Research Policy 53 (2024) 105003

Contents lists available at ScienceDirect

Research Policy

journal homepage: www.elsevier.com/locate/respol

Human capital in corporate venture capital units and its relation to parent firms' innovative performance

David Bendig[a], Vincent Göttel[b,*], David Eckardt[a], Colin Schulz[a]

[a] School of Business and Economics, University of Münster, Geiststraße 26, 48151 Münster, Germany
[b] Entrepreneurship and Technology Management Section, Faculty of Behavioural, Management and Social Sciences, University of Twente, Drienerlolaan 5, 7522 NB Enschede, The Netherlands

ARTICLE INFO

Keywords:
Human capital theory
Attention-based view
Corporate venture capital
CVC unit heads
Patenting
Breakthrough innovation

ABSTRACT

Incumbent firms utilize corporate venture capital (CVC) as a vehicle to enhance their innovative performance. Still, little is known about the central individual in this context: the CVC unit head, who acts as a knowledge broker between portfolio ventures and the parent organization. We combine human capital theory with the attention-based view to investigate the effects of various facets of CVC unit heads' experience on parent firms' innovative inputs in the form of explorative and exploitative patenting and innovative outputs, specifically market and technological breakthrough innovation. Drawing on a dataset of U.S.-listed firms with CVC units, our findings contribute to the CVC literature in three ways. First, we introduce CVC unit heads' career experiences as new individual-level antecedents of parent firms' innovative performance. Second, we enhance the understanding of the CVC-core paradox, which is the tension between exploration and exploitation in the parent firm. Finally, by employing a combination of patents and new product introductions as metrics for innovative performance, we bridge the gap between learning and innovation in extant CVC research, demonstrating that the effects of CVC unit heads include customer-facing outcomes.

1. Introduction

Corporate venture capital (CVC) units are structurally distinct entities that execute external minority equity investments in startups on behalf of their parent firms (Dokko and Gaba, 2012; Gaba and Meyer, 2008). Such investments promise to enhance parent firms' innovative performance (Dushnitsky and Lenox, 2005a; Titus and Anderson, 2018; Wadhwa and Kotha, 2006; Wadhwa et al., 2016). This enhancing effect is rooted in inter-organizational learning. Specifically, established firms invest in startups to learn about new technologies and markets and to foster innovation (Dushnitsky and Yu, 2022; Wadhwa and Kotha, 2006).

Over the last two decades, research investigating the link between CVC and innovation has mainly provided insights into organizational-level dynamics and portfolio contingencies (Drover et al., 2017). At the organizational level, for instance, Keil et al. (2016) outline that the autonomy of CVC units positively moderates the effect of CVC investments on explorative learning. Dushnitsky and Lenox (2005a) demonstrate that this effect is contingent on parent firms' ability to transfer and absorb technological knowledge from their interactions with startups. Concerning portfolio contingencies, researchers have found that industry and technology relatedness between parent firms and startups are significant factors (Belderbos et al., 2018; Keil et al., 2008b), that the effect of parent firms' portfolio diversity is invertedly U-shaped (Wadhwa et al., 2016), and that investor involvement in portfolio ventures increases the effect of higher CVC investments on innovation in the parent firm (Wadhwa and Kotha, 2006).

However, there is a lack of research investigating CVC mechanisms at the individual level and their impact on parent firms' innovative performance (Drover et al., 2017). A handful of studies (e.g., Dokko and Gaba, 2012; Souitaris et al., 2012) have explored how characteristics of CVC managers impact CVC practices in general, but little is known about their specific influence on innovation. This gap is particularly crucial when considering the most important individuals in this context: CVC unit heads. By steering CVC units, they lead the search for new investment opportunities (Miles and Covin, 2002; Wadhwa and Kotha, 2006; Wadhwa et al., 2016) and hold a unique position as knowledge brokers between portfolio ventures and the parent organization (Elfring, 2005; Henderson and Leleux, 2005).

* Corresponding author.
E-mail addresses: dbendig@uni-muenster.de (D. Bendig), v.c.gottel@utwente.nl (V. Göttel), david@eckardt-online.eu (D. Eckardt), colin.schulz@uni-muenster.de (C. Schulz).

https://doi.org/10.1016/j.respol.2024.105003
Received 5 October 2021; Received in revised form 12 February 2024; Accepted 5 April 2024
Available online 26 April 2024

To address this gap, this study links various facets of CVC unit heads' career experience to the parent firms' innovative performance. Drawing on the attention-based view (Ocasio, 1997, 2011), we argue that CVC unit heads act as information filters between startups and corporate business units. To assess ambiguous and complex information, managers rely on mental models that are built on existing knowledge structures (Dearborn and Simon, 1958; Shepherd et al., 2016). We argue that CVC unit heads develop these models through their accumulated human capital resources (HCR) from career experiences and that these models form attentional filters that influence corporate innovative performance. We differentiate among *experience in the parent firm, entrepreneurial experience, independent venture capital (IVC) experience*, and *engineering and science experience*. We consider these in the context of the parent firms' innovative performance, such that we differentiate between innovative inputs and outputs (Rubera and Kirca, 2012). Innovative inputs are comprised of *explorative and exploitative patenting*. Innovative outputs are comprised of *market and technological breakthrough innovation* in the form of new product introductions. To find evidence for these relations, we constructed a large panel dataset of S&P 500 firms with CVC units. We collected data from CVC websites, Crunchbase, PitchBook, LinkedIn, the United States Patent and Trademark Office (USPTO), and product announcements.

Our study contributes to the CVC literature in three major ways. First, we introduce CVC unit heads' career experiences as new individual-level antecedents of parent firms' innovative performance. We theorize and empirically show that CVC unit heads' prominent role in inter-organizational learning (Keil et al., 2016; Weber and Weber, 2011) depends on their experiences and associated knowledge structures, which act as attentional filters. We thereby strengthen the embedding of human capital and the attention-based view in CVC–innovation research (Gaba and Dokko, 2016; Maula et al., 2013).

Second, we add to the understanding of the so-called CVC-core paradox, that is, the tension between CVC-based exploration and exploitation in the core business of the parent firm (Jeon and Maula, 2022). In particular, we emphasize the importance of individual-level variables in influencing such tension and firms' ambidexterity efforts (Hill and Birkinshaw, 2014). Thereby, we also provide a building block for the debate on microfoundations of innovation strategy (Grigoriou and Rothaermel, 2014; Zahra et al., 2020).

Third, we go beyond the dominant approach in CVC research focusing on patenting performance (e.g., Dushnitsky and Lenox, 2005a; Wadhwa et al., 2016) to capture innovation. By using both patents and new product introductions, we bridge the gap between learning and innovation and establish that the influence of CVC unit heads also includes customer-facing results.

2. Theoretical background

2.1. The importance of CVC unit heads

The search for new knowledge and information is a human task carried out by managers, not organizations (Li et al., 2013). CVC managers are tasked with seeking investment opportunities on behalf of their parent firm (Miles and Covin, 2002; Wadhwa and Kotha, 2006; Wadhwa et al., 2016). When they hold board seats in startups, they use their insights to inform their parent firms (Dushnitsky and Lenox, 2006; Keil et al., 2008a). Henderson and Leleux (2005) emphasize that CVC managers are important to knowledge transfer in general and to matching venture personnel with corporate business units in particular.

As the most powerful executives and decision makers in their units, CVC unit heads are to their units what CEOs are to parent firms. CVC unit heads lead the search for startups to invest in. They apply their attentional filters, rooted in their acquired HCR, to broker essential knowledge leading to learning and innovation in the parent firm. The upper echelons perspective emphasizes the critical role that top managers play in collecting and interpreting information for the entire organization (Hambrick and Mason, 1984). Just as other top managers must bring decision-making processes to a timely end (Roberto, 2005; Smith et al., 2006), CVC unit heads are also tasked with this responsibility. Although other management personnel in CVC units also share their ideas, CVC unit heads end discussions and make decisions.

2.2. CVC unit heads' HCR and attentional filters

Expanding on the human capital concept, strategy research refers to HCR as "[…] individual or unit-level capacities based on individual knowledge, skills, abilities, and other characteristics (KSAOs) that are accessible for unit-relevant purposes" (Ployhart et al., 2014, p. 374) and as affecting organizational outcomes (Nyberg and Wright, 2015). When it comes to those capacities in a particular CVC unit, Dokko and Gaba (2012) find that the HCR that CVC unit managers have gained through career experiences also influences CVC unit practices. This human element in the role of knowledge brokers for CVC units has significant implications for the dynamics in the workplace. Utilizing the attention-based view (Ocasio, 1997, 2011), we propose that CVC unit heads function as information filters. Given their limited cognitive capacity, they cannot share all information with the parent firm. In addition, just as top managers in general can be assumed to face bounded rationality when deciding whether or not to pass on a piece of information (Hambrick and Mason, 1984), the same applies to CVC unit heads. The reason for this is that individuals subjectively interpret ambiguous situations and complex information through their cognitive biases (Carpenter et al., 2004; Hambrick, 2007). Thus, CVC unit heads perceive situations and appropriate responses through their cognitive filters. We argue that they develop these filters by gaining HCR through career experience, and these cognitive filters ultimately influence corporate innovative performance.

Top managers pay attention to certain elements depending on their experiences and related knowledge structures (Beyer et al., 1997; Dearborn and Simon, 1958; Dokko and Gaba, 2012; Hambrick and Mason, 1984; Shepherd et al., 2016). In particular, individuals cannot always perceive options that are not in line with their career experiences (Ocasio, 2011). The time constraints in top management roles lead managers to use filtering mechanisms. These mechanisms include relying on cognitive frames, using heuristics, and privileging knowledge based on their experience (Maula et al., 2013). Further, top managers and executives use existing mental models to assess situations under conditions of complexity and ambiguity and to manage competing task demands (Dearborn and Simon, 1958; Shepherd et al., 2016). All of these conditions can be found in the CVC context (Dokko and Gaba, 2012; Keil, 2000; Park and Steensma, 2013; Yang et al., 2009). Accordingly, Freese et al. (2007) state that competencies can blind an organization to information that does not fit into existing mental models. Maula et al. (2013) find that parent firms' innovation activities are contingent on their CVC managers' attentional mechanisms.

2.3. CVC unit heads' specific HCR and parent firms' innovative performance

While human capital has been conceptually established as consisting of both career experience and education (Becker, 1993; Nuscheler et al., 2019; Smith et al., 2005), CVC researchers find specific career experiences to be particularly influential on organizational outcomes (Dokko and Gaba, 2012). Building on these findings, we investigate the impact of various facets of CVC unit heads' career experience-related HCR on their parent firms' innovative performance.

For independent variables, we focus on four facets of career experience from the established category of specific (i.e., limited to a particular context or activity) human capital (Becker, 1993; Dimov and Shepherd, 2005; Gimeno et al., 1997). First, we consider the firm- and industry-specific HCR gained through CVC unit heads' experience in the parent firm. While working in parent firms, CVC managers are supposed to develop mental frameworks through which they interpret new information in line with the parent corporations' beliefs (Dokko and Gaba, 2012; Gaba and Dokko, 2016).

Second, we assume that CVC unit heads' entrepreneurial experience influences innovative performance at their parent firms. In doing so, we draw on the related task-specific HCR (Nuscheler et al., 2019; Zarutskie, 2010) because working as an entrepreneur leads to developing an entrepreneurial mindset (Kuratko et al., 2021). The cognitive aspect of an entrepreneurial mindset lies in "[…] simplifying mental models to piece together previously unconnected information that helps them to identify […] new products or services, and to assemble the necessary resources to […] grow businesses" (Kuratko et al., 2021, p. 1683).

Third, as another element of task-specific HCR (Zarutskie, 2010), we consider IVC experience to influence parent firms' innovative performance (Dokko and Gaba, 2012; Gaba and Dokko, 2016). The IVC industry is inclined toward innovation, and prior exposure to certain technologies and growth markets should influence the way CVC unit heads analyze information about or coming from startups.

Finally, we explore engineering and science experience as technology-specific HCR (Zarutskie, 2010) in the context of CVC unit heads' influence on parent firms' innovative performance (Dokko and Gaba, 2012). The technological understanding inherent in such experience influences CVC unit heads' mental models and, thus, the innovative performance in parent firms.

In this study, we consider the ways in which the aforementioned variables affect innovative performance by means of explorative patenting, exploitative patenting, market breakthrough innovation, and technological breakthrough innovation. Explorative and exploitative patenting relate to the question of whether parent firms build on new or existing knowledge when building new solutions (innovative inputs). Breakthrough innovation relates to the degree of novelty of realized product introductions (innovative outputs). According to Chandy and Tellis (1998, 2000), this novelty lies in either markets or technologies. Table 1 provides an overview of the independent and dependent variables of our research model and their origin.

3. Hypotheses and research model

3.1. *The relationships of CVC unit heads' experience in the parent firm with explorative and exploitative patenting and market and technological breakthrough innovation*

CVC unit heads filter knowledge from CVC ventures through experience in the parent firm. We posit that with a CVC unit head's increasing experience in the parent firm, the mental models they apply in deciding which startups to invest in and learn from become increasingly similar to those they have applied in the parent firm. Accordingly, we assume that the learning CVC unit heads seek through choosing startups to invest in and exchange knowledge with is biased toward incremental learning, as well as refining, extending, and, thus, exploiting the parent firm's existing knowledge. This assumption is related to the findings of Schildt et al. (2005) on industry relatedness between ventures and parent firms. Additionally, Lee et al. (2018) found that if a CVC unit had relative freedom from the strategic attention of the parent firm, but was disconnected from the parent firm's resources, there was a positive influence on the parent firm's explorative patenting and a negative one on

Table 1
Overview of our independent and dependent variables and their origin.

Variables	Background and definitions of similar concepts in extant research	Sources
Independent variables		
Experience in the parent firm *(firm- and industry-specific HCR)*	"[…] managers who have career experience in the adopting organization, regardless of what function they previously performed […]." (Dokko and Gaba, 2012, p. 568)	Dokko and Gaba (2012), Gaba and Dokko (2016)
Entrepreneurial experience *(task-specific HCR)*	"[…] managers having past experience as executives at start-up companies […]." (Zarutskie, 2010, p. 155)	Kuratko et al. (2021), Nuscheler et al. (2019), Zarutskie (2010)
IVC experience *(task-specific HCR)*	"[…] managers having past experience as venture capitalists […]." (Zarutskie, 2010, p. 155)	Dokko and Gaba (2012), Gaba and Dokko (2016), Zarutskie (2010)
Engineering and science experience *(technology-specific HCR)*	"The better a CVC manager understands an adopting firm's technologies and R&D-related goals (e.g., by drawing on prior engineering experience) […]." (Dokko and Gaba, 2012, p. 569)	Dokko and Gaba (2012), Zarutskie (2010)
Dependent variables		
Explorative and exploitative patenting *(innovative inputs)*	"Firms focusing on their current areas of expertise are expected to produce more exploitative patents, while firms looking into new areas are expected to produce more exploratory patents. We construct proxies for exploitative and exploratory patents according to the extent to which a firm's new patents use current versus new knowledge." (Custódio et al., 2019, p. 5)	Cui et al. (2019), Custódio et al. (2019), Jeon and Maula (2022), Keil et al. (2016), Lee et al. (2018), Schildt et al. (2005)
Market and technological breakthrough innovation *(innovative outputs)*	"What, exactly, is a radical product innovation? […] two common dimensions underlie most definitions: (1) technology and (2) markets. The first factor determines the extent to which the technology involved in a new product is different from prior technologies. The second factor determines the extent to which the new product fulfills key customer needs better than existing products (on a per-dollar basis). Considering two levels (low and high) for each factor leads to […] market breakthroughs, technological breakthroughs […]." (Chandy and Tellis, 1998, p. 476)	Chandy and Tellis (1998, 2000)

its exploitative patenting. CVC units led by heads with substantial experience in the parent firm cannot be considered disconnected from the parent firm because of the firm-specific HCR their heads have gained. This further supports our assumptions that experience in the parent firm should negatively influence explorative patenting and positively influence exploitative patenting.

