Abstract
How the interaction between incumbent firms and new ventures drives economic growth has been at the center of attention since Schumpeter’s early work. In this paper, we focus on whether investments by a corporate venture capital (CVC) move the technological position of a new venture toward the technological frontier. In particular, we argue that CVC leadership in the syndicate facilitates the transfer of capabilities to the new venture, and that in turn helps the new venture to generate inventions with more technological influence. Based on semiconductor industry data from 1985 to 1995 and after accounting for selection in the CVC investment process, our regression results show that CVC leadership in the syndicate is associated to new venture inventions with more influence on the successive inventive activity. In addition, the effect decreases when the leadership position is derived from older investments. This suggests a “honeymoon effect,” where the transfer of technological capabilities and support for the new venture wears out as time goes by. Our graphical analysis also found evidence of transfer of technological capabilities from the corporation to the new venture. This transfer is associated to the strength of CVC leadership in the syndicate. Interestingly, we found evidence of a less frequent transfer of technological capabilities from new venture to corporation and no strong evidence of this transfer when CVC investors do not hold leadership positions in the syndicate.
Corporate venture capital financing, investor leadership and technological influence of new venture’s invention
INTRODUCTION

Recent research on Corporate Venture Capital (CVC; i.e., established firm’s investments in privately held entrepreneurial ventures; (Gompers and Lerner 2000)), shows CVC investments improving new venture performance (Cumming 2008, Gompers and Lerner 2000, Hallen et al. 2014, Katila et al. 2008, Maula and Murray 2002, E. Pahnke et al. 2015, Park and Steensma 2012). However, the literature has paid little attention to how CVC investments may affect the new venture’s inventive capabilities (Alvarez-Garrido and Dushnitsky 2016). This is an important gap since, at the center of “the gales of creative destruction” driving the industry into obsolescence (Schumpeter 1942) is the transformation of its core technology, as evidenced by many inventions that changed whole industries (e.g., the laser, Intel’s microprocessor, or Google’s search algorithm). In their chase for Schumpeterian rents, incumbents and new ventures search for novel, influential inventions (Winter 1995). While new entrants are less restrained to explore new technological solutions, incumbents in today’s hi-tech industries are the ones having the technological capabilities and knowledge demanded for an efficient exploration (Schumpeter 1934, 1942). For this reason, we focus on the tension between those with more initiative -- i.e., new ventures -- and those with better technological capabilities -- i.e., incumbents – when developing technological breakthroughs. And from CVC investments in the semiconductor industry, we present evidence of new venture technological influence increasing when a CVC takes a leadership position in the syndicate (i.e., the investor group); yet as in a honeymoon, this effect diminishes as time goes by.

This paper is a first attempt to unveil how CVC investments affect the ability of new ventures to drive the evolution of technology. Despite the aforementioned advances on CVC investment implications for new ventures, it is still unclear how CVC associates with the technological development and innovation trajectories of ventures receiving the investment (Alvarez-Garrido and Dushnitsky 2016). Hence, we do not know whether CVC investment facilitates or hinders the new venture’s development of technological breakthroughs, which are the type of inventions on which transformative innovation builds.
We argue that CVC funding improves the technological influence of the new venture by transferring technological capabilities that increase the new venture’s inventive efficiency. The intricacies (e.g., stickiness, tacitness, risk of spillover) of this transfer demand cooperation and reassurances found when the CVC occupies a leadership position in the investment syndicate (Basu et al. 2015, Szulanski 1996, 2000).

Two aspects of CVC investments draw attention of researchers. On one hand, a sizeable literature has focused on the benefits accrued to the corporation from CVC investments (e.g. Benson and Ziedonis 2009, 2010, Chesbrough 2002, Dushnitsky and Lenox 2005a, 2006, Wadhwa and Basu 2013, Wadhwa and Kotha 2006), including in areas of organizational learning (Schildt et al. 2005) and recognition of discontinuous change (Maula et al. 2012). On the other hand, a growing body of work has focused on the benefits accrued to the new venture. This literature has shown that CVC investments increase the new venture’s likelihood of going public and having both a higher IPO value (Cumming 2008, Gompers and Lerner 2000, Maula and Murray 2002) and innovative output (Alvarez-Garrido and Dushnitsky 2016). Unlike traditional venture capital (VC), which provides mainly managerial advice and financial resources (Hsu 2004), corporate investors also provide expertise and infrastructure for, among others, product development, manufacturing, marketing, and sales (Alvarez-Garrido and Dushnitsky 2016, Dushnitsky 2012, Katila et al. 2008, Maula 2007, Park and Steensma 2012). However, we emphasize that CVC investment is not a sufficient condition for the transfer of capabilities from corporation to new venture.

Building on the notion of CVC investments driven by financial and strategic motives (Chesbrough 2002, Dushnitsky and Lenox 2006), we posit that the CVC leadership position derived from the relative size of the investment in the syndicate is a key aspect to understanding the transfer of capabilities from corporation to new venture. In this way, we extend the research on how organizations become more competitive by leveraging new technology acquisition and accessing windows on future technology (Benson and Ziedonis 2009, Sears and Hoetker 2014) into the realm of new ventures. We ask:
Do CVC investments in entrepreneurial new ventures propel the venture’s inventions toward the technological frontier?

We utilize semiconductor industry data on inventions and venture capital investments from 1985 and 1995 to test our thesis. After accounting for CVC investment selection (Alvarez-Garrido and Dushnitsky 2016, Park and Steensma 2012), our results show that the corporate investor’s prominent position in a syndicate is significant in explaining long term technological significance of the new venture’s patents, which we measured as patent influence Corredoira and Banerjee (2015). And, in an apparent “honeymoon effect,” the effect the corporate investor power in the syndicate decreases as its last investment, from which the leadership position comes, becomes older. In addition, this paper pioneers a graphical analysis of technological positions over time (Stuart and Podolny 1996) to track the technological co-evolution of the CVC-new venture dyad. While limited, this analysis shows patterns supporting bidirectional transfer of technological capabilities between CVCs and entrepreneurial ventures. These patterns are consistent with our argument about CVC financial and strategic motivations, power distribution in the syndicate, and the transfer of inventive capabilities in the dyad.

Our study in conclusion uncovers an interesting, and more complex than usually assumed, relationship between new ventures and corporate investors. This paper highlights CVC leadership and power concentration in a syndicate, measured as the relative financial commitment to the invested venture, as pertinent considerations to understanding the venture’s technological influence. Assumed as an indicator of commitment to supporting the new venture and facilitating the transfer of capabilities, a CVC in a leadership position increases the influence of new venture inventions and is associated with transfer of capabilities between investing corporation and new venture.

**BACKGROUND**

According to extant literature, corporations utilize CVCs for financial and strategic motives (Chesbrough 2002, Dushnitsky and Lenox 2006). Corporations’ structures, technological paths and
market positions (Leonard-Barton 1992) push corporations into conflicting goals when establishing CVCs (O’Reilly III and Tushman 2004, Thornhill and Amit 2001, Zahra 1996). On one hand, they have incentives to sustain a dominant position and avoid technological disruptions that make their complementary assets obsolete and hurt their market position (Christensen and Rosenbloom 1995, Henderson and Clark 1990, Tripsas 1997, Tripsas and Gavetti 2000). On the other hand, they have incentives to introduce innovation to keep up with other firms and improve their competitive position (Basu et al. 2015, Dushnitsky and Lenox 2005a, b, Nagarajan and Mitchell 1998, Zahra and Covin 1995).

