The Innovation Rush.
How Foreign Corporate Venture Capitals are Moving Overseas to Conquer US Ventures

The impact of Proximity Factors, Relational Ties, and Timing of Investment

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Ringrazio la mia famiglia, gli amici,
per l'amore, il supporto, la stima, e la fiducia
che hanno sempre avuto in me

Abstract

The thesis provides insights into the mechanisms influencing the innovation of US ventures when receiving foreign CVC investment. Findings suggest that when dealing with barriers posed by the *liability of distant search*, CVCs must rely on proximity, relational, and timing mechanisms that lower the obstacles of distance. They must consider Proximity Factors, such as the location of the fund and the industry relatedness, that positively impact the exchange of knowledge and resources. Then, they must carefully balance their Relational Ties, which have a contingent impact on the nature of the counterpart. Finally, they must be mindful of the timing of investment, which plays a significant role in determining the needs and motivations of the recipient venture. The research contributes to the existing knowledge on CVC investments, introducing new international considerations. This provides valuable lessons for foreign CVCs and U.S. startups undertaking cross-border investment relationships.

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1. Introduction

More than ever, companies face the dilemma of growing while remaining uncertain about future patterns. Innovation is driven by several trends, such as digitalization, sustainable goals, platform business models, and artificial intelligence, leading to the rapid development of new technologies. Often with the potential to disrupt entire industries, these new solutions have a significant potential impact on the established business models of incumbents. This motivates companies to look for new resources outside their traditional business areas.

One increasingly common strategy is for established companies to take a financial stake in the equity of start-ups. Known as Corporate Venture Capital (CVC), this activity is growing in popularity across various industries. This strategy is an accelerator for the innovative performance of both start-ups and established companies. Consequently, the mechanisms characterizing CVC activities are attracting the attention of numerous academic studies.

Despite increasing studies, CVC faces continuous evolutions in adoption modes, and many research gaps still need to be explored. For instance, historically concentrated among US-based corporations, many other countries are now catching up with innovation-enhancing activities, especially in Europe and Asia (Jeng & Wells, 2000; M. Maula et al., 2005). A study conducted by PwC identifies Europe as an emerging hot spot for CVC funding, reaching a total volume of €623 million in 2020 (PricewaterhouseCoopers, s.d.). This expanded the geographical span of CVCs, which started looking into new areas outside their location, (Leckel et al., 2022).

Illustrative examples can be found in the practices of the largest CVC units. In 2014, Google Ventures announced the opening a new office in London with a 100$ million fund dedicated to high-potential startups in the European tech scene (Murad, 2015). Another case is Intel Capital, which presents a broad portfolio of ventures in Western Europe (14), Israel (23), and Asia Pacific (61), on top of their North America-based portfolio (125) (Intel Capital, s.d.).

Complementing US CVCs investing abroad, European and Asian firms are constantly looking for CVC opportunities in the US. BMW iVentures, for example, is the CVC arm of the Munich-based carmaker. It was established in New York in 2011 with an initial investment of $100 million. It then moved its headquarters to Silicon Valley, the central hub for start-ups in the US. With a high degree of autonomy, the venture capital unit expects an investment

commitment of 500 million euros in US start-ups over ten years (*BMW Group Expands Successful BMW i Ventures Concept and Steps up Collaboration with Start-Ups*, s.d.).

The illustrated evidence highlights that a substantial portion of CVC investments originates overseas, making them a significant area of exploration given the liabilities and challenges of distance. Although CVC's influence on innovation has been the subject of considerable research, most studies focus primarily on domestic activities. Hence this raises questions about how this underexplored boundary condition influences the exchange of knowledge and complementary assets between the investor and the venture. This thesis investigates the classical mechanisms of CVC and their influence on the innovative performance of ventures receiving a CVC investment overseas.

The boundary condition of foreignness is investigated under the compass of the Knowledge-Based View, serving as a rationale to delineate the inner intent of the CVC activities. Taking this perspective, we frame CVC activities as a *distant search* exercise of knowledge sourcing. The integration of international business concerns provides additional details on the boundary condition of distance. This allowed two views to emerge. First, the *liability of foreignness* defines geographical, cultural, and institutional barriers that prevent a firm from operating efficiently in a distant environment. Second, the *liability of outsidership* helps conceptualize foreignness as a logistic challenge that prevents firms from being part of local business networks. These two concepts are interpreted here along with the distant search perspective, using a new comprehensive view of impediments to knowledge sourcing that are created by distance: the *liability of distant search*.

Due to the large availability and reliability of patent and investment data in the region, the sample has been built using US startups as the investment target and foreign CVCs in the life science and electronics industries as investors. In doing so, the research provided a line of reasoning that further research can explore in different institutional contexts. To guide the study, a broad research question was posed:

- *How do foreign CVCs influence the innovation performance of U.S. startups?*

The answer to this guiding question is provided by studying the other three sub-questions.

- *How does the industrial and geographical proximity of foreign CVCs affect the innovation outcomes of U.S. startups?*

- *How does the relational structure of foreign CVCs influence the innovation performance of U.S. startups?*
- *How does the timing of foreign CVC investment influence the innovation performance of U.S. startups?*

To investigate the questions, six study elements have been identified and served as the basis for building variables tested through a statistical model, the zero-negative binomial regression. This led to assessing the direction and significance of the variables on the innovative output of the US startups after receiving the foreign CVC investment. The results identified six mechanisms that impact the *liability of distant search* by influencing familiarity with the local environment and the effective exchange of knowledge and complementary assets.

