000]	
CVC Board Power				34.244*** [0.000]
Net Strategic Competitor	-0.012** [0.027]	-0.023** [0.041]	-0.012* [0.063]	-0.595 [0.312]
VC Reputation	0.005 [0.210]	0.011 [0.236]	0.005 [0.278]	-0.548 [0.246]
TVC Syndicate Size	-0.002 [0.715]	-0.008 [0.356]	-0.002 [0.623]	0.764 [0.110]
Lead CVC Indicator	0.034* [0.098]	0.056* [0.075]	0.033* [0.073]	2.757 [0.115]
Founder CEO Indicator	0.018 [0.243]	0.020 [0.475]	0.017 [0.261]	
CVC Syndicate Investment				17.346*** [0.000]
Start-up Age	-0.036 [0.258]	-0.055 [0.343]	-0.037 [0.251]	1.625 [0.605]
Industry Fixed Effects	Present	Present	Present	Present
Year Fixed Effects	Present	Present	Present	Present
Observations	184	184	184	184
Log Likelihood / Adj. / Pseudo R^2	14.69%	-16.86	15.95%	28.92%

TABLE 7

Insider Shareholdings and Board Control at IPO Issuers Categorized by their Overall Strategic Relationship with *all* CVCs

The primary variables of interest are the insider board control (insider board seats normalized by board size) and insider shareholdings in the start-up. Start-up insiders include the CEO, founders and other management whose shareholdings are available. 'Net Strategic Competitor' is a discrete variable that aggregates all the individual CVC strategic relations with the same start-up into a single observation by summing up these individual strategic relationships (The individual strategic relationship is one if the CVC–Startup relationship is competing, zero if financial and minus one if complementary or weakly complementary). For strictly negative values of the variable, the CVC syndicate (in aggregate) is a potential competitor of the start-up. 'Net Strategic Complement' captures those CVC-Start-up strategic relationships where the discrete variable is strictly positive and CVC syndicate's relationship (in aggregate) with the start-up is complementary.

	Insiders' Shareholdings %			**Insiders' Board Power**		
CVC-Startup Strategic Relationship	**Mean**	**Median**	**Obs.**	**Mean**	**Median**	**Obs.**
Net Strategic Competitor < 0	22.36	15.00	61	0.303	0.286	61
Net Strategic Complement	18.05	14.75	96	0.261	0.250	96
Tests of Equality (p-value)	0.090*	0.153		0.034**	0.033**	

TABLE 8

Determinants of Insider Board Control

Three model specifications are employed: OLS, two-boundary TOBIT and simultaneous equations framework. The specification of the simultaneous equations system estimated using OLS is as follows:

Insider Control = c_0 + c_1Insider Shares + c_2Net Strategic Competitor + c_3VC Reputation + c_4VC Syndicate Size + c_5Lead CVC + c_6Founder CEO + c_7Startup Age + ε

Insider Shares = d_0 + d_1Insider Control + d_2Net Strategic Competitor + d_3VC Reputation + d_4VC Syndicate Size + d_5Lead CVC + d_6VC Investment + d_7Startup Age + η

The dependent variable is insider board seats (normalized by board size) in the start-up. The explanatory variables are shareholdings of insiders, 'Net Strategic Competitor', lead VC reputation, traditional VC syndicate size, an indicator variable denoting that the CVC is also a lead VC, another indicator denoting that the CEO is also a founder and the age of the start-up. Net Strategic Competitor is a discrete variable that aggregates all the individual CVC strategic relations with the same start-up into a single observation by summing up these individual strategic relationships (The individual strategic relationship is one if the CVC–Startup relationship is competing, zero if financial and minus one if complementary or weakly complementary). Additional explanatory variables used in the simultaneous two equation system are the log of dollar investment by the VC syndicate and age of the start-up. Robust p-values are in brackets beneath the parameter estimates.