Dokko and Gaba (2012) find that managers with experience in the parent firm increase CVC units' strategic goal orientation. CVC unit heads use their mental models to decide which startups to invest in and learn from based on their industry-specific HCR through experience in the parent firm. Researchers have found the benefits of industry-specific HCR for firms in other contexts (Harris and Helfat, 1997; Mayer et al., 2012). They are thus likely to use filters rooted in the characteristics of the industries and markets of the parent firms. These filters should help them cater to the specific needs of the consumers of these industries and markets. For this reason, we assume that experience in the parent firm positively influences market breakthrough innovation. CVC unit heads have limited time and cognitive capacity, so they are less likely to pay attention to emerging technologies that might foster technology-driven innovation in the parent firm. Thus, experience in the parent firm should be negatively related to technological breakthrough innovation. Based on the above argumentation and findings, we formulate the following hypotheses:

H1. CVC unit heads' experience in the parent firm is (a) negatively related to explorative patenting and (b) positively related to exploitative patenting in the parent firm.

H2. CVC unit heads' experience in the parent firm is (a) positively related to market breakthrough innovation and (b) negatively related to technological breakthrough innovation in the parent firm.

3.2. The relationships of CVC unit heads' entrepreneurial experience with explorative and exploitative patenting and market and technological breakthrough innovation

We argue that entrepreneurial experience is likely to increase CVC unit heads' preference for explorative patenting, because entrepreneurial experience concerns learning and engaging with explorative work in startups to create something novel. Characteristics of entrepreneurial personalities include creativity and a preference for independence and autonomy (Brandstätter, 2011; Nuscheler et al., 2019; Obschonka et al., 2017). Entrepreneurship is generally geared toward novelty (Sharma and Chrisman, 1999) and has been linked to the ability to recognize new patterns and opportunities (Baron and Ensley, 2006). Therefore, experienced entrepreneurial workers have CVC task-specific HCR, so their mental models help them identify and act on new CVC opportunities. Hence, these mental models are well-suited to recognizing explorative learning and patenting opportunities. CVC unit heads' entrepreneurial focus steers resources toward recognizing explorative patenting opportunities, leaving little cognitive capacity for recognizing exploitative ones.

New technologies and evolving markets present entrepreneurial opportunities (Audretsch, 1995; Kuratko et al., 2021; Schumpeter, 1934). The inherent growth potential of the technology sector is likely the reason that recently gained entrepreneurial experience has taken place in tech startups (Nuscheler et al., 2019). Even if the business models of the startups in which the CVC unit heads have gained entrepreneurial experience have not been entirely digital, it is likely that these startups have been related to innovative technology. For instance, a startup could have used artificial intelligence (AI) applications or the Internet of Things. Thus, in our study of CVC unit heads deciding which startups to invest in and learn from, based on their cognitive frames and filters, we expect entrepreneurial experience to positively affect technological breakthrough innovation. We also expect such attentional focus to inhibit market breakthrough innovation. Based on the above findings and argumentation, we hypothesize:

H3. CVC unit heads' entrepreneurial experience is (a) positively related to explorative patenting and (b) negatively related to exploitative patenting in the parent firm.

H4. CVC unit heads' entrepreneurial experience is (a) negatively related to market breakthrough innovation and (b) positively related to technological breakthrough innovation in the parent firm.

3.3. The relationships of CVC unit heads' IVC experience with explorative and exploitative patenting and market and technological breakthrough innovation

The IVC industry is geared toward novelty. Therefore, previous IVC employment likely comes with a cognitive bias and filters in favor of change and innovation. Such experience should develop exploration capability and market innovation expertise. In the context of IVC funds, Zarutskie (2010) posited that fund managers, through their task-specific HCR, develop crucial fund management skills via trial and error. Thus, we propose that CVC unit heads with IVC experience, when applying trial-and-error informed mental models for startup investments, tend to explore new patenting opportunities instead of exploiting existing ones.

IVC practices entail a focus on growing markets, rooted in the operating model of venture capital firms geared toward initial public offerings or acquisitions as exit strategies (Dushnitsky and Shapira, 2010). For this reason, IVC-related career experiences may contribute to market breakthrough innovation for parent firms when CVC unit heads apply mental models and filters to seek startups to invest in and learn from. Earlier work by Zarutskie (2010) found that IVC experience leads to improved fund performance for portfolio ventures. This finding leads us to assume that startups identified by experienced venture capitalists should foster market breakthrough innovation in the parent firms.

Conversely, we expect a negative correlation between IVC experience and technological breakthrough innovation. Operating within IVC management involves exposure to a broad range of industries and technologies. This breadth may prevent venture capitalists from gaining the deep, tech-specific expertise and HCR they need to evaluate the feasibility of integrating a startup's novel technology into the parent firm's technology base (Dokko and Gaba, 2012). Based on the above argumentation, we thus hypothesize:

H5. CVC unit heads' IVC experience is (a) positively related to explorative patenting and (b) negatively related to exploitative patenting in the parent firm.

H6. CVC unit heads' IVC experience is (a) positively related to market breakthrough innovation and (b) negatively related to technological breakthrough innovation in the parent firm.

3.4. The relationships of CVC unit heads' engineering and science experience with explorative and exploitative patenting and market and technological breakthrough innovation

Professional experience in engineering and science fosters a tendency to build on existing knowledge and optimize existing products (Tabesh et al., 2019). This tendency leads CVC heads to focus on startups in industries close to the parent firm (Dokko and Gaba, 2012) instead of a diverse range of industries that could add complementary knowledge to the parent firm's knowledge base. Furthermore, technology-related experience in engineering and science provides technology-specific HCR and, thus, technologically sophisticated knowledge and mental models. This results in filters that may direct CVC heads' attention toward recognizing opportunities for technological innovation rather than the market. Consequently, such leaders orient their CVC units strategically toward technological innovation rather than financial goals when choosing startups to invest in (Dokko and Gaba, 2012).

Taken together, we posit that CVC heads' past employment in engineering and science benefits exploitative patenting and technological breakthrough innovation in their parent firms. Given the tendency of individuals to focus on one topic and pay less attention to others (Ocasio, 2011), such experience is likely to inhibit explorative patenting and market breakthrough innovation. Hence, we hypothesize:

H7. CVC unit heads' engineering and science experience is (a) negatively related to explorative patenting and (b) positively related to exploitative patenting in the parent firm.

H8. CVC unit heads' engineering and science experience is (a) negatively related to market breakthrough innovation and (b) positively related to technological breakthrough innovation in the parent firm.

Fig. 1 summarizes our research model.

4. Research design

4.1. Sample selection

We used the S&P 500 index for our analysis because it lists CVC units from various industries. It lists 500 of the largest publicly traded companies in the United States, which attract considerable media coverage (Fang and Peress, 2009) and are thus likely to publish information about new products (Zavyalova et al., 2012). We started our investigation with data from the year 2000, which coincides with the end of the third wave of CVC investing (Dushnitsky and Lenox, 2006; Gompers and Lerner, 1998). To mitigate time truncation while capturing the recent surge in activity in the CVC industry (Brigl et al., 2018), we ended in 2018. Specifically, we divided our analysis into two subsamples tailored to each investigated outcome variable (Bendig et al., 2020). For explorative and exploitative patenting, we utilized 485 firm-year observations from 2000 to 2018 and analyzed 330,536 patents. For market and technological breakthrough innovation, we examined 369 firm-year observations from 2008 to 2018, assessing 6367 new product introductions. To alleviate potential concerns of survivorship bias, we included all companies that were part of the S&P 500 index for at least one year during the sample period.

We began constructing the overarching sample by extracting minority investment data from Thomson Refinitiv EIKON PE Screener. To clean this data and identify CVC units, we followed Röhm et al. (2020) in dropping undisclosed and unknown investors. We then manually matched the investors and their transaction data with their parent firms using Capital IQ. This method enabled us to identify 311 active investment entities connected to corporate parent firms listed in the S&P 500 at least once between the years 2000 and 2018. We further identified and manually added 48 additional investment entities connected to the parent firms of our sample during this process, before conducting relevance filtering. We excluded 215 entities, per Capital IQ's description, that were not clearly identifiable as CVC units, including vehicles such as pension funds or employee stock option plans. Finally, we conducted an aggregation on the parent level for the 144 identifiable CVC units that remained, because some were listed as different funds. Our final list contains 133 CVC units.

4.2. Identification of CVC unit heads and their biographical information

We searched for the top decision makers in the CVC units. When possible, we identified a CVC unit head for every year that a firm was listed in our database. Identifying these unit heads required a manual search that drew on various sources and involved four steps:

Step 1 – Construction of candidate list. We used several data sources to identify candidates who could be CVC unit heads. Capital IQ lists important people in the CVC units but rarely provides enough information to identify the leading executive. Identifying CVC unit heads required extensive manual screening and triangulation among data sources. Our search process focused on CVC websites, Crunchbase, PitchBook, and LinkedIn.

Step 2 – Identification of CVC unit heads. We screened the list of candidates from Step 1 to identify CVC unit heads. We found that parent firms used different job titles to designate CVC unit heads, such as managing director, president, and head. Since these job titles were so often ambiguous, we needed to take time to scrutinize them. For example, Applied Ventures (the CVC unit of Applied Materials) has a president as well as a company head. Cross-referencing the data sources revealed that Applied Ventures' president is also the parent firm's chief technology officer (CTO), while the person with the title of Head of Applied Ventures reports to the president and manages the fund's operations. Thus, the job title Head of Applied Ventures refers to the CVC unit head as we define it: the manager with the strongest influence on the CVC unit's daily business. Generally, this process of identifying CVC unit head titles ensures that the CVC unit head is not a C-level executive in the parent firm. This, in turn, ensures that influences arising from board membership are separable from influences connected to the position of the CVC unit head. We identified 164 individuals employed as CVC unit heads—142 men and 22 women.

Step 3 – *Collection of biographical information*. Using LinkedIn, we collected biographical information about the identified CVC unit heads. LinkedIn profiles often include detailed information on professional backgrounds (cf., Nuscheler et al., 2019). We performed this step because we needed to identify types of career experience.

Step 4 – *Securing a panel data structure*. To accurately reflect career experience, we updated the variables for every year an individual was employed as a CVC unit head. For example, total work experience would increase by one year each year. In addition, some CVC unit heads appear in the dataset as the heads of more than one CVC unit. Their experience at the end of one period of employment as head of one CVC unit marks the starting point for their experience at the next. Throughout this process, the dataset maintains its strict panel structure.

4.3. Dependent variables

4.3.1. Explorative and exploitative patenting

To measure innovative inputs, we first extracted patent data from the PatentsView database of the United States Patent and Trademark Office (USPTO) using only patents that were eventually granted. Next, we matched the patents to our CVC units' parent firms using a partly manual process. The firms in our dataset and patenting sample timeframe received 330,536 utility patents.[1] We used the date of the patent application, not the grant date, as the leading date. This is common practice (Custódio et al., 2019; Dushnitsky and Lenox, 2005b; Wadhwa et al., 2016), as the application date more accurately reflects the time of learning than the grant date does (Dushnitsky and Lenox, 2005b) and is independent of delays by the USPTO (Hall et al., 2001). However, this practice led to time truncation in our dataset. The complete USPTO data indicate grant rates of 85 % and 95 % after two and three years, respectively (Hall et al., 2001). In our data, about 80 % of patents were granted within four years. To lessen the extreme effects of time truncation that are likely to occur in 2018, we limited our analysis to data up until 2017. We also ensured that all models in our analysis contained year-fixed effects, as Hall et al. (2001) suggest. To deal with the potential interaction effects of truncation and regional or sector compositions, we conducted additional robustness tests, as discussed in Chapter 5.3.

To further identify explorative and exploitative patents within this patent count, we used backward citations to differentiate the degree to which a patent was based on new or existing knowledge (Chung et al., 2019; Custódio et al., 2019). A new patent application is required to cite

[1] Utility patents are granted for inventions. The other three categories in the USPTO database are design, plant (in the biological sense), and reissue patents. None of these three categories captures the knowledge creation that is relevant to our research.

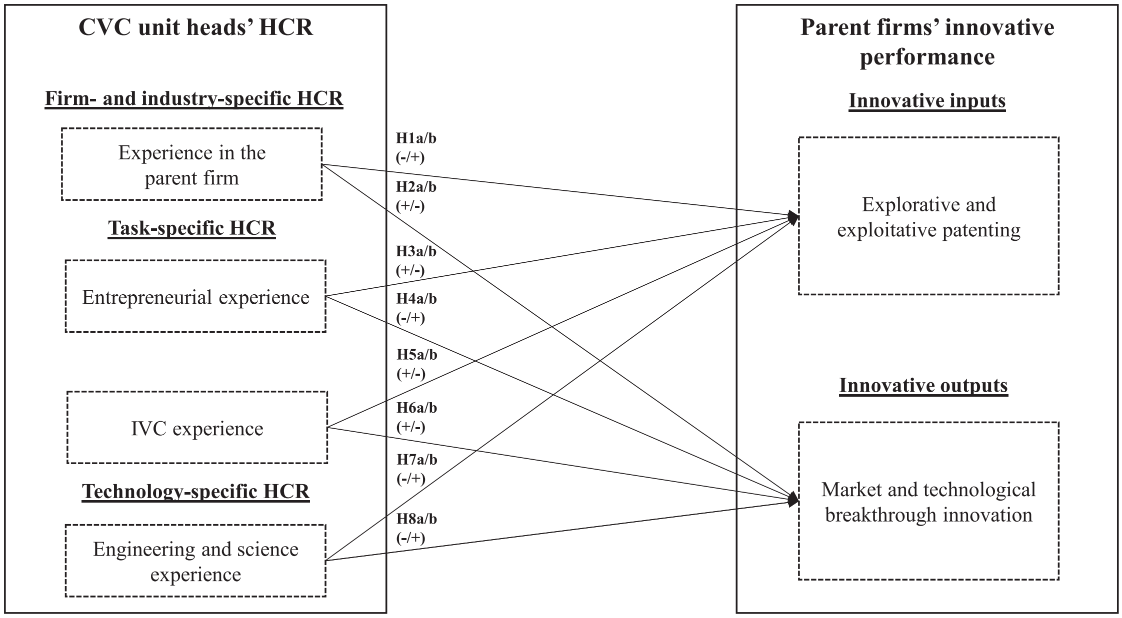

Fig. 1. Research model.

all "prior art" (Sorenson and Stuart, 2001, p. 16), that is all other patents that it refers to and builds on (Sorenson and Stuart, 2001). Following Custódio et al. (2019)'s approach, we considered existing knowledge to be citations of an applicant's own patents or of patents cited in the firm's other applications within the previous five years. We categorized all citations that did not fit those criteria as new knowledge. In line with the approach and threshold recently used by Custódio et al. (2019), we categorized those patents that cited at least 60 % of new knowledge as explorative. We termed patents that cited at least 60 % of existing knowledge as exploitative. Next, we calculated *explorative patenting* as the ratio of explorative patents relative to the total patent applications a firm made in a given year. The total patent applications included patents that were explorative and patents that were exploitative, but also patents that did not fall into any of these categories. Similarly, *exploitative patenting* was the ratio of exploitative patents relative to all of a firm's patent applications in a given year (Chung et al., 2019; Custódio et al., 2019). While researchers have experimented with varying percent levels ranging from 60 up to 100 % of citing new knowledge (Benner and Tushman, 2002), we followed Custódio et al. (2019) in conducting a robustness test of our models using 80 % as the cutoff. Our results aligned with the 60 % version (Model 3a in Table A.1 and Model 3b in Table A.2 in the Appendix).

