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CVC Funding and Technological Evolution: Corporate Investor Power over the Syndicate and Technological Influence of New Venture’s Inventions

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Abstract
How the interaction of incumbents and new ventures drives economic growth has been at the center of attention since early Schumpeter’s work. In this paper, we focus on whether corporate investment moves the technological position of the new venture toward the technological frontier or not. In particular, we argue that CVC acquisition of power over the syndicate facilitates the transfer of capabilities to the new venture and that in turn helps the new venture to generate more influential inventions. Based on semiconductor industry data from 1985 to 1995 and after accounting for selection on the CVC investment process, our regression results show that the power of the CVC over the syndicate is associated to new venture’s inventions with more influence on the evolution of technology. In addition, the effect decreases when power 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 mostly associated to CVC power over the syndicate. While less frequent, we also found evidence of the transfer of technological capabilities from new venture to corporation. Interestingly, we did not find strong evidence of transfer of technological capabilities when CVC investors do not hold leadership position in the syndicate.

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ABSTRACT

How the interaction of incumbents and new ventures drives economic growth has been at the center of attention since early Schumpeter’s work. In this paper, we focus on whether corporate investment moves the technological position of the new venture toward the technological frontier or not. In particular, we argue that CVC acquisition of power over the syndicate facilitates the transfer of capabilities to the new venture and that in turn helps the new venture to generate more influential inventions. Based on semiconductor industry data from 1985 to 1995 and after accounting for selection on the CVC investment process, our regression results show that the power of the CVC over the syndicate is associated to new venture’s inventions with more influence on the evolution of technology. In addition, the effect decreases when power 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 mostly associated to CVC power over the syndicate. While less frequent, we also found evidence of the transfer of technological capabilities from new venture to corporation. Interestingly, we did not find strong evidence of transfer of technological capabilities when CVC investors do not hold leadership position in the syndicate.

INTRODUCTION

The crucial role of entrepreneurial ventures in supporting economic growth has been well established since Schumpeter’s early work. A core aspect of “the gales of creative destruction” driving an existing industry into obsolescence (Schumpeter 1942) is the evolution of the technology on which the industry is built on. Examples of technological inventions qualitatively transforming whole industries are
abundant; suffice to mention the laser, Intel’s microprocessor, or Google’s search algorithm. The Schumpeterian rents from the ownership of transformative technology (Winter 1995) are a major goal for incumbents and new entrants, and what drives their search for novel and influential inventions. The interplay between large firms and new entrants has long been at the center of the literature of innovation and entrepreneurship since early Schumpeter’s work (1934, 1942). Over time arguments have developed into a complementary framework where new ventures and large incumbents collaborate with each other relying on different governance options for the creation of innovative ideas, new products, and the evolution of technology (Arrow 1962, Teece 1986).

The idea of complementarities on innovation between internal resources and external knowledge sourcing has motivated a large body of research on strategic alliances and joint ventures (e.g. Baum et al. 2000) and mergers and acquisitions (e.g. Ahuja and Katila 2001) as external knowledge source strategies. Recently and as an alternative to these strategies, Corporate Venture Capital (CVC), i.e., established firms’ investments in privately held entrepreneurial ventures (Gompers and Lerner 2000) has emerged as a valid approach to balance the firm’s portfolio of technology-sourcing strategies (Van de Vrande 2013). On the one hand, CVC investments benefit the corporation by providing systematic access to new entrepreneurial ventures technological capabilities, which complement the internal Research and Development (R&D) activities of established firms. For example, CVC investments a) increase corporation’s innovative output (Chesbrough 2002, Dushnitsky and Lenox 2005, Wadhwa and Basu 2013, Wadhwa and Kotha 2006) and acquisition performance of a portfolio company (Benson and Ziedonis 2009), b) create significant firm value (Dushnitsky and Lenox 2006), c) enhance explorative learning (Schildt et al. 2005), and d) promote recognition of discontinuous change (Maula et al. 2012). On the other hand, CVC investments also benefit the new venture by providing financial resources and access to complementary-assets. For example, CVC investments increase new venture’s likelihood of a) going public and having higher IPO-value (Cumming 2008, Gompers and Lerner 2000, Maula and Murray 2001), and b) achieving higher innovative output (Alvarez-Garrido and Dushnitsky 2015). This positive influence of corporate investors on the new venture’s performance has been explained based on complementary asset arguments. In fact, unlike traditional venture capital (VC) that 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-
2012).