Research has shown VCs are driven primarily by financial motivation, while CVCs are driven mostly by strategic motivation: a window on technology (Benson and Ziedonis 2009) and the search for complementarities (Alvarez-Garrido and Dushnitsky 2015; Dushnitsky and Lenox 2006). As our interviews with CVC managers of global corporations and venture capital experts have revealed, CVC managers balance two aspects of these financial and strategic motivations. First, they see themselves, and are seen by other firms and the industry, as explorers in search of the new technology that will keep their organization on the cutting edge and sustain a competitive advantage. Second, they have to fulfill the firm’s expectations regarding invested amounts, returns, risks, and areas of investment. And those conditions are generally dictated by attempts to profit from the process of “creative accumulation” (Pavitt 1986), i.e., the leveraging of their technological and market resources, which limits the radicalism of the inventions they pursue.

The literature on the effect of CVC investments on backed-venture performance shows improved innovative capability, i.e., the ability to extract rents from market opportunities, a process that combines inventive, manufacturing, market, and service capabilities (Dushnitsky 2012, Katila et al. 2008, Maula

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1 We interviewed investment experts and corporate venture capital division managers in large technology-based corporations, among others: ABB Group, Siemens Venture Capital, and Bosch. Those semi-structured interviews lasted a minimum of 30 minutes and up to one hour. They focused on the questions surrounding CVC and corporation’s investments and the investment decision process.
The understanding is that corporate investors provide and share a vast set of complementary assets and capabilities with the new venture. This improves new venture operations and, ultimately, performance. Despite being at the forefront since early discussions, the effect of CVC investment on the new venture’s inventive capability still receives little attention. According to Schumpeter’s early work (1934), entrepreneurs, not corporations, were the engine of innovation and growth based on arguments of inertia and corporation avoidance of obsolescence caused by the “gales of creative destruction.” He reversed his position years later to claim that -- due to scientific and technological advances -- only corporations could gather the technological, scientific, and financial resources to be the engines of innovation and growth (Schumpeter 1942). In this sense, we conceptualize CVCs as the linchpin between both positions; an instrument helping the small venture to access the scientific and technological capabilities mustered by the corporation to transform the technological frontier.

**CVC, New Ventures and the Evolution of Technology**

While inventions per se do not disrupt industries and markets, the ways in which they are incorporated in products and services do. And this is from where the relevance of technological evolution comes. Inventions are at the core of market and technological processes that have the potential to radically change competition. In some cases, new inventions create business opportunities to solve technological problems and satisfy human needs; in other cases, they do so by actually changing the realm of possibilities and giving rise to new needs (Arthur 2009). For these reasons, we focus on a specific aspect of the new venture innovative process: the inventive capability. Alvarez-Garrido and Dushnitsky (2016) have shown that CVC backing improves the new venture’s inventive productivity under certain conditions. Among assets a corporate investor can share with and transfer to its portfolio companies, technological capabilities play an important role in explaining the inventive performance of CVC-backed ventures. As posed by Arthur (2009), the value of technology is not only what it produces, but what new opportunities it opens. So influential inventions drive the evolution of the technology in two
ways: 1. By their direct application to technological problems. 2. By their ripple effects on future technological developments. When considered this way, an invention’s influence reflects its novelty and potential to change the technology and competitive landscape (Corredoira and Banerjee 2015).

In order to study whether CVC funding drives entrepreneurial ventures toward the technological frontier, we utilize the collection of existing inventions captured in granted patents, i.e., the technology corpus. There are limits to what the technology corpus can solve, and we consider those limits the technological frontier. An invention becomes influential when it opens new opportunities to provide solutions outside the realm of possibility; those are inventions creating the new technological frontier (Arthur 2009). In this sense the technology corpus is an ever-expanding universe of solutions. Many of them are a refinement of existing ways of solving problems (e.g., a more energy efficient silicon chip). Others are truly expanding the technological frontier (e.g., the scanning tunneling microscope, which at the time made possible the development of nanotechnology (Press Release: The 1986 Nobel Prize in Physics 1986).

The technology corpus is particularly well suited to study how CVC-funding affects the new venture’s technological influence for several reasons. First, technology evolves by building on itself, by recombining existing technologies in order to generate novel technological solutions to existing problems. Second, this self-generating process is not random, and the decisions about what to recombine and what technological problems to solve is driven by inventors (Arthur 2009) acting inside organizations, as for example through entrepreneurial ventures or corporations (Schumpeter 1934, 1942). These organizations provide collective capabilities and guide their inventors’ search, methods and problem selection (Henderson and Cockburn 1994) by means of organizational structures, systems and incentives (Kogut and Zander 1992). And as such, entrepreneurial ventures become more than the hinge between past and future technology: Their choices and capabilities are at the helm of the technological evolution. Finally, the timing of patent granting and patterns of citations provide a record of technological antecedents and descendants, which allows for tracking the evolution of technology and assessing how much successive
technological developments build on each invention (Arthur 2009, Corredoir and Banerjee 2015, Stuart and Podolny 1996). For these reasons, the technology corpus provides the means to study how CVC financing affects the technological influence of entrepreneurial venture invention (under the assumption that CVCs can potentially improve the technological capabilities and modify the choices of the ventures).

**THEORY**

Approaching this paper in an exploratory manner and not advancing formal hypotheses, we describe in this section priors derived from extant literature.


Despite the size of this growing body of research, little attention has been paid to new venture performance implications of CVC financing opportunities. In addition to initial studies on financial outcomes (Cumming 2008, Gompers and Lerner 2000, Maula and Murray 2002), only recently has organizational scholars’ attention shifted toward the strategic implications for CVC-backed ventures (e.g. Basu et al. 2015). In particular, there is a void of evidence about how CVC programs affect the new venture’s technological performance and technological trajectory evolution. A notable exception is an Alvarez-Garrido and Dushnitsky (2016) study into how access to strong complementary assets for innovation affects CVC-backed ventures’ patenting and scientific publication activities. The authors claim that “we know little about the ways in which distinct investor types are associated with different start-up
innovation trajectories” (Alvarez-Garrido and Dushnitsky 2016, p. 2). Understanding this aspect of CVC financing is of particular relevance since it lies on the foundation of CVC as a governance structure. For new ventures, edging the evolution of the technological frontier within an industry is of primary importance to surviving and succeeding when facing incumbents’ competitive pressure. Yet, accessing costly complementary assets – and thus not readily available to the venture – is a critical aspect in this innovative and competitive process. Concurrently, incumbents have an opportunity to invest in external highly innovative ventures and support them with their knowledge and expertise in order to 1) access and co-develop those inventions representing future options on new technological windows, and 2) leverage their competitive advantages. Building on this emerging line of research within corporate venturing, we aim to contribute to the understanding of the innovativeness of new ventures by focusing on whether CVC programs, vis-a-vis traditional VC financing, are associated to new ventures’ inventions with larger influence on the evolution of technologies (i.e., inventions associated to more successive inventive activity (Corredoira and Banerjee 2015).

Per our discussion above, a main motive driving CVC investments in entrepreneurial ventures is to gain a window on new technologies (Benson and Ziedonis 2009). CVC managers usually refer to themselves as the corporation’s explorers for the next technology that will give the firm a competitive edge. The CVC’s “window on technology” goal underlies our expectation of finding inventions of higher technological influence being produced by CVC-backed entrepreneurial ventures.