The studied mechanisms were clustered into three groups. Proximity Factors have been framed as geographical and industrial proximity. These are hypothesized to enable a closer relationship between the foreign CVC and the U.S. startup, resulting in a smoother exchange of knowledge and complementary assets, thereby fostering innovation. Relational Ties have been considered from three perspectives: syndication, multiple CVCs, and the size of the CVC portfolio. The first has been hypothesized to reduce adverse selection during scouting and avoid moral hazards post-investment. At the same time, syndication with multiple CVCs and large portfolios were framed as threats to goal congruence, coordination, and resource focus. Finally, the Timing of Investment is studied as uncertainty may have a negative impact due to the lower absorptive capabilities of early-stage ventures.

The research is divided into eight chapters. Chapter 2 provides a comprehensive thematic literature, emphasizing the salient aspects of CVC relevant to the research scope. Chapter 3 poses the theoretical ground on the interplay between knowledge, innovation, and international business literature to build the main arguments for the research questions. Chapter 4 addresses the conceptual development of the core hypothesis to test. Chapter 5 describes the methodology adopted for the research design, data collection, selection of variables, and statistical model. Chapter 6 analyzes the key results of descriptive statistics and the regression model. Chapter 7 finally discusses the study outcomes by deriving their theoretical conclusions, implications, and limitations. A conclusive section is elaborated in Chapter 8.

2. Literature Review

Statement of Auto-citation

The Literature Review of this Thesis builds upon another project the writer conducted during the CEMS Research Project (Bottegal, 2023). This thesis is considered a contiguous part of this work, as the project constituted the basis for identifying the research gap. Therefore, only minimum edits to my previous work have been applied. This work presented a systematic review of the most relevant literature on Corporate Venture Capital, focusing on articles published in peer-reviewed Journals and categorized through extraction in the database *Scopus* (Appendix 1). The present statement of auto-citation will be considered for the whole extent of the Literature Review section.

2.1 Corporate Venture Capital Overview

Definition of Corporate Venture Capital and its Distinctive Features

A clear definition of Corporate Venture Capital (CVC) is necessary to build a solid inquiry. Over the years, research has defined CVC using different meanings. A comprehensive broad definition can be provided by analyzing several authors who describe CVC activities as a minority equity investment made by an incumbent in an independent entrepreneurial venture (Gompers & Lerner, 1998). Three elements commonly characterize CVC investments. First, besides financial purposes, the objective is often strategic (H. Chesbrough & Tucci, 2004). Second, the startups have independent ownership from the investor. Third, the venture transfers a minority equity stake to the investor, that becomes a shareholder. Consequently, the definition excludes activities involving a firm's innovativeness, such as internal corporate venturing and spinouts. For instance, it excludes inter-organizational relationships such as strategic alliances, joint ventures, or investments in public companies (Dushnitsky & Lenox, 2005b; Gompers & Lerner, 1998).

Chesbrough & Tucci (2004a) examine the role of CVC activities beyond financial returns, detaching them from an asset class perspective and highlighting the centrality of their strategic dimension in complementing other corporate innovation tools. Hence, it is essential to distinguish between alliances and CVC activities, as both allow companies to tap into new technology markets and innovation paths. Dushnitsky & Lavie (2010) define alliances as a

"*voluntary arrangement between independent firms that share and exchange resources in the co-development or provision of products, services, or technologies"* (p. 4). In this case, the following elements represent the substantial distance from CVC activities. The main objective of alliances is the cost-sharing and joint development of a specific product or project with a limited scope.

In contrast, CVC relationships consist of sponsoring emerging or complementary technologies. In CVC, the investment covers the whole operations of the funded venture, while the venture does not influence those of the investor. Furthermore, alliance activities do not involve equity stakes of the partners, with joint ventures involving only equity stakes of the new independent venture. Consequently, both alliance partners are investors that expect their investments to give returns. At the same time, CVC shows differences between the performances of the investor and the recipient of capital, depending on their specific objectives (Dushnitsky & Lavie, 2010).

Even though distinct in definition, research has shown a positive curvilinear relationship between the intensity of alliances and CVC activities when pursued together. Dushnitsky & Lavie (2010) found that alliance formation positively impacts CVC activities to a certain intensity threshold, after which the relationship is attenuated. This finding shows that the excess in pursuing the two activities leads to resource redundancy and internal resource allocation constraints. In the long term, as the corporation matures internal resources and CVC experience, investors become more efficient in pursuing CVC activities, lowering alternative relationships such as alliances.

To give a complete picture of the CVC definition within the firm's organizational structure Keil (2002) clarifies CVC's role within the broader Corporate Venturing framework. Corporate venturing is a branch of corporate entrepreneurship. It is defined as a set of processes and practices that an established firm adopts to explore and exploit new markets and industries by creating new businesses (Narayanan et al., 2009). Corporate venturing can be further classified into internal venturing and external venturing. Internal venturing refers to venturing practices in which the venture is kept within the existing business or new venture divisions (von Hippel, 1977). External venturing "*refers to corporate venturing activities that result in the creation of semi-autonomous or autonomous organizational entities that reside outside the existing organization*" (Sharma & Chrisman, 1999, p.19), among which CVC is included.

History and Characteristics of Corporate Venture Capital

Some articles report that CVC activities have faced many waves from the 1960s to today, suffering shocks from market crashes, technological bubbles, and disruptions in the IPOs (Dushnitsky & Lenox, 2006; Gompers & Lerner, 1998) (Appendix 2).

Corporate venture capital (CVC) experimentation began in the 1960s, with companies diverting excess cash into internal and external ventures inspired by the success of independent VC funds (Dushnitsky & Lenox, 2006). This was interrupted by the 1973 oil crisis, which led to resource constraints and conflicts between CVC programs and parent companies. The 1980s saw an upsurge, particularly in chemicals, metals, technology, and pharmaceuticals, but this was cut short by a market crash at the end of the decade (Gompers & Lerner, 1998). The 1990s saw a CVC boom due to the internet era, followed by a rapid decline after the internet bubble burst (Dushnitsky & Lenox, 2006). In the 21st century, CVC investment has maintained a steady pace with a conservative approach. While sectors such as software, IT, business services, and telecommunications continue to be popular, post-2001 has seen increased interest in biotechnology, medical services, and semiconductors (Dushnitsky & Lenox, 2006) (Appendix 3).