This paper is a first attempt to unveil how CVC investments affect the ability of startups to drive
the evolution of technology. Despite these advances on the implications of CVC investments for both
corporate investors and backed-ventures, it is still unclear how CVC may be associated with the
technological development of start-ups receiving the investment. As stated by Alvarez-Garrido and
Dushnitsky (2015, p. 2). we know little about the ways in which CVC’s are associated with different
start-up innovation trajectories. Hence, we know little about how CVC may be facilitating or hindering
the startup’s development of technological breakthroughs, which are the type of inventions on which
transformative innovation builds on.

A growing body of research analyzes how organizations increase their competitive edge and
performance by leveraging new technology acquisition and the access to windows on future technology
(Benson and Ziedonis 2009, Sears and Hoetker 2014) . We extend this research into the realm of new
ventures by asking: do CVC’s investment in entrepreneurial new ventures propels the venture’s
inventions toward the technological frontier? To do so, we address the issue of whether entrepreneurial
ventures backed by corporations generate inventions with higher technological influence. In this effort,
we also uncover evidence of the transfer of technological capabilities between new venture and corporate
investor, which suggest a bidirectional and co-developmental nature for this governance structure.

Building on the thesis of CVC investments driven by financial and strategic motives (Chesbrough
2002, Dushnitsky and Lenox 2006), we pay particular attention to how the power obtained from and the
timing of CVC investments in a syndicate relate to the technological influence of the venture’s invention
(Corredoira and Banerjee 2015). Utilizing semiconductor industry data on inventions and venture capital
investments from 1985 and 1995 and after accounting for CVC investment selection (Alvarez-Garrido
and Dushnitsky 2015, Park and Steensma 2012), our results show that the power of a corporate investor
over a syndicate is significant in explaining the technological influence of the backed startups’ patents.
And, in what appears to be a “honeymoon effect”, the influence of power decreases as the initial
investment becomes older. To further explore the possible foundations of this effect, we also conducted a
graphical analysis plotting the evolution of the technological positions over time for the dyad CVC-
venture following Stuart and Podolny’s methodology (1996). This analysis shows patterns supporting
bidirectional transfer of technological capabilities between CVCs and entrepreneurial ventures. These patterns are consistent with our argument about CVC’s financial and strategic motivations and the distribution of power in the syndicate.

In conclusion, our study uncovers an interesting, and more complex than usually assumed, relationship between new ventures and corporate investors. This paper highlights CVC power on a syndicate, measured as the relative financial commitment to the invested venture, as a relevant aspect to understand the ventures technological influence. This association rests on two main aspects: i) the decision to gain control on syndicates of ventures with potentially for larger influence inventions, and ii) the transfer of technological capabilities that increase the ability of a venture to develop influential inventions.

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

While inventions per se are not what disrupt industries and markets, the ways in which they are incorporated in products and services do. And, this is where the relevance of technological evolution comes from. 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 others cases, they do so by actually changing the realm of possibilities and giving raise to new needs (Arthur 2009). For these reasons, we focus the attention on a specific aspect of the new venture innovative process: the inventive capability. Alvarez-Garrido and Dushnitsky (2015) have shown that CVC backing improves the new venture’s inventive productivity under certain conditions. Among the assets a corporate investor can share with and transfer to its portfolio companies, technological capabilities play an important role in explaining how CVC-backed ventures perform in terms of inventive activity. As posed by Arthur (2009), the value of technology is not only what can be built with it, 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 and 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 or not, we utilize the collection of existing inventions captured in granted patents, i.e., the technology corpus. There are limits to what can be solved by the technology corpus, and we consider those limits the technological frontier. An invention becomes influential when it is able to open new opportunities to provide solutions outside the realm of what it is possible; 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 (De Solla Price 1986).

The technology corpus is particularly well suited to study how CVC-funding may affect 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 (for example, 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 allow us tracking its evolution and assessing how much successive technological developments built on each invention (Arthur 2009; Corredoira 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 ventures’ invention (under the assumption that CVCs can potentially improve the technological capabilities and modify the choices of entrepreneurial ventures).
THEORY

While we approach this paper in a more exploratory manner, and for that reason we do not advance formal hypotheses, we have priors that have been derived from extant literature. We describe them in this section.