	OLS	**TOBIT**	**Simultaneous Equations**	
	Insider Control		**Insider Control**	**Insider Shares**
Intercept	0.326**	0.326**	0.325**	75.398***
	[0.032]	[0.020]	[0.032]	[0.003]
Insider Shares	0.002**	0.002***	0.002***	
	[0.006]	[0.001]	[0.002]	
Insider Control				20.670***
				[0.010]
Net Strategic Competitor	0.014*	0.014**	0.014*	1.217
	[0.058]	[0.050]	[0.072]	[0.116]
VC Reputation	-0.007	-0.006	-0.007	-0.279
	[0.203]	[0.253]	[0.291]	[0.669]
VC Syndicate Size	-0.003	-0.003	-0.003	-2.988***
	[0.535]	[0.545]	[0.575]	[0.000]
Lead CVC Indicator	0.030	0.030	0.030	-0.520
	[0.208]	[0.136]	[0.168]	[0.818]
Founder CEO Indicator	-0.029	-0.028	-0.029	
	[0.115]	[0.119]	[0.150]	
VC Investment in Start-up				-10.362***
				[0.002]
Start-up Age	-0.017	-0.017	-0.017	0.916
	[0.637]	[0.639]	[0.664]	[0.827]
Industry Effects	Present	Present	Present	Present
Year Effects	Present	Present	Present	Present
Observations	187	187	187	187
Log Likelihood / Adj. / Pseudo R^2	10.68%	148.44	10.68%	36.32%

TABLE 9

Shareholdings and Board Power of Lead VCs

Panel A: Comparing Traditional VCs and Corporate VCs as Solo-Lead Investors

	% of all Start-ups	Shareholdings Mean	Shareholdings Median	% with Board Seats	Number of Start-ups
Solo-Lead Traditional VCs	89.84	17.42	15.90	98.80	168
Solo-Lead Corporate VCs	10.16	15.37	11.30	68.42	19
Tests of Equality of Means and Medians (*t* Test and Wilcoxon Rank Sum Test): p-values		0.34	0.10	0.00	187

Panel B: Comparing Traditional VCs and Corporate VCs as Co-Lead Investors

	% of all VC Investments	Shareholdings Mean	Shareholdings Median	% with Board Seats	Number of VC Investments
Traditional VCs	81.77	13.55	12.30	83.97	287
Corporate VCs	18.23	12.19	10.60	56.25	64
Tests of Equality of Means and Medians (*t* Test and Wilcoxon Rank Sum Test): p-values		0.22	0.09	0.00	351

TABLE 10

Purchase Price per Shareholding Percentage for CVC Investments in Start-ups

The primary variable of interest is the price paid in $ millions by corporate VC investors for each shareholding percentage in a start-up. This is akin to start-up's implied valuation, a ubiquitous measure of valuation employed in the VC industry. The so-called post-money valuation calculates the value of the start-up on the basis of the stake purchased by the investor, which is what our variable captures, albeit across all rounds of funding. The investing CVCs are segregated into three groups: potential competitors, complementary players and financially motivated. For comparison, the average price paid by the TVC syndicate for each percent of shareholding is presented. The total investment in the start-up made by all TVCs in the investment syndicate and their total shareholdings are used to compute this measure.

	Corporate Venture Capitalists		**Traditional VC Syndicate**	
CVC-Startup Strategic Relationship	**Mean**	**Obs.**	**Mean**	**Obs.**
Strategic Competitor	1.66	117	0.68	117
Strategic Complement	1.00	161	0.59	161
Financial	0.51	10	1.21	10
Tests of Equality (p-value) (Strategic Competitor Vs. Strategic Complement)	0.001**		0.167	

TABLE 11

Determinants of the Purchase Prices of CVC Investments in Start-ups

Three model specifications are employed. In the first, the dependent variable is the ratio of CVC investment to shareholdings in a start-up, which measures the price paid by the corporate investor for each percent of shareholdings. This is akin to start-up's implied valuation, a ubiquitous measure of valuation employed in the VC industry. The so-called post-money valuation calculates the value of a start-up on the basis of the stake purchased by the investor. In the second specification, the dependent variable is the log of the dependent variable in the first model. In the third model, we employ a simultaneous equation framework where the dependent variable is the log of the ratio as in the second specification. The second equation explains CVC share ownership.