Another layer of analysis can be discussed by taking a geographical perspective. The dominance of US-based CVC activities has slightly decreased its fraction in favor of companies located in other geographical areas from 88% before 2001 to 75% after. Europe started to gain relevance, with Germany and the UK leading at a 2% fraction and France, Switzerland, and the Netherlands constituting 1% of the market each (Röhm et al., 2020). Geographic concentration in some developed world economies does not mean the funds are invested in the domestic country but could be directed toward foreign targets. Recent studies have shown that increasing CVC investments are being made in start-ups in foreign, distant markets (Gonzales & Ohara, 2019), creating a vibrant international CVC landscape.

2.2 Drivers of CVC Adoption

CVC activities can be implemented for different reasons, depending on the firm's typology and industry-specific drivers. The literature identified the firm's marketing expenditure levels, technological resources, corporation's cash flows, and innovation stock as antecedents of the CVC adoption (Basu et al., 2011). Further financial studies found a positive correlation between CVC activities and the current firm's cash flows, making ventures receiving CVC funds sensitive to the parent firm's financial constraints (Bertoni et al., 2010). Another study

confirmed that launching a CVC strategy positively correlates with the availability and strength of specific resources and financial performance. In contrast, it negatively correlates with the firm debt level (Brinette & Khemiri, 2019).

Moderating elements have been identified in network dynamics and geographical proximity. For instance, interlocking boards - the presence of one member from two or more corporate parents on the venture board - can lead to the diffusion and adoption of standard management practices, including CVC activities (Noyes et al., 2014). Kim et al. (2019) have identified industry's increasing product competition leads firms to shift away from internal R&D in favor of CVC investments. This happens especially for technological leaders who already own an extensive portfolio of patents to maintain their competitive position. They want to keep up with the industry's innovation pace by exploring new knowledge frontiers.

In addition, a corporation's adoption of CVC activities can be influenced by the geographical proximity to existing CVC units of other firms and their success level. This is also associated with the firm's proximity to IVC clusters, which positively correlate with firms starting their own CVC activities. IVC clusters, such as Silicon Valley, lead firms having headquarters in the area to enter the VC market by creating their CVC activities (Gaba & Meyer, 2008).

Other industry-specific drivers that foster CVC adoption are the high level of competitiveness in the industry (Basu et al., 2011), the weakness of the intellectual property regime (Basu et al., 2011; Dushnitsky & Lenox, 2005a), the environmental munificence, and the level of R&D intensity. The last aspect is having more influence in industries with steep growth and high technological turnovers (Sahaym et al., 2010).

2.3 The Objectives of CVC

Several key themes and issues have been widely studied in the CVC literature. These include the objectives of corporations when engaging in CVC. Literature on CVC reports that these activities can be driven by a diverse set of goals that are not solely financial. Even though surveys identify financial returns as a dominant concern, more is needed to explain CVC investment motivation.

Financial gains, a window on technology, and a catalyst for demand

Among cited strategic elements, the *exposure to new technologies and markets* (McNally, 1997; Siegel et al., 1988) is a dominant driver of the CVC activity, followed by marketing new products and monitoring potential acquisition targets (Siegel et al., 1988). Since the investor firms follow multinational approaches, CVC has also shown to be a valuable tool to support and monitor technologies, products, or markets overseas, further expanding the company's network abroad and creating new business opportunities (Winters & Murfin, 1988). Accordingly, other surveys found relevant objectives in identifying new opportunities, developing business relationships, and changing the corporate culture (Sykes, 1990a). These aspects offer a so-called *window on technology* for the investing firm.

CVC is also seen as a *catalyst of demand*, especially regarding investments in complementary technologies, products, and services that can boost the investor's product (Kann & Weyant, 2000). Moreover, the positive association changes in intensity depending on the industry's growth and productivity. This indicates that CVC investments are increasingly pursued as a vehicle to face demand enhancement, especially in sectors that face technological turbulence and strong patent regimes.

A new objective: Sustainability

Increasing research is exploring objectives connected with the increasing popularity of sustainability concerns. Döll et al. (2022) found that companies dedicate 10% to 15% of their CVC capital to investments in sustainability. In addition, Hegeman & Sørheim (2021) found a growing number of CVCs involved in cleantech investments. These investments presented disadvantageous financial returns, with the primary objective being seeking green opportunities rather than having a window on technology, especially for large corporations in the sample.

Battisti et al. (2022) investigated the relationship between CVC investments and the corporate social responsibility of the parent firm. Their central assumption is the possibility of acquiring knowledge through CVC to improve the company's CSR strategy and develop a sustainable competitive advantage. They found a positive effect of CVC operations on the parent corporation's social performance (community, human rights, product responsibility, and workforce scores) and environmental performance (composed of emissions, innovation, and resources used). Moreover, a recent study by Bendig et al. (2022) shows evidence of increasing

green innovation output for those firms that invest in green startups through CVC, suggesting that a green knowledge transfer can occur.

New directions: Harness economic growth

New studies conducted by Dushnitsky & Yu (2022) expanded the geography of the sample to CVC activities of Chinese firms. Chinese firms are the second largest CVC investors after the US ones. Since previous identification of CVC objectives was almost exclusively based on samples from the US or Europe, the authors focused on unfolding the peculiarities of the Chinese environment. The Chinese market is characterized by rapid growth in consumption, loose IP protection, and extremely fierce competition. In contrast with Western CVC practices, the considered sample presents evidence that CVC efforts in China are concentrated in industries that are growing fast but that are not characterized by high R&D intensity, such as online retail, publishing, and education services. Therefore, within a business environment of industrial munificence like China, CVC activities will likely provide abundant opportunities for further growth and economic expansion rather than industrial innovativeness.