The literature on CVC has studied the corporate venture financing of new ventures from mainly three standpoints (Yang et al. 2009): i) what drives the creation CVC units and their investment decisions (e.g., Dushnitsky and Lenox 2006; Dushnitsky and Lenox 2005; Gaba and Bhattacharya 2012), ii) what drives ventures into accepting CVC backing and how that affects the venture’s performance (e.g., Dushnitsky and Shaver 2009; Gompers and Lerner 1999; Maula and Murray 2002), and iii) how CVC structures and systems affect the CVC effectiveness (Basu et al. 2015; Birkinshaw and Hill 2003; Chesbrough 2002; Garud et al. 2002; Zahra and Covin 1995).

Despite the size of this growing body of research, less attention has been paid to the 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 2001), only recently organizational scholars’ attention shifted toward the strategic implications for the CVC-backed ventures (e.g. Basu et al. 2015). In particular, there is a void of evidence about how CVC programs affect the technological performance and technological trajectory evolution of the new venture. A notable exception is the study of Alvarez-Garrido and Dushnitsky (2015), in which the authors explore how the access to strong complementary assets for innovation affects CVC-backed ventures’ patenting and scientific publication activities. In their study, 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 2015, p. 2). Understanding this aspect of CVC financing is of particular relevance since it lies on the foundations of CVC as governance structure. For new ventures, edging the evolution of the technological frontier within an industry is of primary importance to survive and succeed 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).

As per our discussion above, a main motive driving CVC investments in entrepreneurial ventures is gaining a window on new technologies (e.g. Benson and Ziedonis 2008a). CVC managers usually refer themselves as the corporation’s explorers in search for the next technology that will give the firm a competitive edge. The CVC’s pursuit of “a window on technology” goal is the underlying assumption behind 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 CVC has shown that granting access to the corporation’s technological assistance, technical and market expertise are associated with an increase in new venture inventive productivity and venture opportunities nurturing (Alvarez-Garrido and Dushnitsky 2015, 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 of the 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. And this is even more evident when considering the transfer of technological capabilities from the corporate investor to the new venture. An exception is Alvarez-Garrido and Dushnitsky’s (2015) work supporting the role of geographic proximity as a facilitator of transfer of capabilities to boost the venture’s inventive productivity. Therefore, our understanding of transfer of capabilities between corporation investor and venture is very limited. It is not clear whether this technological capabilities transfer is limited to a boost on inventive productivity or it rather reaches other aspects associated to inventive activities, for example organizational inventive routines.

**CVC Power and the CVC-New Venture Relationship**

As we have 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 pushing the technological frontier. Technological capabilities transfer from an investing corporation to the new venture is a phenomenon supported by recent literature (Basu et al. 2015). However, results from Alvarez-Garrido and Dushnitsky (2015) suggest that this transfer may only occur under certain conditions. As the literature has shown, 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 investments significantly increases several corporation performance outcomes (Benson and Ziedonis 2009, Dushnitsky and Lenox 2006, Maula 2007, Schildt et al. 2005). And this is mainly explained by the access to new technological developments of young firms (Chesbrough 2002, Wadhwa and Basu 2013). In this respect, the success of the new venture may reflect in (a) new rent generation for the corporation and (b) the achievement of the strategic intent driving the CVC investments. In this scenario, the corporation’s commitment to support the new venture success is shown by the power acquired by the CVC, as much as 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 becomes a reflection of 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 corporation’s commitment, it also shows CVC control over the new venture. Larger stakes in a 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 are associated 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). There are three ways in which CVC’s 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 venture (Basu et al. 2015; Maula et al. 2009). One of the implications of this research is that corporate investors utilize strong leading position in syndicates in order to successfully manage the complex interactive process with the portfolio company. And, organizational integration impose higher demands on CVC governance structure when knowledge-based assets and tacit knowledge have to be transferred. Second, control implies 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: i) capture a greater value out the CVC investment, ii) collecting higher returns from the transfer and utilization of assets – including technological capability, and iii) appropriating greater value from the access to new technological windows. Nonetheless, influential inventions have the 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; Basu et al. 2015; Dushnitsky and Shaver 2009). Finally, control makes possible to limit negative spillovers. By having decision making and operational control, the CVC can limit the sharing of information the new venture may engage with competitors.