The explanatory variables are shareholdings of corporate venture investors, an indicator variable denoting that the CVC is a potential competitor of the start-up, lead VC reputation, traditional VC syndicate size, an indicator variable denoting that the CVC is also a lead VC, another indicator denoting that the CEO is also a founder, aggregate investment in the VC industry at the time of first CVC investment in the start-up, total VC investment in the start-up and age of the start-up. An additional explanatory variable used in the simultaneous two equation system is the CVC Board Power as measured by the ratio of CVC to total board seats. Robust p-values are in brackets beneath the parameter estimates.

	CVC Investment / CVC Shares	**Log (CVC Investment / CVC Shares)**	**Log (CVC Investment / CVC Shares)**	**CVC Shares**
	TOBIT	**TOBIT**	**Simultaneous Equations**	
Intercept	-5105.452*** [0.000]	0.831 [0.512]	0.768 [0.543]	22.097** [0.022]
CVC Shares	-35.300*** [0.002]	-0.038*** [0.000]	-0.038*** [0.000]	
Strategic Competitor	491.811*** [0.002]	0.183* [0.051]	0.183* [0.063]	0.783 [0.304]
VC Reputation	33.804 [0.538]	0.010 [0.760]	0.010 [0.769]	
TVC Syndicate Size	-70.581 [0.193]	-0.035 [0.299]	-0.035 [0.319]	0.179 [0.498]
Lead CVC Indicator	-267.152 [0.196]	-0.414*** [0.001]	-0.414*** [0.001]	-0.368 [0.714]
Founder CEO Indicator	284.949* [0.075]	0.175* [0.072]	0.175* [0.085]	
Aggr. VC Industry Investment	381.490*** [0.000]	0.224*** [0.000]	0.224*** [0.001]	-0.846* [0.084]
VC Investment in Start-up	561.840*** [0.000]	0.464*** [0.000]	0.464*** [0.000]	0.119 [0.835]
Start-up Age	-276.916*** [0.007]	-0.090 [0.352]	-0.090 [0.372]	0.352 [0.651]
CVC Board Rep				24.902*** [0.000]
Log (CVC Investment / CVC Shares)				-1.972*** [0.000]

Industry Effects	Present	Present	Present	Present
Observations	288	288	288	288
Log Likelihood /Adjusted R^2	-2464	-326.02	42.30%	20.46%

TABLE 12

Determinants of CVC Board Power in Heckman Selection Framework Controlling for Type of Strategic Investment

Three model specifications are employed: OLS, two-boundary TOBIT and simultaneous equations framework. The specification of the simultaneous equations system estimated using OLS is as follows:

CVC Board Power = c_0 + c_1CVC Shares + c_2Strategic Competitor + c_3VC Reputation + c_4TVC Syndicate Size + c_5Lead CVC + c_6Founder CEO + c_7Startup Age + ε

CVC Shares = d_0 + d_1CVC Board Power + d_2Strategic Competitor + d_3Aggr. VC Investment + d_4TVC Syndicate Size + d_5Lead CVC + d_6CVC Investment + d_7Startup Age + d_8(Strategic Competitor * Aggr. VC Investment) + η

The dependent variable is the relative board power (CVC board seats normalized by board size) of each CVC in the start-up. The explanatory variables are the shareholdings of the corporate venture capitalist, an indicator variable denoting that the CVC parent is a potential competitor of the start-up, lead VC reputation, traditional VC syndicate size, an indicator variable denoting that the CVC is also a lead VC investor, another indicator denoting that the CEO is also a founder and the age of the start-up. Additional explanatory variables used in the simultaneous two equation system are the monthly aggregate VC investment in the industry ('Hotness' of VC industry) at the time CVC makes its first investment in the start-up, the relative dollar investment by the CVC and age of the start-up. The inverse mills' ratio derived from the first stage logit estimation is added to account for selection bias, if any. Additional explanatory variables used in the estimation of logistic equation predicting competing CVC investments are the aggregate VC industry investment in the most recent month prior to the CVC investment and the market to book ratio in the high-tech industry in the year of the CVC investment. Robust p-values are in brackets beneath the parameter estimates.