2.4 CVC Governance Structure

Another critical aspect of CVC initiatives is the program's Governance structure. The choice of the governance structure can impact the level of functional expertise involved in the investment, the quality of ties formed with entrepreneurial networks, and the cognitive barriers given by inertial mechanisms (Keil et al., 2008).

By positioning CVC's governance structures on a continuum, defined by the corporate parent's degree of control relative to the CVC activity, we can find some firms investing indirectly in ventures and others operating direct venture investments. Accordingly, programs with *loose* control, called *CVC as LP*, consist of firms delegating venture capital activities to independent venture capital firms, undertaking ad hoc investments to satisfy a long-lasting relationship with the investing firm (McNally, 1997; Sykes, 1990a).

An intermediate structure can be identified in the *wholly owned subsidiary* type. In this case, the firm creates a proprietary and independent CVC unit that operates autonomously as an IVC. These programs have a high degree of autonomy relative to the corporate approval (Siegel et al., 1988) and have the advantage of attracting VCs' cooperation by working as a signal for corporate commitment and increasing the perceived quality of the venture. Furthermore, a

separate subsidy offers superior international flexibility since it can locate the CVC activities in areas with tax advantages on capital gain or excellent network opportunities (Winters & Murfin, 1988).

A wholly-owned subsidiary is typically used by firms that want to increase R&D capabilities (Kann & Weyant, 2000). It provides exposure to entrepreneurs, VC communities and distance from the corporate's routine. This allows higher levels of exploratory capacity in detecting new technologies and investment opportunities. Further studies have found that structural autonomy positively affects the degree of diversification of the CVC's investment portfolio (Yang et al., 2016). Others found that an autonomous structure is associated with ventures pursuing more *explorative* activities rather than *exploitative* ones. This is due to fewer constraints dictated by the parent firm and superior freedom of action. However, when the activities pursued are explicitly *exploitative,* an autonomous CVC may be an obstacle in disclosing knowledge and complementary assets of the parent organization to the funded startups, making it closer to IVCs as investors (S. U. Lee et al., 2018). Risks of isolation can also show in explorative activities. Autonomy can lead to a lack of communication with the parent firm, making the CVC unit less aligned with the firm's exploratory goals and so undermining the CVC's exploratory nature, (Keil, Autio, et al., 2008).

On the other side of the continuum, firms pursue CVC activities as *direct investments*. This third type of structure presents the tightest degree of control operated by the firm. The parent corporation typically adopts this governance mode when the industry requires excellent technical experience, a personal network with the venture, and a high understanding of the capabilities that the firm needs (Keil, Autio, et al., 2008).

2.5 Investment Relationships and The Importance of Complementary Assets

2.5.1 Scouting and Pre-Investment

The relationship between the investor and the venture is a fundamental element to discuss throughout the investment. In the CVC case, due to its solid strategic component, the relationship involves flows of complementary assets covering different layers, from intangible assets such as knowledge to capital and commercial assets. The exchange of resources represents the CVC's core advantage compared to having other investors on board.

Scouting Process and the Paradox of Corporate Venture Capital

From the selection process, research found that CVC units often rely on venture capital intermediaries when scouting and assessing ventures, especially when the firm holds loose control of the CVC activity (*dedicated VC fund* or *wholly owned subsidiary*). However, when the parent assumes a tight governance structure through *direct investments*, the initial touchpoints are referrals by a corporate employee or direct contact the company receives from the entrepreneur himself (Siegel et al., 1988). Regarding this last mode, the research found that entrepreneurs seeking "sharks" correlate positively with the need for unique resources from the corporate investor and a tight patent regime that can prevent misappropriation risks (Katila et al., 2008a).

In particular, the entrepreneur often suffers strong imitation concerns when the venture's technology is a potential substitute for the firm's product and when the CVC manages investments that can substitute the entrepreneur's product. This also affects the quality of deal flows, which are lower when the products and services of the venture are closer to the ones of the investment firm. This ambiguous effect is known as the *paradox of corporate venture capital*. These concerns over imitation in case of high substitutability of products are alleviated with the industry's tight IP regime, such as for the pharmaceutical sector (Dushnitsky & Shaver, 2009). Further research shows that the technological and market overlap of the parent company with the funded venture is positively correlated with the financial commitment of the CVC unit (Wadhwa & Basu, 2013).

Syndication and The Paradox of Information Exchange

A crucial concern for CVC investors is risk exposure. Syndication has shown to be a fundamental tool for CVC investors to enhance their network position and have access to IVCs' specialized knowledge and their ties to venture clusters (Keil et al., 2010). Many CVC units use syndication with IVC networks in the pre-investment phase to ease strategic fit assessment (Yang et al., 2009). The strategy of having a central position in the syndication network is defined as *minimizing centralist.* Alternatively, CVC investors are better off using a *maximizing isolationist* strategy, especially in highly concentrated industries dominated by powerful incumbents. This strategy consists of CVCs staying away from the center of the syndication network. Research has found the latter to be the first-best strategy. The reason stands in the *information exchange paradox* (Anokhin et al., 2011). The paradox sees a firm at the center of a network having higher benefits on knowledge acquisition from other network

members but at the same time suffering a higher risk of knowledge spillovers to potential competitors. This leads to a contingent view of syndication centrality, which is beneficial only in industry fragmentation and detrimental when few powerful incumbents must protect their unique resources.