This brings us to our main point: financial commitment of the CVC in a syndicate (i.e., CVC power) may become a crucial strategic condition for the firms when considering the transfer of technological capabilities in CVC investments. As discussed above, a larger CVC power increases its ability to transfer technological capabilities to the venture, gives it more control over what is done with the transferred technology, and enhance the ability to capture the benefits from that transfer. This combination of control and commitment over resources, capabilities and assets transfer will generate the conditions with the potential for a CVC investment to promote an influential inventive process. It should
be noted, that we do not see power as the mechanism by which the transfer of capabilities occurs, but rather as the catalyst of this transfer. From the corporate investor standpoint, what is important is not the 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 would expect corporations to acquire dominant positions in their CVC-backed ventures’ syndicate only when they see opportunities to access and feel capable to contribute to generate novel technology.

In sum, CVC power enables the corporation’s utilization of the investment as a “window on technology.” It also limits the risk of new venture’s hurtful spillovers affecting the corporation’s competitive position. These are conditions that favor the transfer of assets and capabilities, when technology capabilities are at the core of the CVC-venture collaboration success. For these reasons, we expect to find a positive association between CVC power in the syndicate and the influence of venture’s inventions. However, as time goes by and the “window on technology” motivation wears out, so do the related-risk. As a result, the corporation’s attention will drift to different technological areas. Thus, we would expect a drop in the technological influence of the venture as the leveraging of assets motivation increases in relative importance.

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. We have emphasized the transfer of capabilities from the parent corporation to the new venture. This has leaded us to focus on the technological influence of the new venture inventions. The relative small number of new venture inventions and the overwhelming influence that transferring technological capabilities from a corporation to a small venture justifies this choice. However, we are not negating that corporations can also learn from the new venture, which is one of the reasons for CVCs to exist and new ventures hesitate into engaging 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 the technological position and capabilities of a firm (Stuart and Podolny 1996). In this case, we expect the transfer of technological capabilities between corporation and new venture to be reflected in shorter 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. Both types of learning should be facilitated by CVC power over the syndicate, and the direction of the transfer is likely to be driven by the parent corporation’s motivation and ability to transfer and receive technological capabilities.

METHODOLOGY

Data. We collected semiconductor industry patents and new ventures financing data. Patent information is gathered from granted patents by United States Patents and Trademark Office (USPTO) obtained from National Bureau of Economic Research (NBER) U.S. Patents Citation Data file (Hall et al. 2001). Despite the limitations that patent data present (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 (citations) of their inventive outcome (i.e. patents) (Stuart and Podolny 1996).

Data on the venture financing are drawn from VentureXpert, a comprehensive database on venture investments that is widely used in previous research (e.g. Alvarez-Garrido and Dushnitsky 2015, Dushnitsky and Lenox 2005a, b, Park and Steensma 2012). VentureXpert collects data on new ventures and their financing information; among others, investors and amount raised. It includes information on the composition of the syndicate for each round of investment in every year for each founded venture along with the classification in types of investors, which are important information for the purpose of our study.

Sample. The sample includes all the 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. This results in a total of 154 firms. We collected all the patents granted to those firms with granting dates between 1990 and 1995 result in a dataset of around 11,500 patents. Information for all firms that designed or manufactured semiconductor devices was obtained from databases compiled by ICE and Dataquest, two private research firms specializing in semiconductor industry analysis, for the period 1980–1995. We collected all the VC and CVC investments to those 154 firms over the period 1985-1995. We identified 31 CVC investors, of which 9 part of our semiconductor sample. In total, 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 is composed by 136 patents granted over the period of observation to the new ventures 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 on each 3-year period between 1985 and 1995. The 39 firms receiving funding are all 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 in the evolution of the technology than being cited by a patent that receives no citations. This paper utilizes a measure of patent influence on technological evolution (Corredoira and Banerjee 2015) that improves over the impact measure, usually utilized in the literature, by including not only the direct citations but also indirect citations to the patent over a window of 10 years. Due to patent law 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 topology of the citation tree and the number of citations that are part of it (Corredoira and Banerjee 2015).

*Patent Influence* is calculated from the a-centrality of each focal patent in the network of citations as:

$$x = (I - \alpha A^T)^{-1} e$$

Where $x$ is a vector of a-centralities (which is equal to *Patent Influence* plus 1), $I$ is the identity matrix, $\alpha$ is the attenuation factor, $A^T$ is the transpose of the adjacency matrix (with patents as nodes and citations as edges), and $e$ is a vector of ones (which captures the contribution of each patent to technology) (Bonacich and Lloyd 2001). Following Corredoira and Banerjee (2015), 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 over the 10 years window following the granting of the patent. To anchor our results to extant patent
literature, we also run models with *Impact*, the count of direct citations over the same time window, as the dependent variable.