This idea of a “window on technology” is consistent with the following statement from one of our interviewees regarding how they see themselves:

“When making investment decisions, I am the corporation’s explorer... I am here looking for the new technology, the one that will revolutionize the industry... that is what I am trying to do... find the next big thing on which my corporation will thrive...” (CVC manager)
A similar view of CVCs is behind this quote from one investment expert:

“[…] external sources [are important] for enhancing [large corporation’s] innovative capacity […] CVC activities are one way to […] collaborate with external entrepreneurial ventures […] At the end [large corporations] can be more successful if they are acting more as a start-up in some parts…”  (Investment Expert)

Current work on CVCs shows that granting access to the corporation’s technological assistance and to technical and market expertise associates with an increase in new venture inventive productivity and venture opportunities nurturing (Alvarez-Garrido and Dushnisky 2016, Basu et al. 2015). Apart from this recent work, there is little systematic study of the mechanisms of asset and capability transfer from the corporate investor to the new venture associated to CVC investments. In fact, most literature on CVC argues this transfer is implicitly attached to the investment, but so far limited empirical evidence has been gathered to explore this assumption. This is even more evident when considering the transfer of technological capabilities from the corporate investor to new venture. An exception is Alvarez-Garrido and Dushnisky’s (2016) work supporting the role of geographic proximity as a transfer of capabilities facilitator to boost the venture’s inventive productivity. Therefore, it is still not clear whether this technological capabilities transfer is limited to a boost on inventive productivity or rather it reaches other aspects associated to inventive activities, for example organizational inventive routines.

**CVC Leadership in the Syndicate and the CVC-New Venture Relationship**

As discussed above and consistent with Schumpeter’s position (1942), corporations are the actors that possess the technological, scientific, and financial resources and capabilities to develop the technological advances push the technological frontier. Technological capabilities transfer from investing corporation to new venture is a phenomenon supported in recent literature (Basu et al. 2015). However, results from Alvarez-Garrido and Dushnisky (2016) suggest that this transfer may occur only under certain conditions. The literature also shows new ventures have to strike a difficult balance between
openness and self-preservation when accepting CVC investments (Katila et al. 2008, Maula et al. 2009). Despite this fact, CVC investment significantly increases several corporation performance outcomes (Benson and Ziedonis 2009, 2010, Dushnitsky and Lenox 2006, Maula 2007, Schildt et al. 2005). Access to new technological developments of young firms mainly explains this (Chesbrough 2002, Wadhwa and Basu 2013). In this respect, new venture success may reflect in: 1. New rent generation for the corporation. 2. The achievement of the strategic intent driving the CVC investments. In this scenario, the corporation’s commitment to support new venture success is shown by the leadership position acquired by the CVC, as much as that the power over the syndicate is an enactment of the interest of the investing firm. It is in this way that greater CVC power over the syndicate comes to reflect the increased chances of technological capability transfer, and consequently, of a potentially important contribution to the high technological influence of the CVC-backed venture.

As CVC power over the syndicate reflects the corporation’s commitment, it also shows CVC control over the new venture. Larger stakes in new venture equity is a way for the corporate investor to acquire a leadership position within the syndicate (Basu et al. 2015). In particular, larger financial stakes associate with high power and large managerial control over the invested ventures, which also provides access to the entrepreneurial venture operations (Katila et al. 2008, Maula et al. 2009, Stulz 1988). Large stakes also reflect new venture acceptance of the CVC as a valid partner, which, as per the discussion below, also facilitates the transfer of capabilities from the corporation.

There are three ways in which CVC access to everyday operations connects to the technological capabilities transfer and the related new venture technological influence. First, control facilitates the transfer of capabilities. As recent research suggests, organizational integration in CVC initiatives is a non-trivial matter for both firms and new ventures (Basu et al. 2015, Maula et al. 2009). This implies that corporate investors utilize strong leading positions in syndicates in order to successfully manage the complex interactive process with the portfolio company. And, organizational integration imposes higher demands on CVC governance structure when knowledge-based assets and tacit knowledge have to be
transferred. Second, control also makes possible to limit negative spillovers and prevent leakage of strategic knowledge to rivals (Hernandez et al. 2015, E. C. Pahnke et al. 2015). By having decision-making and operational control, the CVC can limit information sharing between the new venture and competitors. And third, control implies a corporate investor’s agency on the technological agenda development of the backed venture. Controlling the new venture’s technological agenda using larger syndicate power might represent an opportunity for the corporate investor to: 1. Capture a greater value out the CVC investment. 2. Collect higher returns from the transfer and utilization of assets – including technological capability. 3. Appropriate greater value from the access to new technological windows. Nonetheless, influential inventions have potential to change the competitive dynamics within an industry and make the corporation’s technologies and market positions obsolete. So, larger power gives the corporate investor the ability to constrain the backed venture’s search for technologies to those leveraging the competitive position of the corporate investor (Basu et al. 2011, 2015, Dushnitsky and Shaver 2009).

This brings us to our main point: CVC financial commitment in a syndicate (i.e., CVC power) may become a crucial strategic condition for firms considering the transfer of technological capabilities in CVC investments. As discussed above, a larger CVC’s power increases its ability to transfer technological capabilities to the venture. This also gives it more control over the transferred technology and enhances the ability to capture the benefits from that transfer. This combination of control and commitment over resources, capabilities and assets transfer will generate conditions with potential for a CVC investment to promote an influential inventive process. It should be noted that we see power as the catalyst of this transfer and not as the transfer of capabilities mechanism. From the corporate investor standpoint, what is important is not possession of power per se, but rather how the CVC utilizes its power to advance its goals. And since power is costly (because new ventures will not relinquish control gratuitously) and firms need to justify such expensive investments, we expect corporations to acquire dominant positions in their CVC-backed ventures’ syndicate only when they see opportunities to access and contribute to generating novel technology.
In sum, CVC power enables corporations to utilize the investment as a “window on technology.” It also limits the risk of the new venture’s hurtful spillovers affecting the corporation’s competitive position. These conditions favor the transfer of assets and capabilities when technology capabilities are at the core of the CVC-venture collaboration’s success. For these reasons we propose:

Proposition 1: CVC leadership position in a syndicate will be positively associated to the increased influence of new venture inventions on future technological developments.

Before turning into the methodology section, we would like to make a final point regarding the transfer of technological capabilities between corporations and new ventures. Our emphasis of the transfer of capabilities from the investing corporation to new venture leads us to focus on the technological influence of new venture inventions. Justifying this choice is the relatively small number of new venture inventions and the overwhelming influence from the transfer of technological capabilities from a corporation to a small venture. However, we are not negating that corporations can also learn from the new venture, which is a reason for CVCs to exist and new ventures to hesitate accepting CVC funding (Basu et al. 2015, Katila et al. 2008, Maula et al. 2009). In our discussion section and to further explore this possibility, we utilize a technological mapping technique drawing on technological antecedents to assess a firm’s technological position and capabilities (Stuart and Podolny 1996). In this case, we expect the transfer of technological capabilities between corporation and new venture to reflect a decreasing distance between them on the technological map. In case the corporation learns from the new venture, we expect the corporation to get closer to the new venture and vice versa. CVC power over the syndicate should facilitate both types of learning and the direction of the transfer is likely driven by the parent corporation’s motivation and ability to transfer and receive technological capabilities.
METHODOLOGY

Data. We collected semiconductor industry patents and new venture financing data through patents granted by United States Patents and Trademark Office (USPTO) and obtained from National Bureau of Economic Research (NBER) U.S. Patents Citation Data file (Hall et al. 2001). Despite inherent patent data limitations (Alcácer and Gittelman 2006, Jaffe et al. 1993, Roach and Cohen 2012), patent records provide a temporal dimension to track the evolution of technology and technological antecedents (Corredoira and Banerjee 2015). They also allow as to measuring whether two firms have similar capacities by studying the similarity of the inputs (i.e., citations) to their inventive outcome (i.e., patents) (Stuart and Podolny 1996).