	Logistic	**OLS**	**TOBIT**	**Simultaneous Equations**	
	Pr(Strategic Competitor=1)	**CVC Board Power**	**CVC Board Power**	**CVC Board Power**	**CVC Shares**
Intercept	-6.725	0.161**	0.240	0.130*	10.219
	[0.707]	[0.037]	[0.128]	[0.089]	[0.148]
CVC Shares		0.004***	0.008***	0.004***	
		[0.000]	[0.000]	[0.000]	
CVC Board Power					23.273***
					[0.000]
Strategic Competitor		-0.021**	-0.049**	-0.019**	11.075*
		[0.021]	[0.015]	[0.043]	[0.052]
VC Reputation	0.064	0.004	0.012*	0.003	
	[0.212]	[0.132]	[0.069]	[0.262]	
Aggr. VC Industry Investment	-0.089				-0.616
	[0.622]				[0.254]
Strategic Competitor *Aggr. VC Industry Investment					-1.496**
					[0.047]
TVC Syndicate Size		-0.003	-0.006	-0.003	0.635***
		[0.261]	[0.371]	[0.333]	[0.008]
Lead CVC Indicator	0.349*	0.031**	0.061**	0.030**	1.912**
	[0.081]	[0.035]	[0.015]	[0.017]	[0.050]
Founder CEO Indicator		0.002	0.006	0.003	
		[0.827]	[0.772]	[0.755]	
CVC Investment					18.988***
					[0.000]
Start-up Age	-0.055**	-0.018*	-0.045**	-0.018*	-0.600
	[0.042]	[0.057]	[0.035]	[0.089]	[0.454]
High-Tech Market to Book	5.849				
	[0.691]				

Biotech, Pharmaceuticals and Healthcare Indicator	0.888*** [0.009]				
Electronics and Semi-Conductors Indicator	0.567** [0.040]				
Inverse Mills Ratio		0.033 [0.164]	0.074 [0.118]	0.025 [0.291]	1.753 [0.309]
Industry Fixed Effects	Present	Present	Present	Present	Present
Observations	307	288	288	288	288
Log Likelihood / Adj. / Pseudo R^2	-192.42	18.10%	-19.54	16.59%	30.56%

TABLE 13

Determinants of the Purchase Prices of CVC Investments in Heckman Selection Framework Controlling for Type of Strategic Investment

Three model specifications are employed. In the first, the dependent variable is the ratio of CVC investment to shareholdings in a start-up, which measures the price paid by the corporate investor for each percent of shareholdings. This is akin to start-up's implied valuation, a ubiquitous measure of valuation employed in the VC industry. The so-called post-money valuation calculates the value of a start-up on the basis of the stake purchased by the investor. In the second specification, the dependent variable is the log of the dependent variable in the first model. In the third model, we employ a simultaneous equation framework where the dependent variable is the log of the ratio as in the second specification. The second equation explains CVC share ownership.

The explanatory variables are shareholdings of corporate venture investors, an indicator variable denoting that the CVC is a potential competitor of the start-up, lead VC reputation, traditional VC syndicate size, an indicator variable denoting that the CVC is also a lead VC, another indicator denoting that the CEO is also a founder, aggregate investment in the VC industry at the time of first CVC investment in the start-up, total VC investment in the start-up and age of the start-up. An additional explanatory variable used in the simultaneous two equation system is the CVC Board Power as measured by the ratio of CVC to total board seats. The inverse mills' ratio derived from the first stage logit estimation is added to account for selection bias, if any. Additional explanatory variables used in the estimation of logistic equation (reported in Table 12) predicting competing CVC investments are the aggregate VC industry investment in the most recent month prior to the CVC investment and the market to book ratio in the high-tech industry in the year of the CVC investment. Robust p-values are in brackets beneath the parameter estimates.