**Independent variable: CVC Power.** In order to capture the relative power a corporate investor may have over a new venture, 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. Our assumption is that investor’s power in a syndicate derives from how concentrated the investment is. For the investments’ concentration we compute the *Syndicate Herfindahl Index (SHI)* as:

\[
SHI_{i,t} = \frac{\sum_{j=1}^{k}(investment_{j,t})^2}{\left(\sum_{j=1}^{k}investment_{j,t}\right)^2}
\]

where *investment*$_{j,t}$ is the equity investment done by the investor *j* in the time *t* in the venture *i*. This index has values from 0 to 1 for each year, where: 0 indicates that each investor invests the same equity amount in year *t*; 1 indicates maximum concentration, which implies that the total equity invested in *t* comes from one investor. For the investors’ ranking we compute *Syndicate Investor Ranking (SIR)* as:

\[
SIR_{i,j,t} = \frac{investment_{j,t}}{\max(investment_{t})}
\]

where *investment*$_{j,t}$ is the equity investment done by the investor *j* in the year *t* in the venture *i*, and *max(investment)*$_{t}$ is the greatest equity investment received by the venture *i* in time *t*. The SIR indicator varies for each investor of each syndicate in each time, and it takes values from 0 to 1 for each year, where: 0 indicates that an investor invests no equity amount in year *t*; 1 indicates maximum ranking, which implies that the equity investment of the investor *j* is the greatest in time *t*.

Then, for each investor we generate the variable *Power*, which is the product between *SHI* and *SRI*. Combining these two aspects of financing new ventures, we are able to capture the evolution across time of the power structure for each venture’s investment both at the level of the syndicate (with the *SHI*) and at the level of each individual investor (with *SRI*). For example: for the same level of *SHI*, two investors can have different value of *SRI* implying different level of power within the syndicate; or, for the same level of *SRI* for an investor across two different times, that investor can have a different levels of *Power* due to different investment concentration values (*SHI*) of the two times of investments.

Finally, from *Power* we generate our main independent variable *CVC Power*, which is built as follows:
The investment value of each investor in each time $t$ is the cumulated value of equity invested up to time $t$, and it is computed in moving time-windows from two to five years of observation. This is done to capture 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 syndicate’s investors active 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, technological and time trends 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) 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 5 dummy variables to control for unobserved effects associated with each year of observation, and 4 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 a corporate investor power within 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-stages model to account for the selection on the CVC decision to invest.

Following Alvarez-Garrido and Dushnitsky (2015), 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 (2015) and Park and Steensma
(2012) of supply-based instruments in venture financing (Bottazzi et al. 2008), our instrumental variable is the number of investments received by ventures in the semiconductor industry (i.e., SIC 3674). We argue that more investments in semiconductor ventures increase the likelihood of a firm to receive CVC in a year, but there is no link between it and the patent’s influence\(^1\). The first stage also includes such venture’s 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 all 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 Power CVC on Technological Influence and Technological Impact we employ an Ordinary Least Squares (OLS) estimator (PROC ROBUSTREG, SAS version9.2) with corrected robust standard errors for two-stage estimation (Karaca-Mandic and Train 2003).

**ANALYSIS AND RESULTS**

Corporate investor power and venture technological influence

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

---

\(^1\) We follow a similar logic to Alvarez-Garrido and Dushnitsky (2015) and Park and Steensma’s (2012) one. The probability of receiving CVC increases as the number of CVC investments in a particular year increase. However, the exclusion condition is fulfill because while the matching between CVCs and new ventures may be endogenous, the availability of CVC investments on 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.
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 CVC Availability is positive and significant (z<0.001), as expected from previous research (Alvarez-Garrido and Dushnitsky 2015).

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 on CVC investment introducing the variable CVC Probability 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 models in Table 4, Power CVC is measured on a 2-year rolling-window; in other words. This operationalization of CVC 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 this temporal dynamics of syndicate power structure, we replicate Model 3.7 in Table 4 using different time windows, namely from one to four years (see results on Table 4).