Data on venture financing are drawn from VentureXpert, a comprehensive database on venture investments that has been widely used in previous research (e.g. Alvarez-Garrido and Dushnitsky 2016, Dushnitsky and Lenox 2005a, b, Park and Steensma 2012). VentureXpert collects data and financing information on new ventures and investors. Its coverage further includes information on the composition of the syndicate for each round of investment in every year for each venture along with investor type classification, which is important for the purpose of our study.

Sample. The sample includes 154 firms that sold at least one semiconductor product and have at least one U.S. semiconductor patent between 1985 and 1995 (NBER classification main classes 257, 326, 438, and 505) and observed though 2004. We collected all the patents granted between 1990 and 1995 to those firms, resulting in a dataset of about 11,500 patents. Information for all firms that designed or manufactured semiconductor devices from 1980–1995 was obtained from databases compiled by ICE and Dataquest, two private research firms specializing in semiconductor industry analysis. We collected all the VC and CVC investments from 1985-1995 to those 154 firms. We identified 31 CVC investors, of which nine are part of our semiconductor sample. We found that 41 semiconductor firms received funding over that period. They totaled 185 firm-year-funding, of which 84 included CVC funding received by 17 firms. Only ventures receiving VC have received CVC. Our final sample totals 136 patents granted to the
new ventures over the period of observation in those 84 episodes of CVC funding. We defined new ventures, the ones at risk of receiving VC or CVC funding, as firms in the sample with less than 75 patents granted in three-year periods between 1985 and 1995. The 39 firms receiving funding are part of the 41 firms identified as new ventures.

**Dependent variable: Patent Influence.** Since the seminal work of Jaffe and colleagues (Hall et al. 2001, Jaffe et al. 1993), researchers have measured patent impact as the count of citations received. However, being cited by patents having higher citations reflects greater influence on the evolution of the technology than being cited by a patent with no citations. This paper utilizes a measure of patent influence on technological evolution (Corredoira and Banerjee 2015) that improves over the impact measure by including both direct citations and indirect citations to the patent in a 10-year window. Due to patent regulations, this is an important improvement because patents mostly cite the immediate antecedent. For that reason, impact does not account for the inventive activity occurring after the first generation associated to the patent. In this sense, Patent Influence captures not only how much has been built directly on it, but also how much the successive inventive activity built on inventions that build on the patent also indirectly (traced by the record of indirect citations for every generation that build the citation tree). It takes into account the citation tree topology and number of citations that are part of it. Following Corredoira and Banerjee (2015), Patent Influence is calculated as:

\[
\text{Patent Influence} = \left( \sum_{k=1}^{\infty} \alpha^k A^T e \right)
\]

Where \(\alpha\) is the attenuation factor, \(k\) is the citation generation, \(A^T\) is the transpose of the adjacency matrix defined by patent citations, and \(e\) is a vector of 1s capturing the significance of each patent for the technological corpus. We set \(\alpha\) equal to 1, which makes the contribution of any generation identical, independently from the path length to the focal patent. This allows us to capture the association of the patent, as one antecedent, with inventive activity in the 10-year window following the granting of the
patent. To anchor our results to extant patent literature, we also run models with \textit{Impact}, the count of direct citations over the same time window, as the dependent variable.’’

\textbf{Independent variable: CVC Power.} In order to capture corporate investor’’ leadership and relative power in new venture syndicates compared to other investors, we computed \textit{CVC Power} as follows.

First, we computed \textit{Power}_{j,i,t} as the ratio between the equity investment by the investor \textit{j} in the year \textit{t} in the venture \textit{i} (\textit{investment}_{j,i,t}) and the greatest equity investment received by the venture \textit{i} in time \textit{t} (\textit{max(investment}_{i,t}))

\[ \text{Power}_{j,i,t} = \frac{\textit{investment}_{j,i,t}}{\textit{max(investment}_{i,t})} \times h_{i,t} \]

where \textit{h}_{i,t} is defined as

\[ h_{i,t} = \frac{\sum_{1}^{k} (\textit{investment}_{i,t})^2}{(\sum_{1}^{k} \textit{investment}_{i,t})^2} \]

The first factor varies for each investor of each syndicate in each year, and it takes values from 0 to 1 for each year. More precisely, it takes a value of 0 when an investor \textit{j} invests no equity amount in year \textit{t} and a value of 1 when the equity investment of the investor \textit{j} is the greatest on year \textit{t}. The weighting factor \textit{h} captures the concentration level of investments in the syndicate on year \textit{t}, taking values between 1 and 0, where 1 indicates the highest concentration. Thus, we rely on two aspects of the power structure of each venture’s syndicate in every year: investments’ concentration and investors’ ranking. We extend the ideas underlying market power concentration and equity control (Herfindahl 1951, Stulz 1988) to syndicate power concentration. Combining these two aspects of financing new ventures, we are able to capture the evolution of the power structure for each venture’s investment both at the level of the syndicate and at the level of each individual investor.
Second, from $Power_{j,i,t}$ we generate our main independent variable $CVC\ Power_{j,i,t}$, which is built as follows:

$$CVC\ Power_{j,i,t} = \begin{cases} 
0 & \text{if } investment_{j,i,t} = 0 \land j = CVC(\text{corporate investor}) \\
0 & \text{if } investment_{j,i,t} \geq 0 \land j = VC (\text{venture capital}) \\
Power_{j,i,t} & \text{if } investment_{j,i,t} > 0 \land j = CVC (\text{corporate investor}) 
\end{cases}$$

The investment value of each $j$ investor in each time $t$ is the cumulative value of equity invested up to time $t$ in venture $i$, and it is computed in moving time-windows from two to four years of observation. This captures the investment dynamics of each syndicate and the relative power of each investor across time, avoiding misrepresentation in each time $t$ due to lack of investments in a specific time $t$ of the syndicate’s investors activity, otherwise. Using time-windows between two and four years is a common practice in entrepreneurial finance research when studying outcomes of venture financing (Nanda and Rhodes-Kropf 2013, Tian and Wang 2014).

**Control variables.** We control also for specific characteristics of each patent that might affect the venture’s influence (Corredoira and Banerjee 2015). Claims is the number of claims associated to each patent, which captures a patent’s broader functionality. Adjusted Originality is derived from the originality measured (Hall et al. 2001) and adjusted for its bias. Team Size is the number of inventors for each patent. Team Number of Patents is the total of patents granted to all the inventors in the focal patent. Start Inventor equals one if the venture has an inventor in the top 5% of productivity distribution. Finally, we include five dummy variables to control for unobserved effects associated with each year of observation, and four dummy variables to control for specific unobserved effects of the patent’s main technological class.

**Empirical Strategy.** The objective of our analysis is to estimate the effect of corporate investor power within a syndicate on the technological influence of the funded new venture. Previous literature acknowledges that investors and startups select each other (Dushnitsky and Shaver 2009) and that ventures are heterogeneous in their likelihood of receiving CVC funds (Park and Steensma 2012).
Accordingly, our empirical strategy relies on an instrumental variable approach developed as a two-stage model to account for the selection on the CVC decision to invest.