4.3.2. Technological and market breakthrough innovation

We measured innovative outputs as new product introductions, including services, approximating them using product announcements in press releases (Sorescu and Spanjol, 2008). Most product announcements are in *Business Wire* and *PR Newswire*, but we also used the companies' websites. As Li et al. (2013) suggest, we increased the robustness of our measure by calculating the sum of all new product introductions one to three years after the focal year.

To measure the degree of novelty in a firm's innovative outputs, we followed Chandy and Tellis (1998, 2000) in differentiating the dimension of technology innovation from market innovation. The technology dimension captured the novelty of the technology. The market dimension captured customer-need fulfillment. For each new product introduction, three independent experts familiar with the assigned industries and innovation research coded both dimensions on a 9-point Likert scale (Chandy and Tellis, 2000). Our calculation of interrater reliability on the individual product level across the three raters was above 0.7, a result considered reliable (Burke et al., 1999; James et al., 1984). We used the arithmetic mean of all three ratings as the final score for each product introduction. Values equal to or above five qualified the product introduction for each dimension's higher end, being considered a breakthrough. For our analysis, we used the shares of *market breakthrough innovations* and *technological breakthrough innovations* relative to all new product introductions of a firm in a given year. Again, we used the method used by Li et al. (2013) to sum up the data for the three years following the focal year.

4.4. Independent variables

4.4.1. Experience in the parent firm

We measured *experience in the parent firm* as the number of years a CVC unit head worked in the parent firm before working as a CVC unit head.

4.4.2. Entrepreneurial experience

We measured *entrepreneurial experience* as the number of years a CVC unit head worked in a startup before holding the current position. This experience includes self-founded startups and does not require an executive position.

4.4.3. IVC experience

We measured *IVC experience* as years of employment in independent venture capital firms before the CVC unit head started the current position. We focused on venture-related as opposed to administrative positions that usually accompany board mandates in several startups.

4.4.4. Engineering and science experience

We measured *engineering and science experience* as the number of years a CVC unit head spent in engineering-related or professional science jobs before starting the current position.

4.5. Control variables

4.5.1. Individual-level controls

We controlled for CVC unit heads' non-specific HCR using the variable *career variety* (e.g., Becker, 1993; Nyberg and Wright, 2015). Our operationalization of *career variety* followed Crossland et al. (2014). We calculated the number of distinct industries, firms, and functions in which a CVC unit head had worked before starting the focal position, then divided that number by the total years they had worked.

To enable a focused analysis of CVC unit heads' career experience, we also controlled for their educational background using market- and technology-focused controls. To operationalize the market-focused control, we used a binary variable, *MBA holder*, indicating whether the manager held an MBA degree or not. We used degrees in engineering and science to build the technology-focused control variable *engineering and science education*. The binary variable took the value of 1 if a CVC unit head held at least one degree, and the value of 0 if not.

4.5.2. Organizational-level controls

CVC literature shows that *absorptive capacity* influences incumbents' innovation outcomes (Dushnitsky and Lenox, 2005b). We followed Dushnitsky and Lenox (2005b) in using the sum of a firm's R&D investments in years t-4, t-3, and t-2 as a proxy for *absorptive capacity*.

We controlled for firms' *CVC experience*. Over time, firms develop the ability to benefit from the information inherent in their relationships with portfolio ventures (Keil, 2004; Wadhwa et al., 2016). We followed Wadhwa et al. (2016) in calculating a cumulative sum of prior investments, weighted by the time that has passed since the investment. We took the natural logarithm of that sum.

We controlled for *firm size*, as larger corporations tend to have more patenting and product introduction activity than smaller firms. As established in the CVC literature, we used the natural logarithm of a firm's revenues to measure its parent firm's size (Maula et al., 2013; Schildt et al., 2005).

We controlled for *financial slack*, which is connected to explorative efforts (Voss et al., 2008) and innovation (Li et al., 2013). We used the natural logarithm of a firm's current ratio as expressed by the ratio of current assets to current liabilities (Iyer and Miller, 2008).

We controlled for *CVC activity*, as, ceteris paribus, more activity will provide more opportunities to source valuable information. We used the sum of a firm's CVC investments in the past five years, including the focal year, to measure this control variable (Basu and Wadhwa, 2013).

We controlled for *relative strategic motivation* because firms benefit more from CVC investment activity when they have strategic objectives (Dushnitsky and Lenox, 2006). Since not every firm invests for the same reasons (Röhm et al., 2018), researchers generally describe CVC investments as having a dual objective, serving strategic goals as well as financial goals (Allen and Hevert, 2007; Alvarez-Garrido and Dushnitsky, 2016). To assess the importance a CVC investor places on strategic goals versus financial ones, we followed Röhm et al. (2018) in conducting a computer-aided text analysis (CATA) on text files that disclose information about CVC units' objectives, gathered from their websites. We used the CAT-Scanner software (McKenny et al., 2018) and the dictionary from Röhm et al. (2018) to divide the number of strategic words by the number of financial words to operationalize the firm's level of strategic motivation.

We controlled for *exploration orientation*, as the tendency toward exploration among top corporate management teams likely influences an organization's receptiveness to knowledge gained from CVC activity. We analyzed the management discussion and analysis sections of annual Form 10-K reports using the CAT-Scanner (Kabanoff and Brown, 2008; McKenny et al., 2018) and a dictionary designed to capture *exploration orientation* (Uotila et al., 2009). The ratio of explorative words to total words became our measure for the *exploration orientation* control variable.

We controlled for *CTO presence* in the parent firm. Extant research establishes a relationship between the presence of a CTO and the performance of an organization (Medcof and Lee, 2017). Controlling for a CTO's presence is essential to avoid mistakenly attributing the CTO's effects on innovative performance to the CVC unit head. We used a binary variable to indicate whether the parent firm had a CTO in the focal year.

Finally, we acknowledge that not all CVC units have the same structure, so we included dummy variables in our models to indicate different types of CVC units. These are third-party funds, dedicated funds, direct investments, and self-managed funds (Dushnitzky, 2009; Keil, 2000). We excluded third-party funds from our analysis as their dynamics differ from other types of funding (Ludat, 2019) and are unlikely to be set up for strategic purposes. When calculating our models with two types of CVC vehicles, direct investments and self-managed funds, we used dedicated funds as a control group.

5. Empirical analyses and results

5.1. Model specification

We set up four models to test our hypotheses. Models 1a/1b and 2a/2b use fractions for the dependent variables, such as the number of explorative patents compared to all patents. These shares cannot be larger than the whole and are constrained to be non-negative, i.e., they are bound between 0 and 1. As such, fractions offer a more reliable estimation than other types of ratios, which also have constraints criticized by some management scholars (Certo et al., 2020). Our goal is to analyze how CVC unit heads' career experience drives the proportions of our outcome variables. Some commonly applied models cause statistical problems when predicting such proportions, as Villadsen and Wulff (2019) demonstrate in a recent methodological review. Linear regression models produce estimates outside the unit interval and do not allow for a nonlinear effect of the regressors close to 0 and 1. Log-odd transformations restrict the outcome variable to include zeroes and ones present in our data. Tobit models require normality and homoscedasticity of the error term, which is not given in our outcome variables. In contrast, fractional regression models lack these limitations and provide robust and efficient estimation, thus being “the preferred choice” for bounded fractional response variables (Villadsen and Wulff, 2019, p. 3). Consequently, we follow other innovation scholars (e.g., Cui et al., 2019; Mastrogiorgio and Gilsing, 2016) in using fractional regression models as developed by Papke and Wooldridge (1996). All models use industry- and year-fixed effects. To account for a delay between the time a firm encounters new information and learns from it to positive effect, we lag all independent and control variables by one year (Dushnitsky and Lenox, 2005a). This approach also lessens concerns about simultaneity and reverse causality.

5.2. Results

Table 2 shows pairwise correlations and descriptive statistics. The correlations between the variables of interest are generally low ($<|0.3|$) and mostly below $|0.15|$. When deriving the variance inflation factors based on linear regressions, we find that most lie between 1 and 3, well below the accepted threshold of 10 (Busenbark et al., 2017). Still, given that variance inflation factors cannot ensure that our results are not subject to multicollinearity-related type 1 errors (Kalnins and Praitis Hill, 2023), we followed Kalnins (2018) and added highly correlated variables step by step to monitor whether they changed our findings, but they did not. Overall, we concluded that our results are unlikely to be distorted by multicollinearity.

Table 3 reports regression results for explorative patenting (Model 1a) and exploitative patenting (Model 1b). The results do not support H1a and H1b, which state that CVC unit heads' experience in the parent firm is negatively related to parent firms' explorative patenting ($\beta = 0.00$, $p > 0.10$) and positively related to exploitative patenting ($\beta = 0.01$, $p > 0.10$).

Second, we find support for H3a and H3b, which state that CVC unit heads' entrepreneurial experience is positively related to parent firms' explorative patenting ($\beta = 0.06$, $p < 0.01$) and negatively related to exploitative patenting ($\beta = -0.04$, $p < 0.01$). To further interpret the results, we calculated average marginal effects. We predicted an

Table 2
Bivariate correlations and descriptive statistics.

	Mean	S.D.	Min	Max	1	2	3	4	5	6	7	8	9
DV: Innovative inputs													
(1) Explorative patenting	0.37	0.21	0.00	1.00	1.00								
(2) Exploitative patenting	0.54	0.22	0.00	1.00	**−0.82** (0.00)	1.00							
DV: Innovative outputs													
(3) Technological breakthrough innovation	0.08	0.14	0.00	1.00	**−0.15** (0.00)	**0.12** (0.02)	1.00						
(4) Market breakthrough innovation	0.06	0.14	0.00	1.00	−0.08 (0.12)	**0.11** (0.03)	−0.01 (0.87)	1.00					
IV: CVC unit head's HCR													
(5) Experience in the parent firm	6.01	7.39	0.00	33.00	**0.10** (0.04)	**−0.13** (0.01)	−0.07 (0.18)	−0.10 (0.06)	1.00				
(6) Entrepreneurial experience	0.73	2.36	0.00	12.00	**0.20** (0.00)	**−0.16** (0.00)	0.08 (0.10)	−0.10 (0.05)	−0.03 (0.62)	1.00			
(7) IVC experience	0.68	1.98	0.00	9.00	**−0.17** (0.00)	**0.21** (0.00)	0.02 (0.72)	**0.15** (0.00)	**−0.25** (0.00)	−0.04 (0.47)	1.00		
(8) Engineering and science experience	0.84	3.21	0.00	20.00	−0.02 (0.64)	0.02 (0.66)	**0.10** (0.04)	−0.04 (0.42)	**−0.12** (0.02)	−0.08 (0.11)	−0.08 (0.12)	1.00	
Controls (individual level)													
(9) Career variety	0.46	0.29	0.13	2.25	−0.05 (0.36)	0.08 (0.14)	0.04 (0.40)	0.00 (1.00)	**−0.49** (0.00)	−0.04 (0.42)	0.06 (0.22)	**−0.10** (0.04)	1.00
(10) Engineering and science education	0.54	0.50	0.00	1.00	0.01 (0.88)	−0.02 (0.73)	**0.19** (0.00)	−0.07 (0.19)	**−0.16** (0.00)	**0.12** (0.02)	−0.03 (0.60)	**0.24** (0.00)	**0.13** (0.01)
(11) MBA-holder	0.46	0.50	0.00	1.00	0.08 (0.11)	**−0.14** (0.01)	**−0.18** (0.00)	**−0.18** (0.00)	−0.09	**−0.15** (0.07)	**0.14** (0.00)	**−0.21** (0.01)	**0.29** (0.00)
Controls (organizational level)													
(12) CTO presence	0.46	0.50	0.00	1.00	0.00 (0.94)	0.00 (0.95)	−0.02 (0.64)	**−0.11** (0.03)	−0.02 (0.67)	−0.08 (0.13)	−0.04 (0.39)	0.04 (0.45)	0.09 (0.07)
(13) CVC experience[a]	1.25	1.56	−3.51	5.55	0.04 (0.49)	0.02 (0.74)	0.03 (0.53)	−0.03 (0.54)	**0.12** (0.02)	−0.08 (0.13)	0.02 (0.65)	0.09 (0.07)	−0.06 (0.24)
(14) CVC activity	19.79	48.56	0.00	316.00	0.04 (0.44)	−0.03 (0.62)	−0.01 (0.78)	−0.03 (0.51)	**0.17** (0.00)	0.02 (0.68)	−0.06 (0.27)	−0.04 (0.41)	−0.03 (0.58)
(15) Absorptive capacity	6232.51	7974.77	0.00	34,276.00	**−0.20** (0.00)	**0.21** (0.00)	**0.11** (0.03)	**0.15** (0.00)	0.08 (0.14)	**−0.11** (0.03)	**0.12** (0.02)	**−0.13** (0.01)	−0.07 (0.20)
(16) Firm size	9.77	1.25	6.58	12.45	−0.05 (0.35)	0.06 (0.24)	−0.07 (0.17)	**0.12** (0.02)	**0.21** (0.00)	**−0.20** (0.00)	0.08 (0.10)	**−0.13** (0.01)	−0.05 (0.31)
(17) Financial slack[a]	0.62	0.58	−0.80	2.47	0.01 (0.86)	0.06 (0.26)	**0.21** (0.00)	0.02 (0.64)	**−0.30** (0.00)	**0.11** (0.03)	**−0.15** (0.00)	0.00 (0.95)	**0.20** (0.00)
(18) Relative strategic motivation	7.88	7.51	0.00	20.00	−0.04 (0.43)	0.02 (0.68)	0.07 (0.17)	0.04 (0.46)	0.01 (0.89)	**−0.20** (0.00)	−0.09 (0.09)	**0.26** (0.00)	0.00 (0.98)
(19) Exploration orientation	0.00	0.00	0.00	0.01	−0.01 (0.84)	−0.01 (0.89)	0.10 (0.06)	0.08 (0.13)	−0.10 (0.06)	**0.17** (0.00)	**0.12** (0.02)	−0.05 (0.36)	−0.05 (0.37)
(20) Direct investment	0.23	0.42	0.00	1.00	−0.04 (0.38)	0.04 (0.39)	**0.16** (0.00)	−0.01 (0.80)	−0.02 (0.73)	**−0.15** (0.00)	**−0.19** (0.00)	0.03 (0.50)	−0.05 (0.32)
(21) Self-managed fund	0.72	0.45	0.00	1.00	−0.01 (0.80)	0.00 (0.98)	**−0.12** (0.02)	0.05 (0.29)	0.01 (0.90)	**0.18** (0.00)	**0.22** (0.00)	−0.00 (1.00)	0.04 (0.45)
(22) Dedicated fund	0.06	0.23	0.00	1.00	**0.11** (0.04)	−0.08 (0.11)	−0.06 (0.21)	−0.08 (0.10)	0.02 (0.70)	−0.08 (0.14)	−0.08 (0.10)	−0.06 (0.22)	0.02 (0.73)

Note: S.D. = Standard deviation; $n = 381$, this increase, compared to the sample for product introductions, reflects the inclusion of non-lagged values; Bold = significant at the 5 % level; DV = dependent variable; IV = independent variable.
[a]Negative values are due to log transformation.

increase of 0.015 in explorative patenting for every 1 % increase in entrepreneurial experience and a decrease in exploitative patenting of 0.010 for every 1 % increase in entrepreneurial experience. Given that the patenting variables are on a scale between 0 and 1, the changes in explorative and exploitative patenting can be interpreted as changes of 1.5 % and 1 %, respectively. However, entrepreneurial experience is a discrete variable, and single-digit percentage changes are not applicable to it, so we predicted margins at representative values of the independent variable. We used the data range between one standard deviation above and below the mean. However, since the standard deviation is larger than the mean, we used 0 and one standard deviation above the mean, rounded to the next discrete value (3), including the discrete values between 0 and 3. We predicted margins for 0, 1, 2, and 3 years of 0.37, 0.39, 0.41, and 0.43 for explorative patenting and 0.50, 0.48, 0.47, and 0.45, for exploitative patenting, as illustrated in Figs. A.1 and A.2 in the Appendix. For example, one additional year of entrepreneurial experience translates to an increase of 0.02 in the share of explorative patents. The average firm year in our patenting sample has about 670 successful patent applications per year. Increasing the share of explorative patents by two percentage points then translates into an additional 13 explorative patents granted.