In model 3.7 and consistent with our priors, the coefficient of Power CVC is positive and significant (b=23.62; p-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’s patent. In contrast to Technological Influence results, estimates of Power CVC do not show a significant effect on Technological Impact (Model 3.3). The different results for Power CVC on influence and impact suggest that Power CVC increases the indirect effect a new
venture’s invention has 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 Power CVC measured over different time windows. The model number represents the time length of the window used to measure Power CVC, i.e., Model 4.1 uses a 1-year window, Model 4.2 uses a 2-year window and so on.

<table>
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<th>Insert Table 4 about here</th>
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Estimates for all variables across all models on Table 4 are similar in sign and significance levels to those for Model 3.7 in Table 3. Yet, this is not the case for CVC Power. The estimates of Power CVC based on 1- and 2-year windows are similar in size and significance to those on Model 3.7. However, the 3- and 4-year windows show smaller estimates and the significance levels drops below 5% level. So, Power CVC maintains its predictive power on Technological Influence for time-windows specifications that reflect recent investments, but not for time-windows specifications that reflect earlier investment.

In order to further explore the decreasing effect associated with Power CVC 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 on years 3 or 4 before the year of observation (i.e. patent granting year), 0 otherwise. Distant CVC Investment, together with Power CVC, captures the increase or decrease on Power CVC according to when the investment was originated. A negative estimate for Distant CVC Investment indicates that power derived from a resent investment has a larger effect on patent influence than the same power derived from same, but older investment. Consistent with our priors in Model 3.8, 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 show less technological influence than those granted within the first two years from the investment. Therefore, ceteris paribus, the positive effect of Power CVC on Technological Influence is smaller when such power is generated from investments that originated more than 2 years before the granting of the patent. These results are also consistent across time windows specifications and show a drop in the positive effect of CVC Power on
Technological Influence the longer is the time distance between the year of the CVC investment and the patent granting years (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 is what explains the effect of different type of investments on the performance of the new venture (Narayanan et al. 2009). To study the effect of transfer of technological capabilities, recent work has compared the effect of CVC on new venture’s inventive productivity under more and less favorable conditions for the transfer. (i.e., colocation of corporation and new venture) (Alvarez-Garrido and Dushnitsky 2015). We graphically explore the transfer of capabilities in CVC investments, and its relation to corporate power in the venture syndicate, by mapping the technological positions of corporate investor and new venture over time. 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 2-dimensional representation utilizing multidimensional scaling. Technological distance is based on backward citations overlap of the firms. This is calculated for the two firms over three consecutive 3-year windows (one pre- and two post-CVC investment) from citations on all the categories of the new venture’s patents, as defined by Hall et al. (2001). The 2-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 a firm A starts utilizing the same technological capabilities of a 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 one of the 3-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 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 about power as facilitator of 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 the opportunity to significantly contribute to the new ventures technological capabilities (Basu et al. 2015).

The difference between the CVC having a leading position or not become evident when comparing the evolution of technologies of Fuji and Vitesse (Fuji with leading position) and of Fuji and Micron Technology (Fuji 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 Fuji in consecutive periods. In addition, it can be seen that both trajectories follow similar directions showing that their capabilities evolve in a parallel manner. On the same vein, the evolution of Micron Technology capabilities does not show a strong convergence to Fuji’s position as the distance, while getting smaller, still remains several times larger than the distance between Fuji in consecutive periods.

The lack of convergence between new venture and corporation’s technological trajectories is consistently found 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 Fuji, 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 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.
Finally, in the case of CVC holding leading positions, we find two patterns of technological evolution: i) new venture moving toward a mostly static corporation and ii) both moving together in similar directions. 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**

In this paper we contribute 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 ease the generation of new knowledge (Grant 1996, p. 380). Grounded on the strategic motivation behind CVC (Dushnitsky and Lenox 2006 ), we draw on the window on technology as a primary motivation for CVC’s actions (Benson and Ziedonis 2008b). In the semiconductor industry, where technology plays a key role for the 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 investments on the technological trajectory of the new ventures.