Following Alvarez-Garrido and Dushnitsky (2016), we estimate two stages: 1. The probability to receive a CVC investment in each year between 1990 and 1994 for VC-backed ventures. 2. The technological influence of patents granted in the year of the CVC investment to ventures already VC-backed. In line with the intuitions of Alvarez-Garrido and Dushnitsky (2016) and Park and Steensma (2012) of supply-based instruments in venture financing (Bottazzi et al. 2008), our instrumental variable, *3674 Investments*, is the number of investments received by ventures in the semiconductor industry (i.e., SIC 3674). We argue that increasing investments in semiconductor ventures increases the likelihood of a firm to receive CVC in a year, but there is no link between this and the patent’s influence. The first stage also includes such venture characteristics at the time of investment as: *Impact* (count of received citations over the previous three years), *Patents Portfolio* (number of venture patents), *Silicon Valley* (equals one if the venture is located in Silicon Valley), *Start Inventor* (equals one if the venture has an inventor in the top 5% of productivity distribution), and *CVC Previous Investment* (equals one if the venture had a previous CVC investment). These variables are measured with available data at the time of investment, while the patent for which influence is used in the second stage is granted after the investment.

**Model.** The unit of analysis in the first stage is a venture-year. To estimate the likelihood of receiving a CVC investment we use a Probit model with robust standard error (PROC PROBIT, SAS version9.2). Our unit of observation in the second stage is the venture-patent. So, to estimate the effect of *CVC Power on Technological Influence and Technological Impact* we employ an Ordinary Least Squares

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2 We follow logic similar to that of Alvarez-Garrido and Dushnitsky (2016) and Park and Steensma’s (2012). The probability of receiving CVC increases as the number of CVC investments in a particular year increases. However, the exclusion restriction is fulfilled because while the matching between CVCs and new ventures may be endogenous, the availability of CVC investments in that year is not. In other words, while the availability of CVC investments may increase the chances of receiving CVC funding, it is less likely to affect the influence of new venture inventions.
(OLS) estimator (PROC ROBUSTREG, SAS version 9.2) with corrected robust standard errors for two-stage estimation (Karaca-Mandic and Train 2003) as adopted in previous studies (Alvarez-Garrido and Dushnitsky 2016).

**ANALYSIS AND RESULTS**

Table 1 shows descriptive statistics and correlation coefficients. We also run tolerance and variance inflation tests finding no evidence of multicollinearity in our data.

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Insert Table 1 about here
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Table 2 reports the first-stage regression estimates for the likelihood of receiving a CVC investment. The model shows a significantly good fit to our data. Our instrumental variable *Investments* is positive and significant ($z<0.001$), as expected from previous research (Alvarez-Garrido and Dushnitsky 2016).

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Insert Table 2 about here
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Table 3 reports the OLS and second-stage regression estimates. Models 3.1 to 3.4 show results for *Technological Influence*, and models 3.5 to 3.8 show results for *Technological Impact*. Models 3.1, 3.2, 3.5 and 3.6 were estimated with OLS regressions not accounting for selection. Models 3.3, 3.4, 3.7 and 3.8 show 2nd-stage estimates (with robust standard errors corrected for 2SLS estimation procedure; (Karaca-Mandic and Train 2003) taking into account selection of CVC investment introducing the variable *CVC Predicted* as the predicted probabilities estimated in the first-stage, in lieu of CVC. Results across models are consistent. We base our interpretation on models 3.7 and 3.8. In Table 4 models, *CVC Power* is measured on a two-year rolling-window. This operationalization of the corporate investor power over the syndicate accounts for the most recent temporal dynamics of investments since it approximates the power structure in investment rounds close to the patent granting period. In order to explore the
possible effects and implications of these temporal dynamics of syndicate power structure, we replicate Model 3.3 in Table 4 using different time windows, namely from one-to-four years (see results on Table 4).

In model 3.3 and consistent with our priors, the coefficient of \( CVC \) Power is positive and significant (\( b=23.62; p\text{-value}<0.05 \)). Considering the log-transformation in our dependent variable, a 1\% increase in power for a CVC investor implies a 26.6\% increase in the technological influence of the related CVC-backed new venture patent. In contrast to Technological Influence results, estimates of \( CVC \) Power show no significant effect on Technological Impact (Model 3.7). The different results for \( CVC \) Power on influence and impact suggest that \( CVC \) Power increases the indirect effect of a new venture’s invention on future inventive activity but not on the direct citation received by the invention. In other words, when CVCs take a leading role in the syndicate, a backed venture develops inventions likely to open new opportunities for further technological development.

Table 4 reports the model estimates for \( CVC \) Power measured over different time windows. The model number represents the time length of the window used to measure \( CVC \) Power, i.e., Model 4.1 uses a 1-year window, Model 4.2 uses a 2-year window and so on.

Estimates for variables across all models on Table 4 are similar in sign and significance levels to those for Model 3.3 in Table 3. Yet, this is not the case for \( CVC \) Power. The estimates of \( CVC \) Power based on one- and two-year windows are similar in size and significance to those on Model 3.3. However, the three- and four-year windows show smaller estimates and the significance levels drop below the 5\% level. So, \( CVC \) Power maintains its predictive power on Technological Influence for time-window specifications that reflect recent investments, but not for time-window specifications that reflect earlier investment.
To further explore the decreasing effect associated with CVC Power measured on longer windows, we introduce an indicator variable (Distant CVC Investment) that takes a value of 1 when the last CVC investment was made in Year 3 or Year 4 before the year of observation (i.e., patent granting year), 0 otherwise. Distant CVC Investment, together with CVC Power, captures the increase or decrease on CVC Power according to when the investment originated. A negative estimate for Distant CVC Investment indicates that power derived from a recent investment has a larger effect on patent influence than the same power derived from same, but older investment. And In Model 3.8 and consistent with our priors, the coefficient of Distant CVC Investment is negative and significant ($b=-1.80; p$-value<0.05), which suggests that patents granted three or four years after the investment started showing less technological influence than those granted within the first two years of the investment. Therefore, ceteris paribus, the positive effect of CVC Power on Technological Influence is smaller when such power is generated from investments that originated more than two years before the granting of the patent. These results also are consistent across time window specifications and show a drop in the positive effect of CVC Power on Technological Influence the longer the time between the CVC investment and the patent granting (see Figure 1).

Transfer of capabilities between corporation and new venture

Capturing the transfer of capabilities is an elusive task, and extant research has assumed that this transfer explains the effect of different types of investment on new venture performance (Narayanan et al. 2009). To study the effect of transfer of technological capabilities, recent work has compared the effect of CVC on new venture inventive productivity under more and less favorable conditions for the transfer (i.e., colocation of corporation and new venture; (Alvarez-Garrido and Dushnitsky 2016)). We graphically explore the transfer of capabilities in CVC investments and its relation to corporate power in the venture.
syndicate by mapping tracking the technological positions of corporate investor and new venture. This analysis unveils evidence of technological capability transfer directly associated to the inventive process: the ability to build on similar knowledge.

To map firm technological trajectories and following Stuart and Podolny (1996) methodology, we compute the technological distance between firms based on their utilization of technological antecedents and generate a two-dimensional representation utilizing multidimensional scaling. Technological distance is based on backward citation overlap of the firms. This is calculated for the two firms in three consecutive three-year windows (one pre- and two post-CVC investment) from citations on all categories of the new venture’s patents, as defined by Hall et al. (2001). The two-dimensional mapping resulting from those technological distances shows how the technological capabilities of the organizations evolve (Stuart and Podolny 1996): Proximity on the technological map indicates a similarity of inventive process and capabilities, which is captured by the similarity in inputs utilized. For example, when firm A starts utilizing the same technological capabilities of firm B (not necessarily citing B’s patents), we should observe firm A moving closer to firm B on the technological map. This analysis requires both firms to have granted patents in each of the three-year periods, an uncommon inventive productivity for new ventures. For this reason, we expanded our initial sample to include all the new ventures with CVC investments up to year 2000.