Third, we find no support for H5a, stating that CVC unit heads' IVC experience is positively related to parent firms' explorative patenting ($\beta = -0.03$, $p > 0.10$), and H5b, stating that their IVC experience is negatively related to exploitative patenting ($\beta = 0.03$, $p > 0.10$).

Fourth, Hypotheses 7a and 7b postulate that CVC unit heads' engineering and science experience is negatively related to parent firms' explorative patenting and positively related to exploitative patenting. While we find no support for the first relationship ($\beta = 0.02$, $p > 0.10$), the latter is positive and statistically marginally significant ($\beta = 0.02$, $p < 0.10$). The marginal effects in Fig. A.3 in the Appendix show an increase in exploitative patenting of 0.005 for every 1 % increase in engineering and science experience. We predicted margins for 0, 1, 2, 3, and 4 years of 0.48, 0.49, 0.49, 0.50 and 0.50, respectively.

Table 4 reports regression results for technological breakthrough innovation (Model 2a) and market breakthrough innovation (Model 2b).

Table 2
(continued).

	Mean	S.D.	Min	Max	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Controls (individual level)																	
(10) Engineering and science education	0.54	0.50	0.00	1.00	1.00												
(11) MBA-holder	0.46	0.50	0.00	1.00	**−0.21** (0.00)	1.00											
Controls (organizational level)																	
(12) CTO presence	0.46	0.50	0.00	1.00	−0.10 (0.06)	**0.29** (0.00)	1.00										
(13) CVC experience[a]	1.25	1.56	−3.51	5.55	0.06 (0.21)	−0.06 (0.21)	−0.03 (0.56)	1.00									
(14) CVC activity	19.79	48.56	0.00	316.00	−0.05 (0.32)	0.09 (0.08)	0.06 (0.22)	**0.71** (0.00)	1.00								
(15) Absorptive capacity	6232.51	7974.77	0.00	34,276.00	−0.01 (0.87)	**−0.18** (0.00)	**−0.15** (0.00)	**0.45** (0.00)	**0.43** (0.00)	1.00							
(16) Firm size	9.77	1.25	6.58	12.45	**−0.19** (0.00)	0.00 (1.00)	−0.03 (0.51)	**0.34** (0.00)	**0.26** (0.00)	**0.46** (0.00)	1.00						
(17) Financial slack[a]	0.62	0.58	−0.80	2.47	**0.23** (0.00)	**−0.17** (0.00)	−0.07 (0.19)	0.10 (0.06)	**0.13** (0.01)	**0.14** (0.01)	**−0.29** (0.00)	1.00					
(18) Relative strategic motivation	7.88	7.51	0.00	20.00	**−0.16** (0.00)	0.07 (0.20)	0.07 (0.19)	**−0.13** (0.01)	**−0.25** (0.00)	−0.06 (0.26)	0.05 (0.29)	−0.10 (0.06)	1.00				
(19) Exploration orientation	0.00	0.00	0.00	0.01	0.02 (0.70)	−0.05 (0.32)	0.02 (0.68)	0.05 (0.32)	−0.02 (0.63)	**0.22** (0.00)	**0.34** (0.00)	0.00 (0.94)	−0.08 (0.13)	1.00			
(20) Direct investment	0.23	0.42	0.00	1.00	−0.03 (0.62)	**−0.10** (0.06)	0.05 (0.36)	**−0.13** (0.01)	**−0.16** (0.00)	−0.08 (0.11)	−0.06 (0.24)	0.05 (0.33)	**0.25** (0.00)	0.10 (0.06)	1.00		
(21) Self-managed fund	0.72	0.45	0.00	1.00	**0.14** (0.00)	−0.01 (0.90)	−0.03 (0.63)	**0.13** (0.01)	**0.19** (0.00)	**0.13** (0.01)	**0.13** (0.01)	**−0.11** (0.03)	**−0.34** (0.00)	−0.03 (0.60)	−0.86 (0.00)	1.00	
(22) Dedicated fund	0.06	0.23	0.00	1.00	**−0.24** (0.00)	**0.19** (0.00)	−0.04 (0.47)	−0.03 (0.58)	−0.09 (0.09)	−0.10 (0.06)	**−0.14** (0.01)	**0.13** (0.01)	**0.21** (0.00)	**−0.12** (0.02)	**−0.13** (0.01)	**−0.39** (0.00)	1.00

Note: S.D. = Standard deviation; n = 381, this increase, compared to the sample for product introductions, reflects the inclusion of non-lagged values; Bold = significant at the 5 % level; DV = dependent variable; IV = independent variable.
[a]Negative values are due to log transformation.

Table 3
Fractional regression results for explorative and exploitative patenting.

Dependent variables:	Model 1a – DV: explorative patenting		Model 1b – DV: exploitative patenting	
Independent variables				
Experience in the parent firm	0.00		0.01	
	(0.01)		(0.01)	
Entrepreneurial experience	0.06	***	−0.04	***
	(0.02)		(0.02)	
IVC experience	−0.03		0.03	
	(0.03)		(0.02)	
Engineering and science experience	0.02		0.02	*
	(0.01)		(0.01)	
Controls (individual level)				
Career variety	−0.29	**	0.39	***
	(0.13)		(0.13)	
MBA holder	0.37	***	−0.30	***
	(0.12)		(0.11)	
Engineering and science education	0.11		−0.11	
	(0.13)		(0.12)	
Controls (organizational level)				
CVC experience	−0.02		−0.02	
	(0.04)		(0.04)	
CVC activity	−0.00	**	0.00	**
	(0.00)		(0.00)	
Absorptive capacity	−0.00		−0.00	*
	(0.00)		(0.00)	
Firm size	0.09		0.06	
	(0.07)		(0.05)	
Financial slack	0.07		0.09	
	(0.07)		(0.07)	
Relative strategic motivation	−0.01		−0.01	
	(0.01)		(0.01)	
Exploration orientation	−0.96		−54.54	
	(52.03)		(49.34)	
CTO presence	−0.02		0.03	
	(0.08)		(0.08)	
Direct investment	−0.20		0.06	
	(0.21)		(0.19)	
Self-managed fund	−0.19		−0.12	
	(0.21)		(0.23)	
Constant	−1.69	**	−0.06	
	(0.72)		(0.47)	
Industry fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
Observations	485		485	
Chi^2	1.59e+09	***	3.84e+07	***

Note: Fractional regression models (probit). Robust standard errors in parentheses. All control and independent variables are lagged by one year.
*** p < 0.01.
** $p < 0.05$.
* $p < 0.1$.

Table 4
Fractional regression results for technological and market breakthrough innovation.

Dependent variables:	Model 2a – DV: Technological breakthrough innovation		Model 2b – DV: Market breakthrough innovation	
Independent variables				
Experience in the parent firm	0.01		−0.01	
	(0.01)		(0.01)	
Entrepreneurial experience	0.08	**	−0.10	
	(0.04)		(0.07)	
IVC experience	0.04	*	0.09	***
	(0.03)		(0.03)	
Engineering and science experience	0.05	***	−0.05	**
	(0.02)		(0.02)	
Controls (individual level)				
Career variety	0.31		0.14	
	(0.29)		(0.38)	
MBA holder	−0.29		−0.18	
	(0.20)		(0.20)	
Engineering and science education	0.02		−0.48	*
	(0.16)		(0.25)	
Controls (organizational level)				
CVC experience	−0.03		0.07	
	(0.06)		(0.08)	
CVC activity	0.00		−0.00	
	(0.00)		(0.00)	
Absorptive capacity	−0.00	*	0.00	
	(0.00)		(0.00)	
Firm size	0.11		−0.03	
	(0.14)		(0.15)	
Financial slack	0.15		0.37	**
	(0.15)		(0.17)	
Relative strategic motivation	0.02	*	0.02	
	(0.01)		(0.01)	
Exploration orientation	159.57		224.15	
	(97.31)		(148.46)	
CTO presence	0.18		−0.24	
	(0.13)		(0.15)	
Direct investment	0.15		0.77	**
	(0.23)		(0.31)	
Self-managed fund	−0.05		0.59	**
	(0.23)		(0.29)	
Constant	−7.23	***	−0.60	
	(1.32)		(1.39)	
Industry fixed effects	Yes		Yes	
Year fixed effects	Yes		Yes	
Observations	369		369	
Chi^2	10,923.45	***	2.72e+10	***

Note: Fractional regression models (probit). Robust standard errors in parentheses. All control and independent variables are lagged by one year. ***p<0.01, **p<0.05, *p<0.1.

First, the results do not support Hypotheses 2a and 2b, stating that CVC unit heads' experience in the parent firm is positively related to parent firms' market breakthrough innovation (β = −0.01, p > 0.10) and negatively related to technological breakthrough innovation (β = 0.01, p > 0.10).

Second, H4a and H4b postulate that CVC unit heads' entrepreneurial experience is negatively related to parent firms' market breakthrough innovation and positively related to technological breakthrough innovation. The market breakthrough innovation relationship is negative but statistically insignificant (β = −0.10, p > 0.10). The technological breakthrough innovation relation is positive and statistically significant (β = 0.08, $p < 0.05$), thus supporting H4b.

Third, we find support for H6a, stating that CVC unit heads' IVC experience is positively related to parent firms' market breakthrough innovation (β = 0.09, $p < 0.01$), while it has a statistically significant positive relation to technological breakthrough innovation at the 10%-level, contrary to our Hypothesis 6b (β = 0.04, $p < 0.10$).

Lastly, we find support for Hypotheses 8a and 8b, as engineering and science experience is negatively related to market breakthrough innovation (β = −0.05, p < 0.05) and positively related to technological breakthrough innovation (β = 0.05, p < 0.01).

We also calculated the marginal effects of the independent variables on breakthrough innovation. We found that the average marginal effects for entrepreneurial experience, IVC experience, and engineering and science experience in Model 2a are 0.011, 0.004, and 0.008, respectively, and 0.014 and − 0.002 for IVC experience and engineering and science experience, respectively, in Model 2b. We then predicted margins at representative values for the independent variables. We tested 0, 1, 2, and 3 years for entrepreneurial experience and IVC experience and 0, 1, 2, 3, and 4 years for engineering and science experience. For technological breakthrough innovation, we obtained margins of 0.073, 0.083, 0.095, and 0.108 for entrepreneurial experience, 0.077, 0.083, 0.089, and 0.095 for IVC experience, and 0.076, 0.082, 0.089, 0.097, and 0.105 for engineering and science experience. For market breakthrough innovation, IVC experience produced margins of 0.050, 0.058, 0.068, and 0.078, respectively, while engineering and science experience yielded margins of 0.064, 0.059, 0.055, 0.051, and 0.047, respectively. The plots of these marginal effects are illustrated in Figs. A.4 to A.8 in the Appendix.

To elaborate on one example, the expected difference in the dependent variable technological breakthrough innovation between no engineering and science experience and one year of such experience is 0.006 (0.082–0.076). Technological breakthrough innovation refers to the share of technological breakthroughs among all new product introductions for three years following the focal year. Technological breakthroughs are uncommon, so the average three-year period in our product introductions sample contains only about one new technological breakthrough per firm, while it contains about eleven new product introductions. Consequently, an increase of 0.6 percentage points in the share of technological breakthroughs may be statistically significant but not economically significant. Table 5 provides a summary of the hypotheses and findings.

5.3. Robustness and endogeneity tests

We conducted multiple additional tests to increase confidence in our patent-based models 1a and 1b, as presented in Tables A.1 and A.2 in the Appendix. As mentioned above, our measurement of explorative patenting categorized patents as explorative when they cite at least 60 % of new knowledge and exploitative when they cite at least 60 % of existing knowledge. Following Custódio et al. (2019), we also tested our models using 80 % as the cutoff and found results in line with the 60 % version (Models 3a and 3b). IVC experience is now statistically significant for exploitative patenting. Moreover, we followed Lerner and Seru (2022) and investigated potential citation biases based on the interaction effects of truncation and inventor compositions.

First, we ran robustness tests excluding firms from Massachusetts, a state where an unusually high number of patents are filed due to its high-technology concentration (Models 4a and 4b). Second, we ran robustness tests excluding firms in the chemical industry, an industry where an unusually high number of patents are filed due to the competitive relevance of intellectual property in this domain (Models 5a and 5b). Third, we ran robustness tests excluding 10 % of the firms with the highest market-to-book value because such firms are typically correlated with patent biases (Models 6a and 6b). Finally, we ran robustness tests excluding the years before 2009 to account for potential changes in patenting behavior due to the 2008 amendments to the International Accounting Standards 38 (IAS 38) (Models 7a and 7b). IAS 38 was amended in terms of performance-based amortization for intangible assets like patents. All these tests yielded results that supported several effects of our primary analyses, but the engineering and science experience coefficient does not hold for exploitative patenting.

We further drew on multiple methods of mitigating concerns about endogeneity. First, we controlled for several well-justified control variables to mitigate the risk of omitted variables. Second, following Papies et al. (2017), we included time-fixed and industry-fixed effects in our models, to control for such unobserved effects. Third, we used a longitudinal sample and lagged our models to reduce the risk of reverse causality (Saboo et al., 2016). Finally, we employed an instrumental variables approach to minimize the risk of endogeneity. In this approach, we treated the independent variables, entrepreneurial experience, IVC experience, and engineering and science experience, as endogenous variables. Extant research hints that competitors' strategic actions can influence focal firms' strategic actions (e.g., Gimeno and Woo, 1996), like hiring CVC unit heads. Likewise, the hiring patterns of industry peers should be exogenous to innovation activity in the focal firm, and therefore meet the exclusion restriction (Germann et al., 2015). Thus, the industry averages of the independent variables according to their three-digit Standard Industrial Classification (SIC) codes were used as instruments, and we calculated two-stage least squares regressions for all of our study's models (Angrist and Pischke, 2009).