It has been well-established that CVC investments are driven not only by financial but also strategic motivations. Extant literature on the type of financing 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. We mostly agree with this statement because VC and new venture’s incentives are likely to be aligned. However, in line with the literature focusing on the benefits for investing corporations, we distinguish our position by highlighting that, particularly for CVC investors guided by strategic motivations, success is not necessary defined based on new venture’s but on parent corporation’s metrics. In other words, CVC investors will support the success of the new venture as long as that success results on positive outcomes at the investing corporation. Therefore, we emphasize the importance of the 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’s patent influence can be explained, in general, by the corporate investor’s efforts to balance the opportunities and risks involved in opening new
windows of technology. In fact, when firms engage in CVC investments, they face both opportunities and risks. In knowledge intensive industries, as the semiconductor industry is, technology is of foremost importance to sustain competitive positions; therefore, breakthrough inventions put the current technological position of incumbents at risk of becoming obsolete. For this reason, investing corporation’s efforts support the new venture’s R&D efforts may facilitate the opening of new technological windows, which creates opportunities but also increase the risk of dissipating the corporation’s technological advantage. To mitigate these risks and take on the opportunities of a CVC investment, the managerial control stemming from investment syndicate power has a threefold effect. First, it has the potential to facilitate the complex transfer of capabilities, mostly tacit, between corporation and the new venture (Basu et al. 2015; Szulanski 2000). Second, it increases the ability of the corporation to set the new venture’s research agenda (Basu et al. 2015), either to move it toward the technological frontier or away from technologies that may 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 the innovative activities. This limits the exposure to negative spillovers (for example, knowledge appropriation by 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 and, consistent with the window on technology motivation, 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 that investment and power have 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 is an indication that CVC investment moves the new venture’s technological position toward the technological frontier.
In addition, we also 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 level of technological influence than those investments more distant in the past. This “honeymoon effect”, which appears to last 2 years, may be explained by two characteristics of this industry. On the one hand, semiconductor is an industry with very fast-paced technology development, thus, corporate investor’s interest in a new technological window will fade faster as new advances will move the technological frontier to new areas. This underlies in the comment from one of our interviews: our interviewed investment expert:

“We investing on 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 limiting 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 CVCs investments would be targeted into very pragmatic collaborations (Helper et al. 2000), with the goal of developing complementary technologies to leverage the corporation’s assets. As those collaborations reach their goal, the interest of the CVC would dissipate and with it, 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 but rather towards dead-end technologies. To study this possible strategic perspective on CVC investments is out of 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 be cautious with the interpretation of our results. The semiconductor industry is a well-suited context for this study but usual generalizability concerns remain, In addition, the characteristics of the phenomenon under study have imposed limitations on the statistical power of our estimations and technological mapping analysis. While the semiconductor industry is
amongst the ones with most CVC activity (Dushnitsky and Lenox 2005) and relies the most on patenting (Cohen et al. 2000), still 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 sample of 136 observation. Previous research interested in the technology-related topics within the field of CVC have encountered a similar empirical challenge (Benson and Ziedonis 2009).

Following recent studies, we utilized a two-stage approach to account for the selection process a CVC engages in new ventures’ 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 overall CVC’s strategic considerations. We address this limitation by exploring the transfer of technological capabilities by tracking the move 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, while we cannot claim any causality in the relationship between CVC investments, technological capability transfer and firm technological trajectories, we show that this transfer is a plausible mechanism to explain the increase in patent influence driven by CVC power over the investment syndicate. One of the limitations 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 to map their technological trajectory. In this small number, we found a remarkable agreement with our thesis: 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’s invention is associated to the power of the CVC in the
syndicate. Power appears to act as a catalyzer of the transfer of technological capabilities from
corporation to new venture. Finally, according to our interviews and the 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 aimed to study how the technological trajectories of CVC-backed ventures
differ from those receiving only VC investments. We explore the role of CVC power the as a key
facilitator of the corporate investor’s ability to distinctively shape the technological influence of new
venture’s inventions. To do so, we utilize technological influence (Corredoira and Banerjee 2015), a
measure that captures not only the direct but also the indirect effect of an invention on future inventive
activity. This allows us to capture how many inventions have directly drawn on the focal patent, but also
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 the 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 on technological influence than power derived from old investments, proposing
the idea of the “honeymoon effect”.