Two interesting regularities were found when mapping relative technological position of new ventures and corporations. First, when the corporation has a leading power position in the syndicate, both firms become more similar as their technological positions tend to get closer over time. This is consistent with the argument already advanced that power facilitates the complex transfer of technological capabilities. Second, firms tend to take leading positions for new ventures that are technologically proximate, while it is uncommon to find firms’ leading syndicates where the technological distance is too large. This is consistent with the idea of CVCs investing to acquire power when they perceive opportunity to significantly contribute to the new venture’s technological capabilities (Basu et al. 2015). The
difference between the CVC having a leading position or not becomes evident when comparing the evolution of technologies of Fujistu and Vitesse (Fujistu with leading position) and of Fujistu and Micron Technology (Fujistu without leading position). See Figure 2. The technological distance to Vitesse in the last window is smaller and of similar size to the technological distance between Fujistu in consecutive periods. In addition, both trajectories follow similar directions showing that their capabilities evolve in a parallel manner. In the same vein, the evolution of Micron Technology capabilities does not show a strong convergence to Fujistu’s position as the distance, while getting smaller, still remains several times larger than the distance to Fuji in consecutive periods.

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Insert Figure 2 about here
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The lack of convergence between the new venture and corporation’s technological trajectories is consistent when CVCs do not take a leading position in the investment syndicate. It is common to find patterns, as the one between Micron Technology and Fujistu, where despite new ventures showing a move toward the corporation’s technological capabilities, the distance between the two remains much larger than the change between corporation’s technological positions over time (e.g., National Semiconductor and Synaptics, Fig. 2). It is also common to find the new venture distancing itself from the corporation’s technological capabilities, particularly when corporation and new venture start from similar technological capabilities (e.g., Rockwell International and Micro Linear, Fig. 2).

Finally, in the case of CVC holding lead positions, we find two patterns of technological evolution: 1. The new venture moving toward a mostly static corporation (e.g., Data General and Power Integrations, Fig. 2). 2. Both entities moving together in similar directions (e.g., Dell and Rambus, Fig. 2). While it could be argued that these capabilities already existed in the new venture, we show the capabilities’ activation being associated to the CVC leading position. And this activation reflects, in our view, a transfer of, at least, managerial capabilities associated to R&D.
DISCUSSION

This paper contributes to the growing literature on the effects of corporate venture capital on new ventures by studying how the technological trajectories of CVC-backed ventures differ from those VC-backed only. From a theoretical standpoint, we introduce CVC power in the syndicate as a facilitator of technological capability transfer, which eases the generation of new knowledge (Grant 1996, p. 380). Grounded in the strategic motivation behind CVC (Dushnitsky and Lenox 2006), we draw on “window on technology” as a primary motivation for CVC action (Benson and Ziedonis 2009). In the semiconductor industry, where technology plays a key role in competitive positioning and industry dynamics, studying the evolution of technology based on the collection of granted patents allows us to track the effect of CVC investment on the technological trajectory of new ventures.

It has been well-established that CVC investments are driven by both financial and strategic motivations. Extant literature on the type of financing involved has primarily focused on VC vs. CVC funding. It assumes that investors, due to their financial commitment, would contribute their knowledge and expertise to ensure the new venture’s success (e.g. Alvarez-Garrido and Dushnitsky 2016). We mostly agree because VC and new venture incentives are likely aligned. However, in line with literature focusing on the benefits for investing corporations, we distinguish our position by highlighting that success is defined on the basis of the parent corporation’s metrics and not necessarily that of the new venture, particularly for CVC investors guided by strategic motivations. In other words, CVC investors will support the success of the new venture as long as that success results in positive outcomes for the investing corporation. Therefore, we emphasize the importance of CVC power in the investment syndicate as an indicator of the CVC’s leadership role when studying how CVC investments drive the new venture’s technological influence.

The importance of CVC power as a driver of new venture patent influence can be explained, in general, by the corporate investor’s efforts to balance the opportunity and risk involved in opening new
windows of technology. In fact, when firms engage in CVC investment, they face both opportunities and risks. In knowledge intensive industries, like the semiconductor industry, technology is of foremost importance to sustaining competitive positions; therefore, breakthrough inventions put the current technological position of incumbents at risk of becoming obsolete. For this reason, the investing corporation’s efforts supporting the new venture’s R&D may facilitate the opening of new technological windows, which creates opportunities but also increases the risk of dissipating the corporation’s technological advantage. In mitigating these risks and taking on a CVC investment opportunity, the managerial control stemming from investment syndicate power has a threefold effect. First, it potentially facilitates the complex transfer of capabilities, mostly tacit, between corporation and new venture (Basu et al. 2015, Szulanski 2000). Second, it increases the corporation’s ability to set the new venture’s research agenda (Basu et al. 2015), either to move it toward the technological frontier or away from technologies to potentially render the corporate investor’s technological position obsolete. And finally, it increases the corporate investor’s control over the knowledge and information flows generated from innovative activities. This limits exposure to negative spillovers (for example, knowledge appropriation by the direct firm’s competitors). In line with our priors, we found that CVC power increases the influence of new venture patents. This is consistent with firms using CVC investments to acquire power positions in emerging, new ventures to increase the chances of benefiting from future influential inventions (by greater control over capabilities transfer and spillovers).

From an empirical standpoint, we assessed the effect of CVC investments, and the associated power over the investment syndicate, on the technological influence of the new venture’s patents. An increase in technological influence is associated with inventions that push the envelope, spur new technological areas, are consistent with window on technology motivation, and facilitate the development of new technological arenas (Arthur 2009). We found that CVC power in the syndicate is associated to a larger, venture technological influence, which captures the direct and indirect effects on future inventive activity. However, when we measure the effect of investment and power on technological impact, which
captures only the direct effect of the invention on future inventive activity, we found non-significant associations. This suggests that influence is positively associated to increased inventive activity indirectly linked to the focal patent. This indicates that CVC investment moves the new venture’s technological position toward the technological frontier.

In addition, we found that power originated from older investments has less effect on the new venture’s invention influence. In order words, considering a backed-venture patent, CVC power acquired via investments realized closer to the granting date are associated to higher levels of technological influence than those investments more distant in the past. This “honeymoon effect,” which appears to last two years, may be explained by two characteristics of this industry. On one hand, the semiconductor industry is characterized by very fast-paced technology development; thus, corporate investor interest in a new technological window will fade increasingly fast as new advances move the technological frontier to new areas. This underlies the comment from one of our interviews:

“When investing in a new venture we are not worried of losing money… even if we have to abandon it. We keep working with the new venture as long as the technology is cutting edge… If it is no longer cutting edge we just don’t put any additional effort on the new venture, we let it continue on its own path… even if it is failure” (Investment expert)

In that case, we would expect CVCs to limit their transfer of technological capabilities after a relatively short initial period of interest, with most of the knowledge sharing occurring immediately after the CVC investment. On the other hand, competition in this industry is based on constant technological advancements, so much that CVC investment would be targeted into very pragmatic collaborations (Helper et al. 2000), with a goal to develop complementary technologies to leverage the corporation’s assets. As those collaborations reach their goals, CVC interest would dissipate, as would the transfer of capabilities to the new venture. Taking these positions to the extreme would imply, under specific
circumstances, that the CVC might even push the technological efforts of the new venture away from the technological frontier and towards dead-end technologies. To study this possible strategic perspective on CVC investments is outside the purpose of our paper, but its implications for new ventures and the evolution of technology makes it an interesting venue for future research.