In the first stage, we regressed the independent variables on the relevant industry experience instruments and the control variables, as illustrated in Tables A.3 and A.4 in the Appendix. We assessed the instruments' strength, finding all first-stage regressions significant at the 1 % level. When comparing first-stage regressions with and without instruments, the R^2 values across all models were larger for the models with the instruments. In the second stage, we replaced the independent variables with the exogenously predicted values from the first stage (Papies et al., 2017). This approach yielded results comparable to the main models, except for engineering and science experience when exploitative patenting is the dependent variable. When technological breakthrough innovation is the dependent variable, we can see that the main effects do not hold. Thus, these effects should be interpreted with caution and further research is needed. Table A.5 of the Appendix shows the results from the second stage.

6. Discussion and conclusion

CVC unit heads' ability to influence important firm-level metrics is based on the mandate that CVC units must seek investment opportunities for their parent firm (Miles and Covin, 2002; Wadhwa and Kotha, 2006; Wadhwa et al., 2016). The influence of CVC unit heads also stems

Table 5
Summary of the results from regression analyses.

IVs	Hypotheses	DVs	Expected relations	Sig.	Verdict
Experience in the parent firm	H1a	Explorative patenting	Negative	–	Not supported
	H1b	Exploitative patenting	Positive	–	Not supported
	H2a	Market breakthrough innovation	Positive	–	Not supported
	H2b	Technological breakthrough innovation	Negative	–	Not supported
Entrepreneurial experience	H3a	Explorative patenting	Positive	***	Supported
	H3b	Exploitative patenting	Negative	***	Supported
	H4a	Market breakthrough innovation	Negative	–	Not supported
	H4b	Technological breakthrough innovation	Positive	**	Supported
IVC experience	H5a	Explorative patenting	Positive	–	Not supported
	H5b	Exploitative patenting	Negative	–	Not supported
	H6a	Market breakthrough innovation	Positive	***	Supported
	H6b	Technological breakthrough innovation	Negative	(*)	Not supported
Engineering and science experience	H7a	Explorative patenting	Negative	–	Not supported
	H7b	Exploitative patenting	Positive	*	Supported (10%-level)
	H8a	Market breakthrough innovation	Negative	**	Supported
	H8b	Technological breakthrough innovation	Positive	***	Supported

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

from their unique position as knowledge brokers between portfolio ventures and the parent firm (Elfring, 2005; Henderson and Leleux, 2005). This study finds significant relationships between CVC unit heads' career experience and parent firms' innovative performance.

We find that firms with CVC unit heads possessing entrepreneurial experience have higher shares of explorative patents and lower shares of exploitative patents. The literature on CVC has rarely considered the quality of innovative inputs (for an exception, see Schildt et al., 2005), a gap we address by differentiating between explorative and exploitative learning and highlighting the relevance of entrepreneurial experience to these types of learning. Our findings also indicate that entrepreneurial experience fosters technological breakthrough innovation.

Additionally, we investigated the claim that venture capitalists make effective CVC unit heads (Siegel et al., 1988). We observe hints that IVC experience positively relates to market and technological breakthrough innovation. The positive relation to technological breakthrough innovation, contrary to Hypothesis 6b, could indicate that IVC experience gained in the digital era encompasses investments in new technology-based firms (Nuscheler et al., 2019).

Moreover, we find in some models that engineering and science experience positively relates to exploitative patenting and technological breakthrough innovation. Here, we extend the findings of Dokko and Gaba (2012). They observed that CVC units with more engineering-experienced employees exhibit a stronger strategic goal orientation, leading them to emphasize innovation.

We unexpectedly found statistically non-significant relationships between experience in the parent firm and our dependent variables. We had assumed that this type of experience would provide CVC managers with a mental framework through which they interpret new information (Dokko and Gaba, 2012; Gaba and Dokko, 2016). There are two possible explanations for this finding. First, firms generally expect their CVC units to think outside the box and the firm's boundaries. As such, CVC unit heads with experience in the parent firm may abandon former beliefs about their organization and its market environment, acting "almost in antithesis" (Souitaris et al., 2012, p. 477) to their corporate parent. Second, organizational environments changed during our study's timeframe, due to factors such as globalization, financial crisis, and digitalization. This could also explain why experience in the parent firm did not act as a cognitive filter in this study.

6.1. Theoretical implications

This study contributes to the CVC literature in several ways. First, we combine human capital theory (Becker, 1993; Nyberg and Wright, 2015; Schultz, 1961) with the attention-based view (Ocasio, 1997, 2011) to establish CVC unit heads' career experiences as new individual-level antecedents of parent firms' innovative performance. In doing so, we complement CVC scholars' prevalent focus on antecedents at the organizational and portfolio levels (e.g., Dushnitsky and Lenox, 2005a; Keil et al., 2008b; Wadhwa et al., 2016) with insights into the most important individual in CVC units. While our findings empirically support the notion that CVC unit heads facilitate the knowledge transfer between startups and their parent firms (Henderson and Leleux, 2005; Keil et al., 2008a; Keil et al., 2016; Weber and Weber, 2011), we show that the CVC unit heads' role in inter-organizational learning is dependent on their experiences and related knowledge structures, which function as attentional filters. We thus bridge two dominant research streams in the CVC literature, namely, research investigating CVC's impact on innovative performance and research investigating CVC unit heads' characteristics and their impact on CVC practices (e.g., Dokko and Gaba, 2012; Dushnitsky and Shapira, 2010; Gaba and Dokko, 2016; Souitaris et al., 2012; Wadhwa and Kotha, 2006; Winters and Murfin, 1988).

Second, we extend research on the CVC-core paradox, which investigates the tension between CVC-based exploration and exploitation within the core business of the parent firm (Jeon and Maula, 2022). Specifically, we add to research focusing on individual-level mechanisms in CVC units to understand how corporations can manage this tension (e.g., Gaba and Dokko, 2016; Keil et al., 2008a). We demonstrate that certain characteristics of CVC unit heads increase the likelihood of breakthrough innovations, which are associated with long-term growth and thus help justify CVC investments among internal (e.g., business unit managers) and external (e.g., analysts) stakeholders. In doing so, we also add to the CVC literature on ambidexterity (e.g., Hill and Birkinshaw, 2014; Keil et al., 2016). Building on the work of Hill and Birkinshaw (2014), our findings indicate that CVC unit heads' cognitive filters influence how they perceive and act on information from their supportive relational context, which comprises key resource holders who are internal or external to the firm. This, in turn, influences how they "balance between exploring new opportunities and exploiting existing capabilities" (Hill and Birkinshaw, 2014, p. 1901). By linking an individual position embedded in a relational network and organizational knowledge outcomes, our findings also inform the ongoing discussion concerning the microfoundations of innovation strategy (Grigoriou and Rothaermel, 2014; Zahra et al., 2020).

Third, we introduce a new level of analysis for innovative performance and show that CVC unit heads can influence their parent firms' innovation in the form of new product introductions. Most studies on the link between CVC units and firms' innovation are based on patents (e.g., Dushnitsky and Lenox, 2005a; Schildt et al., 2005; Wadhwa et al., 2016). However, patents are less indicative of actual innovation and more so of learning or knowledge creation. Innovation, in contrast, is linked to firm performance and longevity (Covin and Miles, 1999; Wadhwa et al., 2016). Our use of both patents and new product introductions to measure innovative performance helps bridge the gap between learning and innovation (Rubera and Kirca, 2012). Therefore, we suggest that CVC unit heads should be investigated not only in terms of their influence on learning but also as yielding customer-facing results and generating revenue. We hope that by using this new level of analysis, we have increased confidence in the link between CVC unit heads and innovation and introduced possibilities for future research.

6.2. Practical implications

Our study has several practical implications. Some CVC units strive more for financial gain, while others are more interested in meeting strategic goals (Dokko and Gaba, 2012; Dushnitsky and Lenox, 2005b; van de Vrande et al., 2011). Our study shows that CVC unit heads can influence strategic outcomes, namely, parent firms' innovative performance. The main takeaway for firms is that CVC unit heads can increase innovative inputs in terms of patents as well as tangible, commercialized innovative outputs in terms of new product introductions.

Our results can also help companies make sound decisions in their search for new CVC unit heads. By grounding our analysis in observable criteria related to career experience, we create a tool for making informed hiring decisions. For instance, when recruiters look for suitable candidates outside their organizations and go through career information on networking platforms like LinkedIn, they could consider that IVC experience is associated with an increase in both market and technological breakthrough innovation. Additionally, recruiters could be aware that appointing internal managers with experience in the parent firm to the position of CVC unit head is not associated with increased innovative performance.

6.3. Limitations and future research

This study has limitations that lead to opportunities for future research. Our findings are generalizable to companies with CVC units across a variety of industries. However, because firms self-selected into our sample, we cannot generalize these findings to all firms, including those without CVC activity, so firms that are just beginning their CVC activity may not experience the same dynamics. Further, CVC units could also foster process innovation, which our focus on new product introductions does not capture. Accordingly, we call for future CVC research to cover the innovation spectrum in alternative and comprehensive ways.

Another limitation of our work is that while we address the powerful CVC unit head, we do not address the rest of the CVC unit's top management team or corporate people who rotate into CVC units. Future studies could focus on the career experiences of these individuals. In addition, we cannot fully rule out that endogeneity biased our results regarding technological breakthrough innovation. Future research may draw on interviews with CVC unit members to shed light on inter- and intra-organizational learning.

By focusing research on the CVC unit head, we open further avenues for research. First, instead of concentrating on parent firm outcomes, scholars could examine CVC managers' influences on startups' outcomes. Dynamics within critical dyads or between teams also provide fertile ground for further research. For example, it would be helpful to understand CVC unit head–CEO dyads and how their characteristics influence CVC activity and outcomes. Finally, given the debate about isomorphism in CVC activity (Souitaris et al., 2012) and our results concerning experience in the parent firm, we encourage further research on the differences and performance implications between internal and external hires for CVC units.

CRediT authorship contribution statement

David Bendig: Conceptualization, Methodology, Project administration, Resources, Supervision, Validation, Writing – original draft, Writing – review & editing. **Vincent Göttel:** Conceptualization, Methodology, Project administration, Supervision, Validation, Visualization, Writing – review & editing. **David Eckardt:** Conceptualization, Formal analysis, Investigation, Methodology, Software, Visualization, Writing – original draft. **Colin Schulz:** Conceptualization, Methodology, Validation, Visualization, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix A

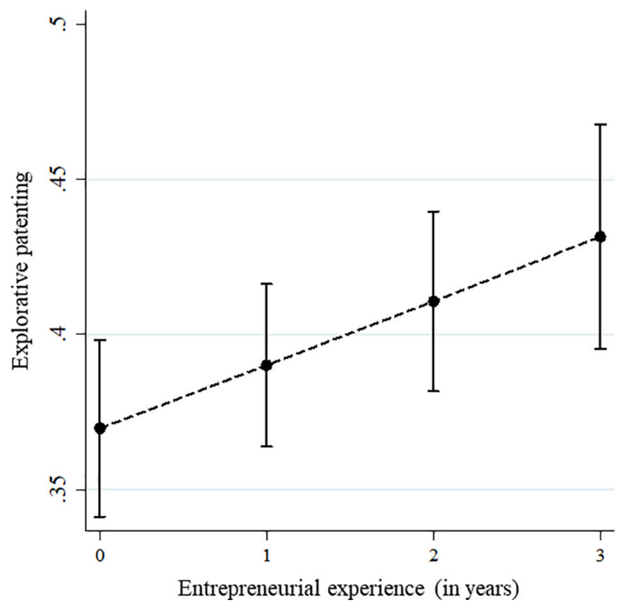

Fig. A.1. Predictive margins of the direct effect of entrepreneurial experience on explorative patenting.

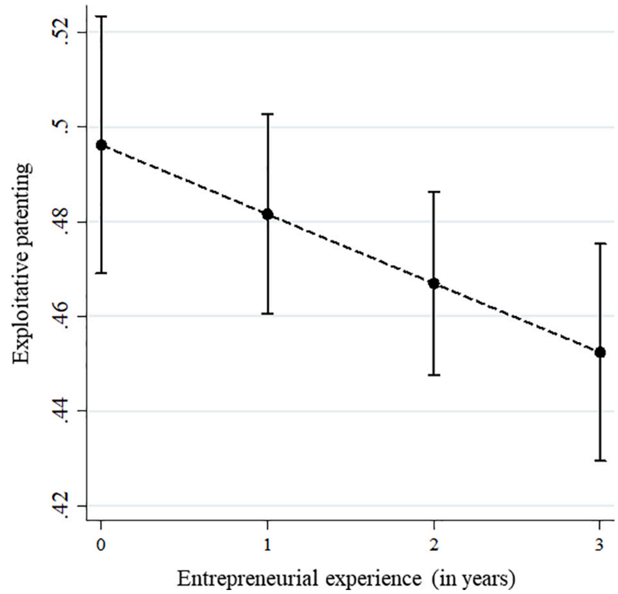

Fig. A.2. Predictive margins of the direct effect of entrepreneurial experience on exploitative patenting.

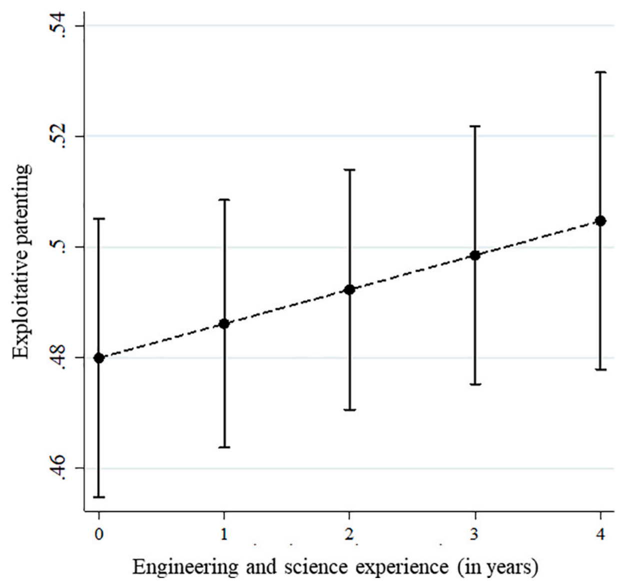

Fig. A.3. Predictive margins of the direct effect of engineering and science experience on exploitative patenting.

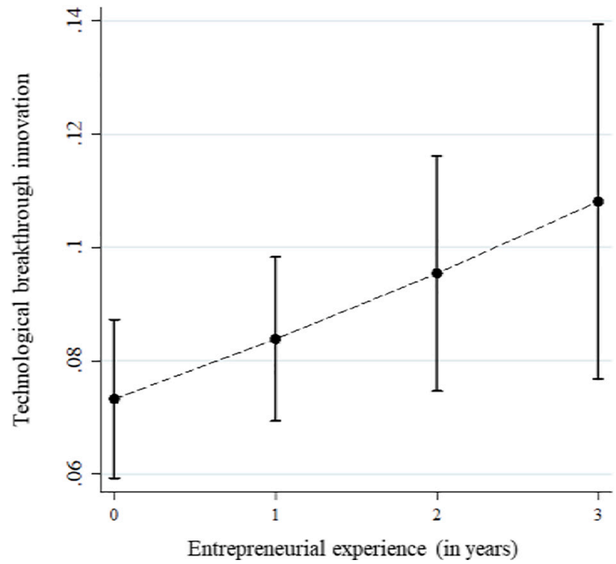

Fig. A.4. Predictive margins of the direct effect of entrepreneurial experience on technological breakthrough innovation.