In addition, we also utilize a technological mapping technique in order to explore whether CVC
investments result into 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 position 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 over time.
We found an interesting interplay between CVC investment and the corporate investor’s exposure to competitive pressures, and the transfer of capabilities from CVC and new venture. For example, when CVC acquires power in the syndicate, it is common to find evidences suggesting a technological capability transfer from the corporate investor to the 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 explain the effective access and integration of new venture and corporation’s 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 the new venture’s 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, the effect of power on the new venture’s technological influence is weaker when derived from distant investments, which suggest a “honeymoon effect.”
Table 1. Correlation Matrix and Descriptive Statistics

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<th>V.1</th>
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<th>V.3</th>
<th>V.4</th>
<th>V.5</th>
<th>V.6</th>
<th>V.7</th>
<th>V.8</th>
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<th>V.13</th>
<th>V.14</th>
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Mean 0.46 0.12 0.01 0.06 15.91 9.84 2.18 0.70 0.52 0.32 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 14.94 1.00 1.00 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 = 156. Correlations significant at p-value < 0.05 are in bold.

Table 2. First stage regression.

Probit regression

Number of obs = 345
Wald chi2(6) = 34.83
Prob > chi2 = 0.0000

Log pseudolikelihood = -93.439595
Pseudo R2 = 0.1586

(Std. Err. adjusted for 41 clusters in code)

<table>
<thead>
<tr>
<th></th>
<th>Robust</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coef.</td>
<td>Std. Err.</td>
<td>p-value [95% Conf. Interval]</td>
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<tr>
<td>Portfolio (3-year window)</td>
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<td>0.019</td>
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<tr>
<td>Impact (3-year window)</td>
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<td>0.938</td>
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<td>0.235</td>
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<tr>
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<td>0.245</td>
<td>0.033</td>
<td>0.042</td>
</tr>
<tr>
<td>Star inventor (dummy)</td>
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<td>0.165</td>
<td>0.027</td>
<td>0.043</td>
</tr>
<tr>
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<td>0.090</td>
<td>0.020</td>
<td>0.000</td>
<td>0.050</td>
</tr>
</tbody>
</table>
### Table 3. Regression Models for Influence and Impact

<table>
<thead>
<tr>
<th>Model</th>
<th>Influence</th>
<th>Impact</th>
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<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>2nd STAGE</td>
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<tr>
<td>Intercept</td>
<td>z.07 ***</td>
<td>2.01 *</td>
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<tr>
<td>CVC</td>
<td>0.81</td>
<td>-0.26</td>
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<tr>
<td>CVC Power over Syndicate</td>
<td>1.00</td>
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<tr>
<td>Distal CVC Investment</td>
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<td>1.13 **</td>
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<tr>
<td>Claims</td>
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<td>0.04</td>
</tr>
<tr>
<td>Adj. Originality</td>
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<td>0.06</td>
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</tr>
<tr>
<td>Class 25/7</td>
<td>1.06 **</td>
<td>1.06 **</td>
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<tr>
<td>Class 326</td>
<td>2.83 ***</td>
<td>2.83 ***</td>
</tr>
<tr>
<td>Class 438</td>
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<td>1.15 ***</td>
</tr>
<tr>
<td>Years 90-91</td>
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<td>0.70</td>
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<tr>
<td>Years 92-93</td>
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<td>0.70</td>
</tr>
</tbody>
</table>

### Table 4. Regression Models for Influence and Power Calculated for Different Time Windows.

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<th>Impact</th>
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</thead>
<tbody>
<tr>
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<td>Model 4.1</td>
<td>Model 4.2</td>
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<td>2.05 **</td>
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<tr>
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<td>0.06</td>
</tr>
<tr>
<td>Number of Inventors</td>
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<td>0.06</td>
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<tr>
<td>Star Inventor</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Class 25/7</td>
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<td>1.35</td>
</tr>
<tr>
<td>Class 326</td>
<td>1.35</td>
<td>1.35</td>
</tr>
<tr>
<td>Class 438</td>
<td>1.35</td>
<td>1.35</td>
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<tr>
<td>Years 90-91</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td>Years 92-93</td>
<td>0.70</td>
<td>0.70</td>
</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 a pooled probit from first stage. Robust Std errors in parentheses. 2nd stage Std errors corrected for 1st stage estimation.

R²: 0.257 0.279 0.319 0.305 0.304 0.317 0.307 0.326
Figure 1. Technological Maps for New Ventures and Corporations

![Marginal Effect of Power CVC on Patent Influence](image)

Figure 2. Technological Maps for New Ventures and Corporations

![Configuration in 2 Dimensions](image)

FUJ has a leading position in syndicate

FUJ does not have leading position in syndicate

**REFERENCES**