Recent research found that being part of a network of VCs is necessary per se. Companies show to invest with the side purpose of maintaining their financial relationships with VCs networks. This is because VCs are a valuable source of information from the entrepreneurial world. However, the centrality in the networks of VCs is not dependent only on CVC investments but on the overall R&D efforts of the corporation, showing the importance of engaging in a complementary set of innovative activities (Braune et al., 2021). In particular, the company's syndication with high-status VCs has proven to trigger superior engagement in CVC dynamics from the corporate's top management, which starts paying particular attention to technological discontinuities and new opportunities (M. V. J. Maula et al., 2013). Experience of syndication with IVCs also has a beneficial effect in determining the venture's exit performance since the CVC investors are less prone to knowledge misappropriation to maintain the collaborative relationship with the syndicate (Kang & Hwang, 2019).

From a financial perspective, risk can also be moderated by portfolio diversification. However, in CVC, this matter becomes complex since the financial outlook is only one of the objectives. Yang et al. (2014) identified the investor's wealth as a significant determinant of diversification's success. They found a U-shaped relationship between the wealth of the company and the diversification of the CVC investment portfolio. Therefore, financial constraints undermine value creation from a highly diversified portfolio. Instead, the authors propose that a focused CVC program with low diversification can create superior value. In another study, Yang et al. (2016) found that the growth potential associated with CVC portfolio diversification is also contingent on the governance mode. CVC units with a high level of autonomy from the corporate parent show a positive correlation between diversification and the value growth of the investment portfolio. In contrast, the correlation is negative in the case of low structural autonomy.

2.5.2 Post-Investment Dynamics:

After the investment starts, a phase of monitoring and exchanging information and assets follows. This phase is characterized by creating mechanisms to influence the venture's

behavior and cope with agency issues. By doing so, CVC units actively stimulate outflows of knowledge in the industry and technologies (Gompers & Lerner, 1998; Yang, 2012).

Monitoring and Control

Monitoring and control activities both in US-based and EU-based CVCs consist in taking a seat in board meetings or observer seats, reviewing the venture's reports on a weekly or monthly basis (M. V. J. Maula, 2001; McNally, 1997; Sykes, 1990a), and conducting monthly site visits (Bottazzi et al., 2004). The number of seats is typically correlated with the competitive position of the products, meaning parent firms with complementary products receive a higher number of board seats compared to the case the products are potential substitutes. However, CVCs are rarely lead investors, while this is a role that primarily IVCs have (Masulis & Nahata, 2011). Instead of leading the investment, CVC investors are much more likely to ask for "veto rights" when seeking influence in the board's decisions (Cumming & Johan, 2008). In the case of the CVC being a leading investor, some protection dynamics are put in place by the venture to limit the risk of misappropriations from investors that are potential competitors, retaining higher board representation for themselves (Masulis & Nahata, 2011).

Knowledge exchange

The second aspect to analyze is exchanging information and knowledge between the CVC and the venture. The exchange is typically bidirectional. Through its presence on the board, the CVC unit can advise how to tackle and solve short-term issues (McNally, 1997) while acquiring knowledge on new investment opportunities and forming business relationships for the parent company (Sykes, 1990a). Regarding relational matters, several frictions must be considered when assessing the flows. The most important is the cultural difference between corporate and venture business methods (Siegel et al., 1988). Many researchers found that CVCs typically need help to promote a fruitful relationship with their ventures compared to IVCs (Bottazzi et al., 2008; Hill & Birkinshaw, 2008; Keil, Autio, et al., 2008). However, this is reduced by complementarity, meaning the more substantial the complementarity between capabilities or products of the CVC and venture, the higher the social relationship development between the two (Maula et al., 2009).

Once established that ventures can use the knowledge and complementary assets of the corporate investor to drive their business operations and improve their technologies, CVC can put in place several modes of knowledge exchange and technological alliances. For Instance, Di Lorenzo & van de Vrande (2019) outlined that this often happens through the formation of investment relationships or employees moving from the corporate mother to the venture. The latter increases the knowledge inflow of the venture, which will start drawing more on the investor's technology.

Shuwaikh & Dubocage (2022) outlined the comparative advantage of CVC over IVC in venture financing. They defined three mechanisms that CVCs use to leverage their complementary resources effectively. (1) absorptive capacity of the parent company allows for better leverage of the knowledge produced by the venture, (2) business area similarity increases the potential technological contribution the investor can bring into the company, (3) close business fit, and geographical proximity facilitate the transfer of knowledge, R&D resources, and employees.

Field Gutmann et al. (2019) present a taxonomy that distinguishes four CVC types based on the complementary services they provide to the venture. The authors identify value creation services and value capture services.

Value creation services concern

- The creation of reputation: credibility and legitimacy in negotiating with suppliers and communicating with customers.
- Support activities: legal services, recruiting, and infrastructures
- Core business activities: strategy, operations, finance, marketing, and development of products and services through knowledge and technical expertise.

Value capture services concern

- Formal activities: help the venture to build direct revenues through the creation of a customer base and relationships with suppliers
- Informal activities: network activities with stakeholders internal to the venture and external that could lead indirectly to new revenue streams.

Along these two dimensions, CVC units can be divided based on their focus on one and the other (Appendix 4). *Observers* present a soft focus in both dimensions, showing motivation in catching strategic insights on technology and the market rather than increasing the value of the

venture. The *harvester* is instead highly focused on providing value-capture services, signaling interest in improving the venture's efficiency and increasing revenues to obtain financial results. Conversely, the *enabler* is instead focused on expanding the venture's innovation and connecting ventures in its portfolio for long-term alliances. The builder focuses on both activities to improve the industry's ecosystem and increase inter-firm collaboration.

2.6 Performance of Implications

The CVC literature has identified performance measures that can be outlined from three different viewpoints. The CVC relationships involve three main parties that expect a return on the partnership activity. These are the entrepreneurial venture whose benefits go beyond financial gains, the CVC fund, and the parent firm.