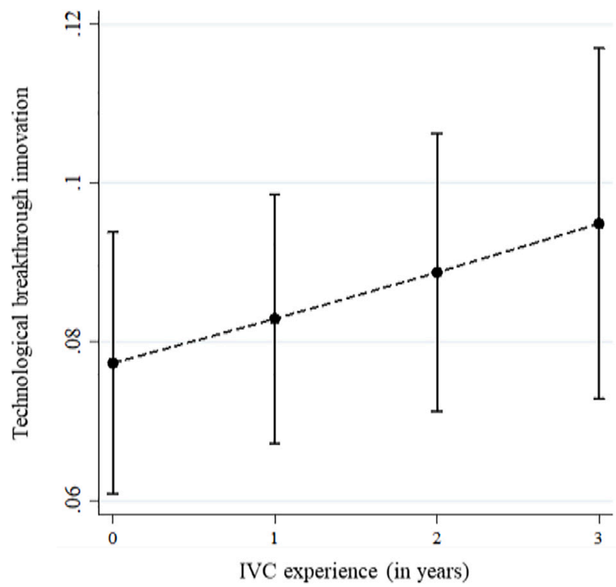

Fig. A.5. Predictive margins of the direct effect of IVC experience on technological breakthrough innovation.

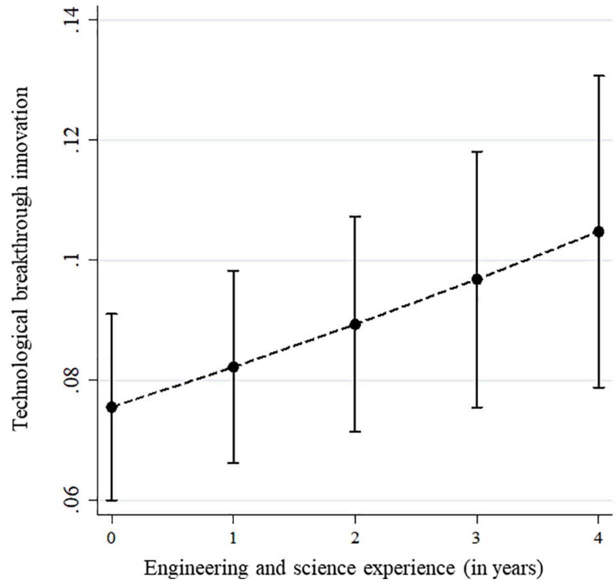

Fig. A.6. Predictive margins of the direct effect of engineering and science experience on technological breakthrough innovation.

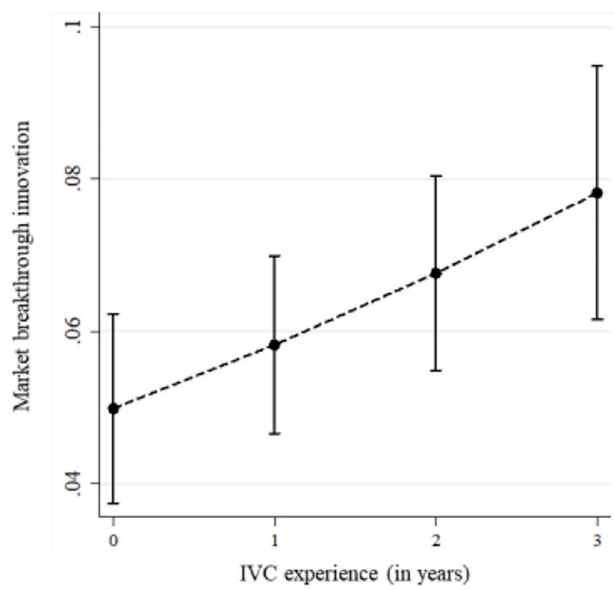

Fig. A.7. Predictive margins of the direct effect of IVC experience on market breakthrough innovation.

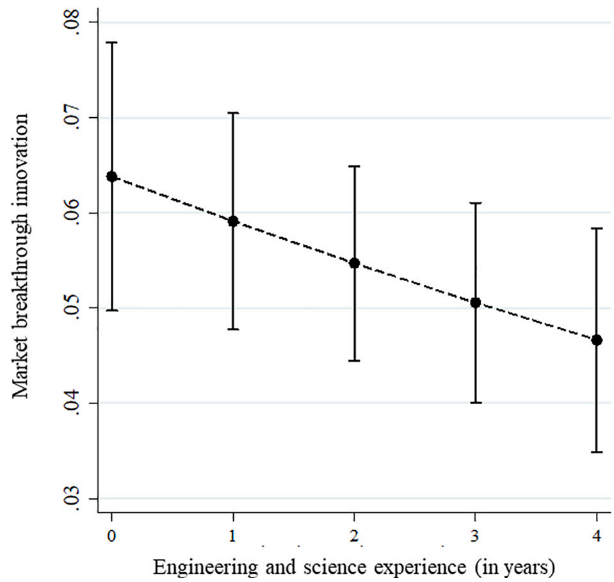

Fig. A.8. Predictive margins of the direct effect of engineering and science experience on market breakthrough innovation.

Table A.1
Robustness analyses for explorative patenting.

	Model 3a 80 % cutoff		Model 4a Wo Mass.		Model 5a Wo chemicals		Model 6a Mar.-to-book		Model 7a IAS 38	
Independent variables										
Experience in the parent firm	−0.00		0.00		0.01		0.00		0.00	
	(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
Entrepreneurial experience	0.05	***	0.06	***	0.06	***	0.07	***	0.05	***
	(0.02)		(0.02)		(0.02)		(0.02)		(0.01)	
IVC experience	−0.02		−0.01		−0.06		−0.03		−0.04	
	(0.03)		(0.03)		(0.04)		(0.03)		(0.02)	
Engineering and science experience	0.01		0.02		0.02		0.03	*	0.02	
	(0.01)		(0.01)		(0.02)		(0.01)		(0.02)	
Controls (in. level)										
Career variety	−0.36	**	−0.3	**	−0.27	**	−0.23	*	−0.26	*
	(0.14)		(0.14)		(0.13)		(0.13)		(0.14)	
MBA holder	0.38	***	0.36	***	0.45	***	0.45	***	0.25	**
	(0.12)		(0.13)		(0.14)		(0.13)		(0.10)	
Engineering and science education	0.01		0.12		0.02		0.08		0.08	
	(0.01)		(0.13)		(0.02)		(0.13)		(0.12)	
Controls (org. level)										
CVC experience	−0.02		−0.03		0.00		−0.04		−0.02	
	(0.04)		(0.05)		(0.05)		(0.05)		(0.04)	
CVC activity	−0.00	**	−0.00	*	−0.00	***	−0.00	**	−0.00	**
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Absorptive capacity	−0.00		−0.00		−0.00		0.00		0.00	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Firm size	0.08		0.12		0.13	*	0.11		0.02	
	(0.07)		(0.08)		(0.08)		(0.08)		(0.06)	
Financial slack	0.03		0.05		0.09		0.09		0.02	
	(0.07)		(0.07)		(0.08)		(0.07)		(0.07)	
Relative strategic motivation	−0.01		−0.01		−0.01		−0.01		−0.00	
	(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
Exploration orientation	1.47		−7.77		−38.49		−5.04		24.88	
	(52.24)		(52.01)		(55.61)		(55.73)		(51.93)	
CTO presence	−0.05		−0.01		0.01		−0.05		−0.01	
	(0.08)		(0.08)		(0.09)		(0.08)		(0.08)	
Direct investment	−0.19		−0.24		−0.09		−0.03		−0.19	
	(0.21)		(0.22)		(0.21)		(0.20)		(0.16)	
Self-managed fund	−0.14		−0.25		−0.13		−0.13		−0.10	
	(0.20)		(0.22)		(0.22)		(0.19)		(0.16)	
Constant	−1.89	***	−1.93	**	−2.01	***	−1.97	**	−1.78	***
	(0.69)		(0.77)		(0.71)		(0.82)		(0.58)	

(*continued on next page*)

Table A.1 (*continued*)

	Model 3a 80 % cutoff		Model 4a Wo Mass.		Model 5a Wo chemicals		Model 6a Mar.-to-book		Model 7a IAS 38	
Industry fixed effects	Yes		Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
Observations	485		470		419		433		353	
Chi^2	2.46e+13	***	1.59e+09	***	1.11e+09	***	2.07e+09	***	1.96e+09	***

Note: Fractional regression models (probit). Robust standard errors in parentheses. All control and independent variables are lagged by one year.
DV: explorative patenting.
*** $p<0.01$.
** $p<0.05$.
* $p<0.1$.

Table A.2
Robustness analyses for exploitative patenting.

	Model 3b 80 % cutoff		Model 4b Wo Mass.		Model 5b Wo chemicals		Model 6b Mar.-to-book		Model 7b IAS 38	
Independent variables										
Experience in the parent firm	0.00		0.01		0.01		0.01		0.00	
	(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
Entrepreneurial experience	−0.04	***	−0.04	***	−0.04	***	−0.05	***	−0.03	*
	(0.01)		(0.02)		(0.02)		(0.02)		(0.02)	
IVC experience	0.03	**	0.02		0.04		0.03		0.03	
	(0.02)		(0.02)		(0.04)		(0.02)		(0.02)	
Engineering and science experience	0.02	*	0.02		0.02		0.01		0.01	
	(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
Controls (in. level)										
Career variety	0.33	***	0.38	***	0.35	***	0.37	**	0.42	***
	(0.11)		(0.13)		(0.13)		(0.14)		(0.14)	
MBA holder	−0.25	**	−0.31	***	−0.33	***	−0.36	***	−0.44	***
	(0.11)		(0.12)		(0.12)		(0.12)		(0.12)	
Engineering and science education	−0.11		−0.08		−0.10		−0.09		−0.16	
	(0.11)		(0.13)		(0.14)		(0.12)		(0.12)	
Controls (org. level)										
CVC experience	−0.01		−0.03		−0.02		−0.02		−0.02	
	(0.04)		(0.04)		(0.04)		(0.04)		(0.04)	
CVC activity	0.00	**	0.00	**	0.00	***	0.00	**	0.00***	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Absorptive capacity	−0.00	*	−0.00		−0.00		−0.00	*	−0.00	
	(0.00)		(0.00)		(0.00)		(0.00)		(0.00)	
Firm size	0.05		0.07		0.08		0.06		0.02	
	(0.05)		(0.06)		(0.06)		(0.06)		(0.05)	
Financial slack	0.07		0.11		0.09		0.10		0.11	
	(0.07)		(0.07)		(0.08)		(0.07)		(0.07)	
Relative strategic motivation	−0.01	**	−0.01		−0.01		−0.00		−0.01	
	(0.01)		(0.01)		(0.01)		(0.01)		(0.01)	
Exploration orientation	−56.77		−60.14		−41.12		−60.36		−104.22	**
	(45.08)		(49.30)		(58.10)		(46.81)		(44.94)	
CTO presence	0.01		0.02		0.04		0.04		0.13	
	(0.08)		(0.08)		(0.09)		(0.08)		(0.09)	
Direct investment	−0.00		0.04		0.04		−0.01		−0.25	
	(0.19)		(0.20)		(0.19)		(0.21)		(0.30)	
Self-managed fund	−0.13		−0.13		−0.20		−0.10		−0.42	
	(0.22)		(0.23)		(0.25)		(0.23)		(0.32)	
Constant	−0.02		−0.13		−0.05		−0.11		1.45	***
	(0.44)		(0.53)		(0.53)		(0.56)		(0.55)	
Industry fixed effects	Yes		Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
Observations	485		470		419		433		353	
Chi^2	6.15e+07	***	4.19e+07	***	1.06e+08	***	1.82e+07	***	504,750.3	***

Note: Fractional regression models (probit). Robust standard errors in parentheses. All control and independent variables are lagged by one year.
DV: exploitative patenting.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table A.3
Endogeneity tests: 1st stage models for explorative and exploitative patenting.

	Experience in the parent firm		Entrepreneurial experience		IVC experience		Eng. and science experience	
Independent variables								
Experience in the parent firm (mean)	0.82	***	−0.03		−0.00		0.00	
	(0.06)		(0.03)		(0.02)		(0.03)	
Entrepreneurial experience (mean)	−0.25		1.02	***	−0.06		−0.05	
	(0.27)		(0.12)		(0.08)		(0.14)	
IVC experience (mean)	−0.29		0.19	*	1.03	***	−0.22	
	(0.25)		(0.11)		(0.07)		(0.13)	
Eng. and science experience (mean)	−0.19		−0.10	*	0.14	*	0.82	***
	(0.13)		(0.05)		(0.04)		(0.07)	
Controls (individual level)								
Career variety	−7.67	***	−0.95	**	0.42	*	−0.07	
	(0.86)		(0.37)		(0.25)		(0.45)	
MBA holder	0.29		−0.59	**	0.21		−0.80	***
	(0.54)		(0.23)		(0.16)		(0.29)	
Engineering and science education	0.77		0.67	***	−0.11		0.69	***
	(0.48)		(0.21)		(0.14)		(0.26)	
Controls (organizational level)								
CVC experience	0.08		−0.05		−0.05		0.23	**
	(0.21)		(0.09)		(0.06)		(0.11)	
CVC activity	0.01		0.01	***	−0.00		0.00	*
	(0.00)		(0.00)		(0.00)		(0.00)	
Absorptive capacity	0.00	*	−0.00	***	0.00	**	−0.00	
	(0.00)		(0.00)		(0.00)		(0.00)	
Firm size	0.58	**	0.20	*	−0.11		−0.47	***
	(0.26)		(0.11)		(0.08)		(0.14)	
Financial slack	−1.64	***	0.51	**	−0.56	***	−0.54	**
	(0.50)		(0.21)		(0.14)		(0.26)	
Relative strategic motivation	0.00		−0.04	***	−0.00		0.10	***
	(0.04)		(0.02)		(0.01)		(0.02)	
Exploration orientation	231.23		165.97		323.40	***	−210.89	
	(339.40)		(145.80)		(97.81)		(178.65)	
CTO presence	1.58	***	−0.53	**	−0.31	**	0.15	
	(0.50)		(0.22)		(0.14)		(0.26)	
Direct investment	−1.69	*	−0.46		−0.47		1.63	***
	(1.01)		(0.43)		(0.29)		(0.53)	
Self-managed fund	−0.58		1.50	***	0.06		1.26	**
	(0.96)		(0.41)		(0.28)		(0.50)	
Constant	−0.27		−2.34	*	0.37		2.80	*
	(3.14)		(1.35)		(0.90)		(1.65)	
Industry fixed effects	Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes	
Observations	485		485		485		485	

Note: Robust standard errors in parentheses. All control and independent variables are lagged by one year.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table A.4
Endogeneity tests: 1st stage models for market and technological breakthrough innovation.