As with all analyses, we should cautiously interpret these results. The semiconductor industry is a well-suited context for this study, but usual generalizability concerns factor in. In addition, the characteristics of the phenomenon under study have imposed limitations on the statistical power of our estimations and technological mapping analysis. Though the semiconductor industry is among those with most CVC activity (e.g. Dushnitsky and Lenox 2005a, b, 2006) and relies the most on patenting (Cohen et al. 2000), new ventures (the ones that are at risk of receiving CVC funding) are granted few patents per year. This, combined with the necessary time to capture the evolution of the venture’s technological trajectories (from 1995 to 2004) and the number of CVC investments, has resulted in a 136-sample observation. Previous research into technology-related topics within the CVC field has encountered a similar empirical challenge (Benson and Ziedonis 2009).

Following recent studies, we utilized a two-stage approach to account for the selection process connected to a CVC engaging in new venture financing decisions (Alvarez-Garrido and Dushnitsky 2015; Park and Steensma 2012). While this identification has been validated to address the endogeneity concern in the CVC selection of a new venture to invest, it cannot account for a CVC selection process that may explain the decision of taking a leading position in the syndicate (namely, CVC power). While the literature has made advances in understanding which ventures would receive CVC investments, our understanding of when the CVC would take a leading position is limited. Our interviews and recent literature (Basu et al. 2015) suggest that this decision is based on information accessed by the CVC during due diligence and through overall strategic considerations. We address this limitation by exploring the transfer of technological capabilities by tracking the movement of firms in the technological space over time. The analysis that follows is consistent with the thesis advanced in so far, and supports the
plausibility of technological capability transfer as a driver of increased influence for the new venture’s inventions.

Regarding the transfer of technological capabilities, we cannot claim any causality in the relationship between CVC investments, technological capability transfer and firm technological trajectories. However, we show that this transfer is a plausible mechanism to explaining the increase in patent influence driven by CVC power over the investment syndicate. One limitation of this analysis is due to the demanding data requirements. Although we expanded our sample, a limited number of new ventures have enough granted patents for us to map their technological trajectory. In this small number, we found a remarkable agreement with our thesis (Eight of nine maps show patterns consistent with our expectations): Technological positions of new ventures and corporate investors get closer over time when the CVC has a leading power position over the syndicate.

In brief, when taken together, our quantitative results and the graphical analysis support the overall thesis of CVC investments driving the new venture toward the technological frontier. The increase in technological influence of new venture invention is associated to CVC power in the syndicate. Power appears to catalyze the transfer of technological capabilities from corporation to new venture. Finally, according to our interviews and technological map analysis -- and consistent with recent work (Basu et al. 2015), power is acquired when corporations see opportunities to which they can contribute with their capabilities, which provides them the ability to transfer those capabilities and limit negative spillovers.

**CONCLUSION**

Our paper contributes to the growing literature on the effects of corporate venture capital on new ventures. Our analysis has targeted how the technological trajectories of CVC-backed ventures differ from the technological trajectories of ventures receiving only VC investments. We explore the role of CVC power as a key facilitator of the corporate investor’s ability to distinctively shape the technological influence of new venture inventions. To do so, we utilize technological influence (Corredoira and
Banerjee 2015), a measure that captures both the direct and indirect effect of an invention on future inventive activity. This allows us to capture how many inventions have directly drawn on the focal patent and gauge the ripple effect the focal patent may have through those inventions on technology evolution. By controlling for a variety of explanatory factors of innovative activity, we found that CVC investments increase the influence of new venture inventions, and this effect is larger when the corporate investor has more power in the investment syndicate. We also found that power derived from recent investments results in larger increases to technological influence than power derived from old investments, suggesting a “honeymoon effect”.

In addition, we utilize a technological mapping technique to explore whether CVC investments result in a transfer of technological capabilities, which are directly associated to the inventive process. To do so, we map the technological positions of the corporate investor and the backed-ventures and track their technological positions over time. The positioning of the firms in the technological space is based on the similarity and dissimilarity of the portfolio of backward citations (i.e., input to new inventions). The utilization of technological antecedents is associated with the type of capabilities the firm possesses: the more similar the antecedents utilized by two firms, the more similar the innovative processes are likely to be. In this way, proximity is associated to similar technological capabilities. This allows us to visually describe how the firms’ technological trajectories evolve.

We found an interesting interplay between CVC investment, the corporate investor’s exposure to competitive pressures, and the transfer of capabilities from CVC and new venture. For example, when the CVC acquires power in the syndicate, it is common to find evidences suggesting a technological capability transfer from corporate investor to new venture. However, when the CVC does not acquire a controlling stake in the investing syndicate, the capability transfer is not clearly evident from the mapping of technological trajectories.

In sum, our study brings to light an intricate relationship in the technological arena between CVC and new ventures. It highlights power over the syndicate as an important aspect to explaining the effective
access and integration of new venture and corporation knowledge. The transfer of technological capabilities appears to be heavily influenced by the CVC’s perceived risks and opportunities. This transfer of capabilities to support new venture movement toward the technological frontier should not be taken for granted. Our results suggest that, by allowing the transfer of technological capabilities and reducing negative spillover, CVC power over the syndicate enables the corporate investor to join the backed-ventures in a co-development effort for new technology. Our graphical analysis presents evidence of transfer of technological capabilities to and from the new venture, more prevalent when the CVC holds leading power over the syndicate. The time dimension adds to the complexity of the relationship, and the effect of power on the new venture’s technological influence is weaker when derived from distant investments, which suggests the “honeymoon effect.”

REFERENCES


TABLES AND FIGURES

Table 1. Correlation Matrix and Descriptive Statistics

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Mean 6.46 0.12 0.01 0.06 15.54 0.48 2.18 0.70 0.32 0.42 0.24 0.03 0.25 0.29 0.46
Std Dev 2.42 0.32 0.02 0.24 11.12 0.31 1.54 0.46 0.47 0.50 0.43 0.17 0.43 0.46 0.50
Minimum 0.26 0.00 0.00 0.00 1.00 0.00 1.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
Maximum 10.84 1.00 0.14 1.00 70.00 1.00 8.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00

Number of Observations = 136. Correlations significant at p-value < 0.05 are in Bold.
Table 2. Probit model (first stage)

| Model 4.1                  | Influence |  |  |  |  
|----------------------------|-----------|---|---|---|---
|                             |           |   |   |   |   
| 5674 Investments           | 0.05 ***  |   |   |   |   
|                            | (0.02)    |   |   |   |   
| Portfolio                  | -0.01     |   |   |   |   
|                            | (0.02)    |   |   |   |   
| Impact                     | 0.00      |   |   |   |   
|                            | (0.00)    |   |   |   |   
| Silicon Valley             | 0.15      |   |   |   |   
|                            | (0.26)    |   |   |   |   
| Prior CVC Investment       | 0.52 **   |   |   |   |   
|                            | (0.25)    |   |   |   |   
| Star Investor              | 0.37 **   |   |   |   |   
|                            | (0.17)    |   |   |   |   
| Model/Chi2                 | 34.83 *** |   |   |   |   
| R^2                        | 0.16      |   |   |   |   