2.6.1 Performance Of the Venture

Financial Performance

A CVC investor significantly differs from traditional VCs regarding the advantages it can offer to the funded venture. The research identified recurrent firm elements the venture could access on top of the financial capital. These are typically corporate laboratories, an established network of customers and suppliers, distribution channels (Acs et al., 1997; Pisano, 1991; Teece, 1986a), and knowledge about the industry. There are also indirect benefits that can be found in endorsement dynamics. The investing firm's reputation can signal the venture's quality in attracting talent, partners, and capitals (Stuart et al., 1999). The endorsement effect has been further studied by Bjørgum & Sørheim (2015), who confirmed that the involvement of a CVC investor in pre-commercial stages helps increase young technology firms' credibility.

From a survey conducted by McNally (1997), the prevailing benefits for the venture are problem-solving capabilities, corporate management knowledge, and technical expertise. In another survey by Kelly et al. (2000), R&D and new product development-related elements emerged. Besides financial capital, ventures can get manufacturing, research, and marketing resources. Manufacturing aids consist of purchasing power in cost and quality and manufacturing knowledge and capabilities. Marketing and distribution-related items can provide a solid advantage to the venture. These often consist in improving distribution channels and networks, offering a widely known customer base, market research capabilities, and an

overall “halo effect” given by a solid reputation, in line with the endorsement effect. Lastly, legal aids can come from the firm’s experience in patent approvals, compliance with regulatory standards, and customer support procedures.

On top of the list of benefits illustrated above, Gompers & Lerner (1998) found that the presence of a CVC investment does not have any decremental effect on the venture’s survival when compared to pure VC funding, with a higher likelihood of succeeding when there is high relatedness between the two sides of the deal. The same research presents evidence of premium prices paid by CVC activities giving the venture average superior financial resources. This also reflects on IPOs valuation, which finds CVC-backed ventures receiving higher results than comparable VC-backed ventures, especially when there is a high strategic fit between the CVC firm and the venture (Ivanov & Xie, 2010). Moreover, Hochberg et al. (2007) further advance these findings by outlining the increase in a venture’s survival chances when the VC investors are well-networked with CVC investors in case the venture is backed by VCs only.

Dai et al. (2022) corroborated that CVC investments positively impact the venture's financial performance. However, the authors find that post-IPO, high venture R&D intensity weakens CVC’s positive effect on financial performance. This finding suggests that CVC investors may become concerned about the venture’s fast growth after the IPO because it could become a potentially strong competitor. Literature also shows some concerns about startup valuation by the CVC unit. Röhm et al. (2018) show that CVCs with strategic objectives tend to give lower valuations to the startups since they are more aware of the potential value creation of synergies and complementary assets they can bring into it. In this case, entrepreneurs are more willing to accept a discount, aware of these potential benefits.

Innovation Performance

More recent studies focused on the venture’s innovation performance rather than the financial one. Yang (2012) finds a positive correlation between corporate investors’ knowledge outflows and the performance of their portfolio, highlighting the vast benefits of inter-organizational learning. Research conducted by Alvarez-Garrido & Dushnitsky (2016), Park & Steensma (2013), and Chemmanur et al. (2014) have shown that having CVC as investors leads to a superior number of both patent applications and patents granted when compared to ventures that are backed by IVCs only. In addition, Alvarez-Garrido & Dushnitsky (2016) found that innovation performance is also subject to CVC’s ability to access the complementary assets of

its parent firm to support the venture's growth. These studies allow researchers to highlight the interplay between corporate resources and CVC's ability to determine the venture's success.

Boundary conditions on the timing of investments have been set by Park & Bae (2018), who found the CVC benefits on the venture's innovation performance are more robust when the CVC fund comes subsequently to the startup's initial funding from IVCs. This means an early CVC investment is more likely to create knowledge misappropriation and competitiveness from the corporation rather than value creation and collaboration. On the contrary, if the technology is well established, this hazard diminishes in favor of collaborative dynamics and superior protection of a well-established startup's knowledge. Therefore, an initial IVC investment is more beneficial since the IVCs have no interest in the venture's knowledge.

Finally, a recent study by Wang et al. (2021) in the Chinese CVC context shows that the technological fit between the startup and the parent corporation positively affects innovation output. The fit allows investors to provide higher financial aid to support the venture's strategic goals and better monitor the utilization of the invested resources. This positive relation has, however, an inverted U shape. This is due to a technology overlap and consequent knowledge redundancy. Therefore, it is beneficial to a threshold where the marginal innovation output flattens with the increase in strategic fit.

Further study by Paik & Woo (2017) connects the venture's performance to organizational considerations, merging the effects of governance on innovation outputs. They use the R&D intensity of the CVC-backed ventures normalized by sales as the dependent variable, finding this is positively affected by the founder's characteristics. The study shows evidence that founders with a background in incumbent firms positively affect the venture's R&D investments, with an amplified effect for founders from top management positions. This effect is due to higher goal congruence between the firm and the incumbent founder, which leads to superior knowledge spillovers from the parent firm to the venture.

2.6.2 Performance of Parent Corporation

Besides the financial performance of the CVC fund, which reflects the corporation's profitability, there are diverse other objectives the parent corporation can consider a matter of success. We already mentioned strategic objectives such as obtaining a *window on technology*

and *demand enhancement*. We have seen that these objectives can be complemented by reaching sustainable goals and harnessing economic growth.

Financial Performance

Starting from financial outcomes, a study on the Internal Rate of Return (IRR) performance of CVC investments reports average negative returns (Allen & Hevert, 2007). Other research by Dushnitsky & Lenox (2006) uses *Tobin's q* as the dependent variable to measure financial performance through a firm's value creation. This measure captures both financial returns and long-term strategic benefits incorporated into the firm's value. The analysis led to industry-dependent results, finding a strong positive effect of CVC on Tobin's q in the devices and the information industry. Moreover, the positive relationship increases when the firm's objective is explicitly strategic.