	CVC Investment / CVC Shares	**Log (CVC Investment / CVC Shares)**	**Log (CVC Investment / CVC Shares)**	**CVC Shares**
	TOBIT	**TOBIT**	**Simultaneous Equations**	
Intercept	-5090.202*** [0.000]	0.829 [0.520]	0.767 [0.548]	21.435** [0.028]
CVC Shares	-35.291*** [0.002]	-0.038*** [0.000]	-0.038*** [0.000]	
Strategic Competitor	490.500*** [0.002]	0.184* [0.057]	0.184* [0.069]	0.875 [0.263]
VC Reputation	33.206 [0.560]	0.010 [0.767]	0.010 [0.777]	
TVC Syndicate Size	-70.540 [0.194]	-0.035 [0.299]	-0.035 [0.320]	0.178 [0.502]
Lead CVC Indicator	-270.942 [0.236]	-0.414*** [0.003]	-0.414*** [0.004]	-0.135 [0.901]
Founder CEO Indicator	285.070* [0.075]	0.175* [0.072]	0.175* [0.086]	
Aggr. VC Industry Investment	380.563*** [0.000]	0.224*** [0.000]	0.224*** [0.001]	-0.805 [0.104]
VC Investment in Start-up	561.353*** [0.000]	0.464*** [0.000]	0.464*** [0.000]	0.177 [0.760]
Start-up Age	-274.101* [0.049]	-0.090 [0.395]	-0.090 [0.416]	0.157 [0.854]
CVC Board Rep				24.683***

				[0.000]
Log (CVC Investment / CVC Shares)				-1.971*** [0.000]
Inverse Mills Ratio	-15.646 [0.969]	0.002 [0.984]	0.002 [0.984]	1.042 [0.582]
Industry Effects	Present	Present	Present	Present
Observations	288	288	288	288
Log Likelihood /Adjusted R^2	-2464	-326.02	42.08%	20.25%

TABLE 14

Post-IPO Performance of Start-ups backed by Corporate Venture Investors

The performance of start-ups is tracked and coded at the end of the third year, past the IPO year. Panel A reports some financial measures of performance – Tobin's Q, Return on Assets (market value) and Return on Equity (market value). Tobin's Q is defined as (item6 - item60 + item25*item199) / item6; Return on Assets as item18/(item6 - item60 + item25*item199); and Return on Equity as item18/(item25*item199). All items are sourced from Compustat. Panel B reports the fate of non-existent start-ups at the end of the third year, past the IPO year – whether they were acquired or went out of business. 'Net Strategic Competitor' is a discrete variable that aggregates all the individual CVC strategic relations with the same start-up into a single observation by summing up these individual strategic relationships (The individual strategic relationship is one if the CVC–Startup relationship is competing, zero if financial and minus one if complementary or weakly complementary). For strictly negative values of the variable, the CVC syndicate (in aggregate) is a potential competitor of the start-up. 'Net Strategic Complement' captures those CVC-Start-up strategic relationships where the discrete variable is strictly positive and CVC syndicate's relationship (in aggregate) with the start-up is complementary.

Panel A: Financial Performance of Existent Start-ups 3 years after IPO

CVC-Startup Strategic Relationship	Number of Start-ups	Tobin's Q Median	Return on Assets Median	Return on Equity Median
Net Strategic Competitor < 0	49	1.79	-0.16	-0.23
Net Strategic Complement	59	2.01	-0.13	-0.14
Tests of Equality of Medians (Median Two-Sample test): p-value		0.56	0.17	0.17

Panel B: Fate of Non-Existent Start-ups 3 years after IPO

CVC-Startup Strategic Relationship	Acquired or Merged	Out of Business / No Financial Information
Net Strategic Competitor < 0	0	12
Net Strategic Complement	9	28