Number Observations = 343

*p-value < 0.10  **p-value < 0.05  ***p-value < 0.01

Standard errors are clustered

Table 3. Regression Models for Influence and Impact

<table>
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<tr>
<th></th>
<th>Influence</th>
<th>Impact</th>
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<th></th>
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<tr>
<td></td>
<td>Model 3.2</td>
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<td>Model 3.5</td>
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<td>Model 3.7</td>
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<td>2.12 ***</td>
<td>2.01 **</td>
<td>-1.00</td>
<td>-1.03</td>
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<td>(0.77)</td>
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<td>(0.64)</td>
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<tr>
<td>CVC Predicted</td>
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<td>1.90</td>
<td>1.84</td>
<td>0.52</td>
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<td>(0.87)</td>
<td>(0.73)</td>
<td>(2.36)</td>
<td>(2.30)</td>
<td>(0.59)</td>
<td>(0.52)</td>
</tr>
<tr>
<td>CVC Power</td>
<td>26.38 **</td>
<td>32.11 ***</td>
<td>23.62 **</td>
<td>25.12 ***</td>
<td>7.92</td>
<td>9.96</td>
</tr>
<tr>
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<td>(14.52)</td>
<td>(11.44)</td>
<td>(10.29)</td>
<td>(7.96)</td>
<td>(10.34)</td>
<td>(8.97)</td>
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<td>Distant CVC</td>
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<td>-1.80 **</td>
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<td>-0.73</td>
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<td>0.04 **</td>
<td>0.04 **</td>
<td>0.04 **</td>
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<td>(0.02)</td>
<td>(0.02)</td>
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<td>0.56</td>
<td>0.57</td>
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<tr>
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<td>(0.68)</td>
<td>(0.64)</td>
<td>(0.29)</td>
<td>(0.29)</td>
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<tr>
<td>Number of Inventors</td>
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<td>0.38 ***</td>
<td>0.39 ***</td>
<td>0.37 ***</td>
<td>0.18</td>
<td>0.17</td>
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<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.06)</td>
<td>(0.06)</td>
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<tr>
<td>Star Investor</td>
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<td>0.73</td>
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<td>0.35</td>
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<td>1.57 ***</td>
<td>1.68 ***</td>
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<td>(0.65)</td>
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<tr>
<td>Class 438</td>
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<td>1.91 ***</td>
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<td>1.81 ***</td>
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<td>(0.68)</td>
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</tr>
<tr>
<td>Years 96-91</td>
<td>0.27</td>
<td>0.35</td>
<td>0.25</td>
<td>0.40</td>
<td>0.94</td>
<td>0.97</td>
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<td>(0.53)</td>
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</tr>
<tr>
<td>Years 92-93</td>
<td>-0.66</td>
<td>-0.59</td>
<td>-0.72</td>
<td>-0.58</td>
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<td>(0.53)</td>
<td>(0.26)</td>
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</tr>
</tbody>
</table>

Number Observations = 136  *p-value < 0.10  **p-value < 0.05  ***p-value < 0.01

CVC for 2nd stage is the predicted probability of the pooled probit from the 1st stage.

Errors corrected for 1st stage estimation.

Standard errors are in parentheses.
### Table 4. Regression Models for Influence and Power Calculated for Different Time Windows

<table>
<thead>
<tr>
<th>Influence</th>
<th>Model 4.1</th>
<th>Model 4.2</th>
<th>Model 4.3</th>
<th>Model 4.4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intercept</strong></td>
<td>2.08 ***</td>
<td>2.12 ***</td>
<td>2.03 **</td>
<td>2.02 **</td>
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<td></td>
<td>(0.75)</td>
<td>(0.76)</td>
<td>(0.78)</td>
<td>(0.78)</td>
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<tr>
<td><strong>CVC Predicted</strong></td>
<td>1.94</td>
<td>1.90</td>
<td>2.41</td>
<td>2.53</td>
</tr>
<tr>
<td></td>
<td>(2.13)</td>
<td>(2.36)</td>
<td>(2.63)</td>
<td>(2.52)</td>
</tr>
<tr>
<td><strong>CVC Power</strong></td>
<td>24.30 ***</td>
<td>23.62 **</td>
<td>16.46</td>
<td>16.82</td>
</tr>
<tr>
<td></td>
<td>(6.92)</td>
<td>(10.29)</td>
<td>(11.35)</td>
<td>(11.24)</td>
</tr>
<tr>
<td><strong>Claims</strong></td>
<td>0.04 **</td>
<td>0.04 **</td>
<td>0.04 **</td>
<td>0.04 **</td>
</tr>
<tr>
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<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.02)</td>
</tr>
<tr>
<td><strong>Adj. Originality</strong></td>
<td>0.63</td>
<td>0.65</td>
<td>0.77</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>(0.67)</td>
<td>(0.68)</td>
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<td>(0.67)</td>
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<tr>
<td><strong>Number of Inventors</strong></td>
<td>0.41 ***</td>
<td>0.39 ***</td>
<td>0.39 ***</td>
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<td>(0.11)</td>
<td>(0.11)</td>
<td>(0.11)</td>
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<tr>
<td><strong>Star Inventor</strong></td>
<td>0.57</td>
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<tr>
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<td>(0.50)</td>
<td>(0.50)</td>
<td>(0.50)</td>
</tr>
<tr>
<td><strong>Class 257</strong></td>
<td>1.50 ***</td>
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<td>1.63 ***</td>
<td>1.62 ***</td>
</tr>
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<td>(0.55)</td>
<td>(0.56)</td>
<td>(0.56)</td>
<td>(0.56)</td>
</tr>
<tr>
<td><strong>Class 326</strong></td>
<td>2.09 ***</td>
<td>2.14 ***</td>
<td>2.21 ***</td>
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<td>(0.62)</td>
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</tr>
<tr>
<td><strong>Class 438</strong></td>
<td>1.71 **</td>
<td>1.74 **</td>
<td>1.73 **</td>
<td>1.73 **</td>
</tr>
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<td>(0.68)</td>
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<tr>
<td><strong>Years 90-91</strong></td>
<td>0.34</td>
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<tr>
<td><strong>Years 92-93</strong></td>
<td>-0.71</td>
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</tbody>
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**Time Window for CVC Power**

<table>
<thead>
<tr>
<th>1yrs</th>
<th>2yrs</th>
<th>3yrs</th>
<th>4yrs</th>
</tr>
</thead>
</table>

Number Observations = 136. *p-value < 0.10  **p-value < 0.05  ***p-value < 0.01

CVC for 2nd stage is the predicted probability of the pooled probit from the 1st stage.

Errors corrected for 1st stage estimation.

Standard errors are in parentheses.
Figure 2. Technological Maps for New Ventures and Corporations

VTS: Vitesse Semiconductor Corp.
MNT: Micron Technology Inc.
FUJ: Fujitsu Ltd.

SNP: Synaptics Inc.
NSC: National Semiconductors Corp.
INT: Intel Capital Corp.
MLC: Micro Linear Corp.
ROC: Rockwell International

DAT: Data General Corp.
PII: Power Integrations Inc.
INT: Intel Capital Corp.
COM: Compaq Corp.
SYN: Synergy Semiconductors Corp.

FUJ has a leading position in syndicate
FUJ does not have a leading position in syndicate

NSC does not have leading position in syndicate
ROC does not have a leading position in syndicate

DAT has a leading position in syndicate
COM does not have a leading position in syndicate

RAM: Rambus Inc.
DLL: Dell Ventures
INT: Intel Capital Corp.