More generally, a recent by Janney et al. (2021) studied the effect of the parent corporation's investment history on the cumulative abnormal return of the investments using a sample of biotechnology firms. They identified the industry's prominence of the firm (e.g., firms that received approval for their drugs) as a determinant of higher financial returns because of their demonstrated ability to commercialize their drugs. In addition, firms with prior experience in CVC investments in their acquisition target gain superior returns when making their acquisition announcement.

Innovation Performance

Performance considerations on innovation output have been addressed by several research. As mentioned, firms that hold CVC activities are positively associated with corporate R&D, increasing the overall R&D efforts of the parent firm (H. Chesbrough & Tucci, 2004). Accordingly, the innovation output quantified by patent citation rates of the firm is positively associated with CVC activities, with an increased effect subject to the weakness of IP regimes and the firm's absorptive capacities (Dushnitsky & Lenox, 2005b).

Some scholars investigated the impact of firm-specific attributes on innovation performance. Wadhwa & Kotha (2006) found that the innovation output connected to CVC also depends on the firm's level of involvement in the venture's activity (e.g., through board seats).

Innovation performance takes a U-shaped relationship when the level of involvement is high and an inverted U-shape when the level of involvement is low. This leads to a decrease in the innovation rate as investments increase. In a contingency view, a firm with low involvement capabilities is better off investing higher sums in fewer startups. In addition, Weber & Weber (2007) follow a relatedness perspective finding that a high *relational fit* between investor and startup, formed by the simultaneous presence of high ties in social capital and high knowledge relatedness, eases knowledge transfer and knowledge creation between the firm and the venture, leading to more radical innovations.

Research conducted by Kim et al. (2016) on IT companies identified that CVC positive returns in patents are much stronger if the firm is a technology leader, while laggards are less able to trigger innovation benefits from CVC activities. Furthermore, Wadhwa et al. (2016) investigated the effect of CVC portfolio diversity on innovation performance, showing an inverted U-shaped relationship. This shows that the benefits of portfolio diversity on knowledge inflows exist but if conducted moderately. In addition, some contingencies moderate the adverse effects of diversity and increase the benefits. In fact, the deeper the technological knowledge and the deeper the connection with external knowledge from alliances, the more the portfolio diversity benefits the parent company.

Extending the methods of innovation measurement, Schildt et al. (2005) used a backward citation approach to measure the firm's innovative gains from the venture. They found a positive correlation between CVC activities and the number of venture patent citations the parent company made after the investment. Lee et al. (2015) take the same backward citation approach. Their research formally introduces the concept of CVC activities as a *distance search process* that firms can use to source external knowledge from new ventures. Despite confirmation of the beneficial effect of CVC activities on knowledge inflows, the authors show this is valid to a certain threshold, after which the knowledge transfer decreases. This leads to considerations on knowledge maximization and the necessity for CVC programs to introduce knowledge transfer mechanisms. Furthermore, the authors showed that the inverted U-shaped relationship could be moderated by knowledge diversity, which increases the innovative outcome and more substantial outcomes in CVC programs that are tightly tied to the parent firm rather than those loosely tied.

New research has shown that the two performance types identified above, innovative and financial, are not mutually exclusive. Kang et al. (2021) found a positive relationship between technology spillovers and capital gains. However, this effect is weaker in cases where the investor's objective is solely financial or the focus of the CVC fund is solely on early-stage ventures. This confirms the importance of investors' objectives and timing in determining the outcome of CVC investments. Huang & Madhavan (2021) agree on further exploring the interrelationship between CVC performance outcomes. They found that, in general, CVC investments have a positive impact on both the financial and strategic performance of both the parent corporation and the ventures through their learning and complementary assets mechanisms.

2.7 Geographic Distance

While screening literature on CVC, it has been noticed that some studies started exploring the impact of geographic distance on CVC actions, opening a closer integration of CVC with the international business theories regarding the influence of proximity and cross-border investments. Under geographic distance, companies operate in different institutional settings, which can directly affect innovation and financial matters. For instance, geographic distance exacerbates CVC costs connected to the information collected in pre-investment and the exchange of complementary assets and knowledge in the post-investment phase. In this section, this new research stream has been organized and analyzed.

2.7.1 Geographical Proximity

Following the paradox of CVC (Dushnitsky & Shaver, 2009), Kang & Hwang (2019) found that the risk associated with information asymmetry is more substantial in long-distance investments. This is because ventures in low appropriability regimes could suffer higher post-investment hazards from a parent corporation operating in institutional contexts where the venture needs more knowledge. Higher financial premiums or benefits connected to the corporate's complementary assets must offset this cost. Furthermore, relatedness would decrease the CVC unit's information asymmetry since CVC could leverage its social network in a foreign IVC community to assess the reliability of the investment in the screening process. Therefore, the authors suggest CVCs should primarily target ventures in industries with tight appropriability regimes or a high relatedness with the parent's business units when investing in low proximity.

Geographical distance is also advanced by Field Mazza & Shuwaikh (2022), who find proximity particularly relevant for CVC funding compared to IVC since it allows a better exchange of knowledge and resources through physical contact, which is crucial to determine CVC's success. Proximity positively influences the CVC investment amount and the venture's exit through IPO. Dai et al. (2022) use geographical proximity to measure influence on the venture's financial performance. The authors find that geographical proximity strengthens the positive relationship between CVC investment and the venture's economic performance. This suggests that distance is a relevant element to bring into the analysis.

Wang et al. (2021) also discuss the importance of geographical proximity. The authors find a U-shaped relationship between the CVC portfolio's diversification and the parent firm's value. This effect is positively moderated when there is geographic proximity between the parent firm and the portfolio of companies.