	Experience in the parent firm		Entrepreneurial experience		IVC experience		Eng. and science experience	
Independent variables								
Experience in the parent firm (mean)	0.77	***	0.00		0.01		−0.01	
	(0.07)		(0.03)		(0.02)		(0.03)	
Entrepreneurial experience (mean)	−0.43		1.09	***	−0.22	*	−0.05	
	(0.43)		(0.17)		(0.13)		(0.20)	
IVC experience (mean)	−0.83	**	0.18		1.12	***	−0.17	
	(0.38)		(0.15)		(0.11)		(0.17)	
Eng. and science experience (mean)	−0.25		−0.10		0.15	***	0.83	***
	(0.16)		(0.06)		(0.05)		(0.07)	
Controls (individual level)								
Career variety	−7.98	***	−0.81	**	0.33		−0.12	
	(1.02)		(0.40)		(0.30)		(0.47)	
MBA holder	−0.28		−0.19		0.27		−0.67	**
	(0.71)		(0.28)		(0.21)		(0.33)	
Engineering and science education	−0.27		0.90	***	0.27		0.83	**
	(0.70)		(0.28)		(0.20)		(0.32)	
Controls (organizational level)								
CVC experience	−0.18		−0.17		−0.11		0.56	***
	(0.29)		(0.11)		(0.08)		(0.13)	

(continued on next page)

Table A.4 (*continued*)

	Experience in the parent firm		Entrepreneurial experience		IVC experience		Eng. and science experience	
CVC activity	0.01	*	0.01	**	−0.00		0.00	
	(0.01)		(0.00)		(0.00)		(0.00)	
Absorptive capacity	0.00		−0.00	***	0.00		−0.00	
	(0.00)		(0.00)		(0.00)		(0.00)	
Firm size	0.50		0.31	*	0.03		−0.44	**
	(0.45)		(0.18)		(0.13)		(0.21)	
Financial slack	−1.59	***	0.41	*	−0.82	***	−0.94	***
	(0.59)		(0.23)		(0.17)		(0.27)	
Relative strategic motivation	0.00		−0.03		0.01		0.12	***
	(0.05)		(0.02)		(0.01)		(0.02)	
Exploration orientation	−139.50		414.26	**	526.17	***	7.86	
	(460.41)		(182.43)		(134.26)		(212.48)	
CTO presence	1.40	**	−0.67	***	−0.41	**	0.02	
	(0.61)		(0.24)		(0.18)		(0.28)	
Direct investment	−1.09		−0.40		−0.80	**	1.39	**
	(1.35)		(0.54)		(0.39)		(0.62)	
Self-managed fund	−0.03		1.69	***	0.02		0.98	
	(1.31)		(0.52)		(0.38)		(0.60)	
Constant	1.46		−4.54	**	−1.29		2.73	
	(4.77)		(1.89)		(1.39)		(2.20)	
Industry fixed effects	Yes		Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes		Yes	
Observations	369		369		369		369	

Note: Robust standard errors in parentheses. All control and independent variables are lagged by one year.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

Table A.5
Endogeneity tests: 2nd stage models for dependent variables.

	Explorative patenting		Exploitative patenting		Tech. Break. innovation		Market Break. innovation	
Independent variables								
Experience in the parent firm (pred.)	0.00		−0.00		−0.01	**	0.00	
	(0.00)		(0.00)		(0.00)		(0.00)	
Entrepreneurial experience (pred.)	0.04	***	−0.03	***	−0.01		−0.01	
	(0.01)		(0.01)		(0.01)		(0.01)	
IVC experience (pred.)	−0.02	*	0.02		0.01		0.02	*
	(0.01)		(0.01)		(0.01)		(0.01)	
Eng. and science experience (pred.)	−0.00		0.01		0.00		−0.02	***
	(0.01)		(0.01)		(0.01)		(0.01)	
Controls (individual level)								
Career variety	−0.08		0.07		−0.04		0.04	
	(0.06)		(0.05)		(0.04)		(0.04)	
MBA holder	0.12	***	−0.11	***	−0.05	**	−0.05	**
	(0.03)		(0.03)		(0.02)		(0.02)	
Engineering and science education	0.05	*	−0.03		0.02		−0.02	
	(0.03)		(0.02)		(0.02)		(0.02)	
Controls (organizational level)								
CVC experience	−0.00		−0.01		−0.01		0.01	
	(0.01)		(0.01)		(0.01)		(0.01)	
CVC activity	−0.00	***	0.00	***	0.00		−0.00	
	(0.00)		(0.00)		(0.00)		(0.00)	
Absorptive capacity	0.00		−0.00	**	−0.00	***	0.00	
	(0.00)		(0.00)		(0.00)		(0.00)	
Firm size	0.02		0.03	***	0.02		−0.03	*
	(0.01)		(0.01)		(0.01)		(0.01)	
Financial slack	0.02		0.03		0.03		0.03	
	(0.03)		(0.02)		(0.02)		(0.02)	
Relative strategic motivation	−0.00		−0.00	**	0.00		0.00	**
	(0.00)		(0.00)		(0.00)		(0.00)	
Exploration orientation	−5.30		−15.44		29.13	*	33.83	**
	(16.07)		(14.86)		(16.19)		(15.95)	
CTO presence	−0.00		0.01		0.02		−0.02	
	(0.02)		(0.02)		(0.02)		(0.02)	
Direct investment	−0.07		0.02		0.03		0.06	
	(0.05)		(0.04)		(0.04)		(0.04)	
Self-managed fund	−0.08	*	−0.02		0.04		0.06	
	(0.05)		(0.05)		(0.04)		(0.04)	
Constant	0.20		0.33	**	−0.27	*	0.55	***
	(0.15)		(0.14)		(0.14)		(0.14)	

(*continued on next page*)

Table A.5 (*continued*)

	Explorative patenting	Exploitative patenting	Tech. Break. innovation	Market Break. innovation
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	485	485	369	369

Note: Robust standard errors in parentheses. All control and independent variables are lagged by one year.
*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$.

References

Allen, S.A., Hevert, K.T., 2007. Venture capital investing by information technology companies: did it pay? J. Bus. Ventur. 22 (2), 262–282. https://doi.org/10.1016/j.jbusvent.2006.01.001.

Alvarez-Garrido, E., Dushnitsky, G., 2016. Are entrepreneurial ventures' innovation rates sensitive to investor complementary assets? Comparing biotech ventures backed by corporate and independent VCs. Strateg. Manag. J. 37 (5), 819–834. https://doi.org/10.1002/smj.

Angrist, J.D., Pischke, J.-S., 2009. Mostly Harmless Econometrics: An empiricist's Companion. Press, Princeton, NJ, Princeton Univ. https://doi.org/10.1515/9781400829828.

Audretsch, D.B., 1995. Innovation, growth and survival. Int. J. Ind. Organ. 13 (4), 441–457. https://doi.org/10.1016/0167-7187(95)00499-8.

Baron, R.A., Ensley, M.D., 2006. Opportunity recognition as the detection of meaningful patterns: evidence from comparisons of novice and experienced entrepreneurs. Manag. Sci. 52 (9), 1331–1344. https://doi.org/10.1287/mnsc.1060.0538.

Basu, S., Wadhwa, A., 2013. External venturing and discontinuous strategic renewal: an options perspective. J. Prod. Innov. Manag. 30 (5), 956–975. https://doi.org/10.1111/jpim.12039.

Becker, G.S., 1993. Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, 3rd ed. University of Chicago Press, Chicago.

Belderbos, R., Jacob, J., Lokshin, B., 2018. Corporate venture capital (CVC) investments and technological performance: geographic diversity and the interplay with technology alliances. J. Bus. Ventur. 33 (1), 20–34. https://doi.org/10.1016/j.jbusvent.2017.10.003.

Bendig, D., Foege, J.N., Endriß, S., Brettel, M., 2020. The effect of family involvement on innovation outcomes: the moderating role of board social capital. J. Prod. Innov. Manag. 37 (3), 249–272. https://doi.org/10.1111/jpim.12522.

Benner, M.J., Tushman, M., 2002. Process management and technological innovation: a longitudinal study of the photography and paint industries. Adm. Sci. Q. 47 (4), 676–706. https://doi.org/10.2307/3094913.

Beyer, J.M., Chattopadhyay, P., George, E., Glick, W.H., Ogilvie, D., Pugliese, D., 1997. The selective perception of managers revisited. Acad. Manag. J. 40 (3), 716–737. https://doi.org/10.5465/257060.

Brandstätter, H., 2011. Personality aspects of entrepreneurship: a look at five meta-analyses. Personal. Individ. Differ. 51 (3), 222–230. https://doi.org/10.1016/j.paid.2010.07.007.

Brigl, M., Dehnert, N., Groß-Selbeck, S., Roos, A., Schmieg, F., Simon, S., 2018. How the best corporate venturers keep getting better. Boston Consulting Group 1–17. https://image-src.bcg.com/Images/BCG-How-the-Best-Corporate-Venturers-Keep-Getting-Better-Aug-2018_tcm9-200601.pdf.

Burke, M.J., Finkelstein, L.M., Dusig, M.S., 1999. On average deviation indices for estimating interrater agreement. Organ. Res. Methods 2 (1), 49–68. https://doi.org/10.1177/109442819921004.

Busenbark, J.R., Love, E.G., Shane, P.B., 2017. Foreshadowing as impression management: illuminating the path for security analysts. Strateg. Manag. J. 38, 2486–2507. https://doi.org/10.1002/smj.2659.

Carpenter, M.A., Geletkanycz, M.A., Sanders, W.G., 2004. Upper echelons research revisited: antecedents, elements, and consequences of top management team composition. J. Manag. 30 (6), 749–778. https://doi.org/10.1016/j.jm.2004.06.001.

Certo, S.T., Busenbark, J.R., Kalm, M., LePine, J.A., 2020. Divided we fall: how ratios undermine research in strategic management. Organ. Res. Methods 23 (2), 211–237. https://doi.org/10.1177/1094428118773455.

Chandy, R.K., Tellis, G.J., 1998. Organizing for radical product innovation: the overlooked role of willingness to cannibalize. J. Mark. Res. 35 (4), 474–487. https://doi.org/10.1177/002224379803500406.

Chandy, R.K., Tellis, G.J., 2000. The incumbent's curse? Incumbency, size, and radical product innovation. J. Mark. 64 (7), 1–17. https://doi.org/10.1509/jmkg.64.3.1.18033.

Chung, S., Animesh, A., Han, K., Pinsonneault, A., 2019. Software patents and firm value: a real options perspective on the role of innovation orientation and environmental uncertainty. Inf. Syst. Res. 30 (3), 1073–1097. https://doi.org/10.1287/isre.2019.0854.

Covin, J.G., Miles, M.P., 1999. Corporate entrepreneurship and the pursuit of competitive advantage. Entrep. Theory Pract. 23 (3), 47–63. https://doi.org/10.1177/104225879902300304.

Crossland, C., Zyung, J., Hiller, N.J., Hambrick, D.C., 2014. CEO career variety: effects on firm-level strategic and social novelty. Acad. Manag. J. 57 (3), 652–674. https://doi.org/10.5465/amj.2012.0469.

Cui, V., Ding, W.W., Yanadori, Y., 2019. Exploration versus exploitation in technology firms: the role of compensation structure for R&D workforce. Res. Policy 48 (6), 1534–1549. https://doi.org/10.1016/j.respol.2019.03.008.

Custódio, C., Ferreira, M.A., Matos, P., 2019. Do general managerial skills spur innovation? Manag. Sci. 65 (2), 459–476. https://doi.org/10.1287/mnsc.2017.2828.

Dearborn, D.C., Simon, H.A., 1958. Selective perception: a note on the departmental identifications of executives. Sociometry 21 (2), 140–144. https://doi.org/10.2307/2785898.

Dimov, D.P., Shepherd, D.A., 2005. Human capital theory and venture capital firms: Exploring "home runs" and "strike outs". J. Bus. Ventur. 20 (1), 1–21. https://doi.org/10.1016/j.jbusvent.2003.12.007.

Dokko, G., Gaba, V., 2012. Venturing into new territory: career experiences of corporate venture capital managers and practice variation. Acad. Manag. J. 55 (3), 563–583. https://doi.org/10.2139/ssrn.1969861.

Drover, W., Busenitz, L., Matusik, S., Townsend, D., Anglin, A., Dushnitsky, G., 2017. A review and roadmap of entrepreneurial equity financing research: venture capital, corporate venture capital, angel investment, crowdfunding and accelerators. J. Manag. 43 (6), 1820–1853. https://doi.org/10.1177/0149206317690584.

Dushnitsky, G., Lenox, M.J., 2005a. When do incumbents learn from entrepreneurial ventures? Corporate venture capital and investing firm innovation rates. Res. Policy 34 (5), 615–639. https://doi.org/10.1016/j.respol.2005.01.017.

Dushnitsky, G., Lenox, M.J., 2005b. When do firms undertake R&D by investing in new ventures? Strateg. Manag. J. 26 (10), 947–965. https://doi.org/10.1002/smj.488.

Dushnitsky, G., Lenox, M.J., 2006. When does corporate venture capital investment create firm value? J. Bus. Ventur. 21 (6), 753–772. https://doi.org/10.1016/j.jbusvent.2005.04.012.

Dushnitsky, G., Shapira, Z., 2010. Entrepreneurial finance meets organizational reality: comparing investment practices and performance of corporate and independent venture capitalists. Strateg. Manag. J. 31 (9), 990–1017. https://doi.org/10.1002/smj.

Dushnitsky, G., Yu, L., 2022. Why do incumbents fund startups? A study of the antecedents of corporate venture capital in China. Res. Policy 51 (3), 104463. https://doi.org/10.1016/j.respol.2021.104463.

Dushnitzky, G., 2009. Corporate venture capital: Past evidence and future directions. In: Basu, A., Casson, M., Wadeson, N., Yeung, B. (Eds.), The Oxford Handbook of Entrepreneurship. Oxford Univ. Press, Oxford, pp. 387–432. https://doi.org/10.1093/oxfordhb/9780199546992.003.0015.

Elfring, T., 2005. Dispersed and focused corporate entrepreneurship: Ways to balance exploitation and exploration. In: Elfring, T. (Ed.), Corporate Entrepreneurship and Venturing. Springer Science+Business Media, New York, pp. 1–17. https://doi.org/10.1007/0-387-24850-1_1.

Fang, L., Peress, J., 2009. Media coverage and the cross-section of stock returns. J. Financ. 64 (5), 2023–2051. https://doi.org/10.1111/irfi.12191.

Freese, B., Keil, T., Teichert, T., 2007. Fostering entrepreneurial firms: Recognizing and adapting radical innovation through corporate venture capital investments. In: Thérin, F. (Ed.), Handbook of Research on Techno-Entrepreneurship. Edward Elgar, Cheltenham, UK, pp. 111–125. https://doi.org/10.4337/9781847205551.00013.

Gaba, V., Dokko, G., 2016. Learning to let go: social influence, learning, and the abandonment of corporate venture capital practices. Strateg. Manag. J. 37 (8), 1558–1577. https://doi.org/10.1002/smj.

Gaba, V., Meyer, A.D., 2008. Crossing the organizational species barrier: how venture capital practices infiltrated the information technology sector. Acad. Manag. J. 51 (5), 976–998. https://doi.org/10.5465/amj.2008.34789671.

Germann, F., Ebbes, P., Grewal, R., 2015. The chief marketing officer matters! J. Mark. 79 (3), 1–22. https://doi.org/10.1509/jm.14.0244.

Gimeno, J., Woo, C.Y., 1996. Hypercompetition in a multimarket environment: the role of strategic similarity and multimarket contact in competitive de-escalation. Organ. Sci. 7 (3), 322–341. https://doi.org/10.1287/orsc.7.3.322.

Gimeno, J., Folta, T.B., Cooper, A.C., Woo, C.Y., 1997. Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. Adm. Sci. Q. 42 (4), 750. https://doi.org/10.2307/2393656.

Gompers, P., Lerner, J., 1998. The determinants of corporate venture capital success: organizational structure, incentives, and complementarities (NBER working paper no. 6725). National Bureau of Economic Research. https://www.nber.org/papers/w6725. https://doi.org/10.3386/w6725.

Grigoriou, K., Rothaermel, F.T., 2014. Structural microfoundations of innovation: the role of relational stars. J. Manag. 40 (2), 586–615. https://doi.org/10.1177/0149206313513612.

Hall, B.H., Jaffe, A., Trajtenberg, M., 2001. The NBER patent citations data file: lessons, insights and methodological tools. NBER Working Paper Series 8498. https://doi.org/10.3386/w8498.

Hambrick, D.C., 2007. Upper echelons theory: an update. Acad. Manag. Rev. 32 (2), 334–343. https://doi.org/10.5465/AMR.2007.24345254.

Hambrick, D.C., Mason, P.A., 1984. Upper echelons: the organization as a reflection of its top managers. Acad. Manag. Rev. 9 (2), 193–206. https://doi.org/10.2307/258434.

Harris, D., Helfat, C., 1997. Specificity of CEO human capital and compensation. Strateg. Manag. J. 18 (11), 895–920. https://doi.org/10.1002/(SICI)1097-0266(199712)18:11<895::AID-SMJ931>3.0.CO;2-R.

Henderson, J., Leleux, B., 2005. Corporate venture capital: Realizing resource combinations and transfers. In: Elfring, T. (Ed.), Corporate Entrepreneurship and Venturing. Springer Science+Business Media, New York, pp. 73–100. https://doi.org/10.1007/0-387-24850-1_4.

Hill, A., Birkinshaw, J., 2014. Ambidexterity and survival in corporate venture units. J. Manag. 40 (7), 1899–1931. https://doi.org/10.1177/0149206312445925.

Iyer, D., Miller, K., 2008. Performance feedback, slack, and the timing of acquisitions. Acad. Manag. J. 51 (4), 808–822. https://doi.org/10.5465/amj.2008.33666024.

James, L.R., Demaree, R.G., Wolf, G., 1984. Estimating within-group interrater reliability with and without response bias. J. Appl. Psychol. 69 (1), 85–98. https://doi.org/10.1037/0021-9010.69.1.85.

Jeon, E., Maula, M., 2022. Progress toward understanding tensions in corporate venture capital: a systematic review. J. Bus. Ventur. 37 (4), 106226 https://doi.org/10.1016/j.jbusvent.2022.106226.

Kabanoff, B., Brown, S., 2008. Knowledge structures of prospectors, analyzers, and defenders: content, structure, stability, and performance. Strateg. Manag. J. 29 (2), 149–171. https://doi.org/10.1002/smj.

Kalnins, A., 2018. Multicollinearity: how common factors cause type 1 errors in multivariate regression. Strateg. Manag. J. 39 (8), 2362–2385. https://doi.org/10.1002/smj.2783.

Kalnins, A., Praitis Hill, K., 2023. The VIF score. What is it good for? Absolutely nothing. Organ. Res. Methods. https://doi.org/10.1177/10944281231216381.

Keil, T., 2000. External Corporate Venturing: Cognition, Speed, and Capability Development. Doctoral dissertation. Helsinki University of Technology Institute of Strategy and International Business.

Keil, T., 2004. Building external corporate venturing capability. J. Manag. Stud. 41 (5), 799–825. https://doi.org/10.1111/j.1467-6486.2004.00454.x.

Keil, T., Autio, E., George, G., 2008a. Corporate venture capital, disembodied experimentation and capability development. J. Manag. Stud. 45 (8), 1475–1505. https://doi.org/10.1111/j.1467-6486.2008.00806.x.

Keil, T., Maula, M., Schildt, H., Zahra, S., 2008b. The effect of governance modes and relatedness of external business development activities on innovative performance. Strateg. Manag. J. 29 (8), 895–907. https://doi.org/10.1002/smj.

Keil, T., Zahra, S.A., Maula, M., 2016. Explorative and exploitative learning from corporate venture capital: a model of program-level determinants. Handbook of Research on Corporate Entrepreneurship 259–289. https://doi.org/10.4337/9781785368738.00017.

Kuratko, D.F., Fisher, G., Audretsch, D.B., 2021. Unraveling the entrepreneurial mindset. Small Bus. Econ. 57 (4), 1681–1691. https://doi.org/10.1007/s11187-020-00372-6.

Lee, S.U., Park, G., Kang, J., 2018. The double-edged effects of the corporate venture capital unit's structural autonomy on corporate investors' explorative and exploitative innovation. J. Bus. Res. 88 (June 2017), 141–149. https://doi.org/10.1016/j.jbusres.2018.01.049.

Lerner, J., Seru, A., 2022. The use and misuse of patent data: issues for finance and beyond. Rev. Financ. Stud. 35 (6), 2667–2704. https://doi.org/10.1093/rfs/hhab084.

Li, Q., Maggitti, P.G., Smith, K.G., Tesluk, P.E., Katila, R., 2013. Top management attention to innovation: the role of search selection and intensity in new product introductions. Acad. Manag. J. 56 (3), 893–916. https://doi.org/10.5465/amj.2010.0844.

Ludat, J., 2019. Essays on Corporate Venture Capital. Doctoral Dissertation. Technical University of Munich.

Mastrogiorgio, M., Gilsing, V., 2016. Innovation through exaptation and its determinants: the role of technological complexity, analogy making & patent scope. Res. Policy 45 (7), 1419–1435. https://doi.org/10.1016/j.respol.2016.04.003.

Maula, M.V., Keil, T., Zahra, S.A., 2013. Top management's attention to discontinuous technological change: corporate venture capital as an alert mechanism. Organ. Sci. 24 (3), 926–947. https://doi.org/10.1287/orsc.1120.0775.

Mayer, K.J., Somaya, D., Williamson, I.O., 2012. Firm-specific, industry-specific, and occupational human capital and the sourcing of knowledge work. Organ. Sci. 23 (5), 1311–1329. https://doi.org/10.1287/orsc.1110.0722.

McKenny, A.F., Short, J.C., Ketchen, D.J., Payne, G.T., Moss, T.W., 2018. Strategic entrepreneurial orientation: configurations, performance, and the effects of industry and time. Strateg. Entrep. J. 12 (4), 504–521. https://doi.org/10.1002/sej.1291.

Medcof, J.W., Lee, T., 2017. The effects of the chief technology officer and firm and industry R&D intensity on organizational performance. R&D Manag. 47 (5), 767–781. https://doi.org/10.1111/radm.12275.

Miles, M.P., Covin, J.G., 2002. Exploring the practice of corporate venturing: some common forms and their organizational implications. Entrep. Theory Pract. 26 (3), 21–40. https://doi.org/10.1177/104225870202600302.

Nuscheler, D., Engelen, A., Zahra, S.A., 2019. The role of top management teams in transforming technology-based new ventures' product introductions into growth. J. Bus. Ventur. 34 (1), 122–140. https://doi.org/10.1016/j.jbusvent.2018.05.009.

Nyberg, A.J., Wright, P.M., 2015. 50 years of human capital research: assessing what we know, exploring where we go. Acad. Manag. Perspect. 29 (3), 287–295. https://doi.org/10.5465/amp.2014.0113.

Obschonka, M., Fisch, C., Boyd, R., 2017. Using digital footprints in entrepreneurship research: a twitter-based personality analysis of superstar entrepreneurs and managers. J. Bus. Ventur. Insights 8, 13–23. https://doi.org/10.1016/j.jbvi.2017.05.005.

Ocasio, W., 1997. Towards an attention-based view of the firm. Strateg. Manag. J. 18 (51), 187–206. https://doi.org/10.1002/(SICI)1097-0266(199707)18:1+<187::AID-SMJ936>3.0.CO;2-K.

Ocasio, W., 2011. Attention to attention. Organ. Sci. 22 (5), 1286–1296. https://doi.org/10.1287/orsc.1100.0602.

Papies, D., Ebbes, P., van Heerde, H.J., 2017. Addressing endogeneity in marketing models. In: Leeflang, P.S.H., Wieringa, J.E., Bijmolt, T.H., Pauwels, K.H. (Eds.), Advanced Methods for Modeling Markets. Springer International Publishing, Cham, pp. 581–627. https://doi.org/10.1007/978-3-319-53469-5_18.

Papke, L.E., Wooldridge, J.M., 1996. Econometric methods for fractional response variables with an application to 401(k) plan participation rates. J. Appl. Econ. 11 (6), 619–632. https://doi.org/10.1002/(SICI)1099-1255(199611)11:6<619:AID-JAE418>3.0.CO;2-1.

Park, H.D., Steensma, H.K., 2013. The selection and nurturing effects of corporate investors on new venture innovativeness. Strateg. Entrep. J. 7, 311–330. https://doi.org/10.1002/sej.

Ployhart, R.E., Nyberg, A.J., Reilly, G., Maltarich, M.A., 2014. Human capital is dead; long live human capital resources! J. Manag. 40 (2), 371–398. https://doi.org/10.1177/0149206313512152.

Roberto, M.A., 2005. Why Great Leaders don't Take Yes for an Answer: Managing for Conflict and Consensus. Wharton School Publishing, Upper Saddle River, N.J.

Röhm, P., Köhn, A., Kuckertz, A., Dehnen, H.S., 2018. A world of difference? The impact of corporate venture capitalists' investment motivation on startup valuation. J. Bus. Econ. 88 (3), 531–557. https://doi.org/10.1007/s11573-017-0857-5.

Röhm, P., Merz, M., Kuckertz, A., 2020. Identifying corporate venture capital investors – a data-cleaning procedure. Financ. Res. Lett. 32 (101092) https://doi.org/10.1016/j.frl.2019.01.004.

Rubera, G., Kirca, A.H., 2012. Firm innovativeness and its performance outcomes: a meta-analytic review and theoretical integration. J. Mark. 76 (3), 130–147. https://doi.org/10.1509/jm.10.0494.

Saboo, A.R., Chakravarty, A., Grewal, R., 2016. Organizational debut on the public stage: marketing myopia and initial public offerings. Mark. Sci. 35 (4), 656–675. https://doi.org/10.1287/mksc.2015.0970.

Schildt, H., Maula, M.V.J., Keil, T., 2005. Explorative and exploitative learning from external corporate ventures. Entrep. Theory Pract. 29 (4), 493–515. https://doi.org/10.1111/j.1540-6520.2005.00095.x.

Schultz, T.W., 1961. Investment in human capital. Am. Econ. Rev. 51 (1), 1–17.

Schumpeter, J.A., 1934. The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle. Harvard University Press, Cambridge, Mass.

Sharma, P., Chrisman, J.J., 1999. Toward a reconciliation of the definitional issues in the field of corporate entrepreneurship. Enterp. Theory Pract. 23 (3), 11–28. https://doi.org/10.1177/104225879902300302.

Shepherd, D.A., Mcmullen, J.S., Ocasio, W., 2016. Is that an opportunity? An attention model of top managers' opportunity beliefs for strategic action. Strateg. Manag. J. 38 (3), 626–644. https://doi.org/10.1002/smj.

Siegel, R., Siegel, E., MacMillan, I.C., 1988. Corporate venture capitalists: autonomy, obstacles, and performance. J. Bus. Ventur. 3 (3), 233–247. https://doi.org/10.1016/0883-9026(88)90017-1.

Smith, A., Houghton, S.M., Hood, J.N., Ryman, J.A., 2006. Power relationships among top managers: does top management team power distribution matter for organizational performance? J. Bus. Res. 59 (5), 622–629. https://doi.org/10.1016/j.jbusres.2005.10.012.

Smith, K.G., Collins, C.J., Clark, K.D., 2005. Existing knowledge, knowledge creation capability, and the rate of new product introduction in high-technology firms. Acad. Manag. J. 48 (2), 346–357. https://doi.org/10.5465/amj.2005.16928421.

Sorenson, O., Stuart, T.E., 2001. Syndication networks and the spatial distribution of venture capital investments. Am. J. Sociol. 10 (6), 1546–1588. https://doi.org/10.1086/321301.

Sorescu, A.B., Spanjol, J., 2008. Innovation's effect on firm value and risk: insights from consumer packaged goods. J. Mark. 72 (2), 114–132. https://doi.org/10.1509/jmkg.72.2.114.

Souitaris, V., Zerbinati, S., Liu, G., 2012. Which iron cage? Endo- and exoisomorphism in corporate venture capital programs. Acad. Manag. J. 55 (2), 477–505. https://doi.org/10.5465/amj.2009.0709.

Tabesh, P., Vera, D., Keller, R.T., 2019. Unabsorbed slack resource deployment and exploratory and exploitative innovation: how much does CEO expertise matter? J. Bus. Res. 94, 65–80. https://doi.org/10.1016/j.jbusres.2018.08.023.

Titus, V., Anderson, B.S., 2018. Firm structure and environment as contingencies to the corporate venture capital-parent firm value relationship. Enterp. Theory Pract. 42 (3), 498–522. https://doi.org/10.1111/etap.12264.

Uotila, J., Maula, M., Keil, T., Zahra, S.A., 2009. Exploration, exploitation, and financial performance: analysis of S&P 500 corporations. Strateg. Manag. J. 30 (2), 221–231. https://doi.org/10.1002/smj.

Villadsen, A., Wulff, J., 2019. Are you 110% sure? Modeling of fractions and proportions in strategy and management research. Strateg. Organ. 19 (2), 1–26. https://doi.org/10.1177/1476127019854966.

Voss, G.B., Sirdeshmukh, D., Voss, Z.G., 2008. The effects of slack resources and environmental threat on product exploration and exploitation. Acad. Manag. J. 51 (1), 147–164. https://doi.org/10.5465/AMJ.2008.30767373.

van de Vrande, V., Vanhaverbeke, W., Duysters, G., 2011. Technology in-sourcing and the creation of pioneering technologies. J. Prod. Innov. Manag. 28 (6), 974–987. https://doi.org/10.1111/j.1540-5885.2011.00853.x.

Wadhwa, A., Kotha, S., 2006. Knowledge creation through external venturing: evidence from the telecommunications equipment manufacturing industry. Acad. Manag. J. 49 (4), 1–17. https://doi.org/10.5465/AMJ.2006.22083132.

Wadhwa, A., Phelps, C., Kotha, S., 2016. Corporate venture capital portfolios and firm innovation. J. Bus. Ventur. 31 (1), 95–112. https://doi.org/10.1016/j.jbusvent.2015.04.006.

Weber, C., Weber, B., 2011. Exploring the antecedents of social liabilities in CVC triads — a dynamic social network perspective. J. Bus. Ventur. 26 (2), 255–272. https://doi.org/10.1016/j.jbusvent.2009.07.004.

Winters, T.E., Murfin, D.L., 1988. Venture capital investing for corporate development objectives. J. Bus. Ventur. 3 (3), 207–222. https://doi.org/10.1016/0883-9026(88)90015-8.

Yang, Y., Narayanan, V.K., Zahra, S., 2009. Developing the selection and valuation capabilities through learning: the case of corporate venture capital. J. Bus. Ventur. 24 (3), 261–273. https://doi.org/10.1016/j.jbusvent.2008.05.001.

Zahra, S.A., Neubaum, D.O., Hayton, J., 2020. What do we know about knowledge integration: fusing micro- and macro-organizational perspectives. Acad. Manag. Ann. 14 (1), 160–194. https://doi.org/10.5465/annals.2017.0093.

Zarutskie, R., 2010. The role of top management team human capital in venture capital markets: evidence from first-time funds. J. Bus. Ventur. 25 (1), 155–172. https://doi.org/10.1016/j.jbusvent.2008.05.008.

Zavyalova, A., Pfarrer, M.D., Reger, R.K., Shapiro, L.D., 2012. Managing the message: the effects of firm actions and industry spillovers on media coverage following wrongdoing. Acad. Manag. J. 55 (5), 1079–1101. https://doi.org/10.5465/amj.2010.0608.