2.7.2 Cross-border Corporate Venture Capital

Cross-border investments are increasingly attracting the attention of CVC research. Kang et al. (2021) postulated that because of the adverse selection of the startups' technologies, CVC deals in the early-stage phases of the startup are less likely to happen in cross-border investments. The corporation's foreignness can exacerbate this risk to the venture's location and business environment, leading foreign companies to suffer cultural and institutional disadvantages compared to local players (Bell et al., 2012). In addition, the distance could lead to a higher risk of imitation from the venture's perspective, which could have less protection in the appropriability regime of the investor's location. One solution to overcome this liability is establishing a local CVC unit (Q. Lu & Hwang, 2010). In line with Kang and Hwang (2019), Kang et al. (2021) conclude that early-stage CVC deals are more likely to happen in a tight IP regime. The authors found that establishing a local CVC unit could reduce the information risks of adverse selection. However, this would not reduce the imitation risk suffered by the venture and the institutional and cultural distances sustained by the investor since its operations would still be outside the venture's location.

Some research investigated the main reasons behind foreign CVC. In front of an increasing amount of venture investments made by Chinese IVCs (1292 deals) and CVCs (354 deals) in the United States from 2010 to 2017, Gonzales & Ohara (2019) identified five reasons that drive these deals. "(*1) bring the product to the Chinese market; (2) use the product in a Chinese*

firm; (3) access the technology of the United States startup; (4) undertake joint R&D and product development; and (5) manufacture the product in China" (p. 8). 60% of the deals have joint R&D and product development as primary drivers, standing for collaborative and strategic objectives with the US startups.

One study by Belderbos et al. (2018) found that geographic diversity in the CVC portfolio can increase technological performance. In particular, the study showed that geographic diversity in CVC pursued simultaneously with technology alliances has a U-shaped correlation with the technological outcomes. This means exploring new sources of knowledge through CVC activities in foreign locations increases cross-fertilization and innovation output. However, an excess of diversification of countries and partners increases the struggles in absorbing this pool of knowledge. This U-shape relationship finds an explanation in two events. First, increasing diversity hinders CVC flexibility by increasing complexity in coordination, managerial capabilities, and resource constraints. Second, the simultaneous involvement in CVC and technological alliances within the same location increases the likelihood of knowledge redundancy (Appendix 5).

3. Theoretical Background

Due to the increasing amount of literature that deals with international issues in the CVC field, an entire chapter was dedicated to the geographical distance. The nuanced role of geographical proximity in determining the dynamics of the firm-venture relationship and the resulting performance has been highlighted by Kang & Hwang (2019), Mazza & Shuwaikh (2022), Dai et al. (2022), and Wang et al. (2021). Emphasis has been placed on the attrition that distance can create in the financing elements of CVC, such as information asymmetry in the pre-investment stage and resource sharing in the post-investment phase. This stream of research opens a wide gap for developing CVC literature, starting from integrating innovation practices and international business concerns.

An international perspective opens up valuable new research directions. For example, rather than technological and commercial support, start-ups often need the firm's knowledge and resources of the international context to pursue market expansion. Moreover, CVC's innovative and financial performance still lacks research attention from an international point of view. Despite Belderbos et al. (2018) efforts in assessing the IP performance of the corporation when pursuing international CVC activities and alliances, no attention has been given to the implication of receiving a foreign CVC investment on the startup's innovative performance. Therefore, it is of primary interest to uncover the effect distance has on the learning mechanisms offered by CVC vehicles.

3.1 Knowledge-based view

In this thesis, it is considered helpful to employ the firm's knowledge-based view (KBV), which has significantly evolved from the standard resource-based perspective. Starting from the traditional view's emphasis on physical resources (Barney, 1991), the KBV views a firm's knowledge assets as the primary source of competitive advantage. KBV has been widely discussed, and its limitations must be acknowledged.

From the KBV perspective, a firm is an entity composed of unique assets constructed by a firm-specific knowledge (Spender, 1996). Accordingly, knowledge emerges as the most important resource to increase economic returns and strengthen a firm's competitive position (Teece, 1998).

KBV emphasizes that knowledge resides within the individual. Therefore, individuals are the inherent catalyst of knowledge exchange and creation who act within and outside the organizational boundaries (Grant, 1996). In this context, the primary role of a firm is to orchestrate the distribution and application of existing knowledge to generate new knowledge that underpins advanced technologies and products (Zahra & George, 2002).

However, this theory presents relevant criticism. Foss (1996) emphasizes that not all knowledge held by a firm can generate a competitive advantage; the specific knowledge that does so is often tacit, complex, and firm-specific, and it is difficult to capture through IP. Furthermore, he argues that knowledge is not merely contained within the firm but is a result of interactive processes and organizational routines. Additionally, there are several challenges in managing knowledge. Different objectives across different business units can lead to coordination difficulties (Grant, 1996). This implies that the range of knowledge types, from tangible to intangible, can introduce weaknesses in knowledge capture, dissemination, and use (Nonaka & Takeuchi, 1996).

This highlights the intrinsic limitations of this research, which starts from the fundamental assumption that IP is a proxy for innovation, as it results from knowledge recombination. For instance, not all knowledge is patentable or protectable by IP rights, and not all knowledge that could be protected is indeed patented, often due to secrecy and strategic reasons. Despite several limitations, knowledge development and acquisition from external sources is crucial for firms to continue their innovation activities (Tallman & Phene, 2007), making it a relevant topic of study in this context.

3.2 An International Adaptation of the Knowledge-Based View

Innovation is a systemic and open process that goes beyond company boundaries and a trans-local phenomenon that transcends regional boundaries (Belussi et al., 2010). In today's global economy, cross-border investments are a powerful mechanism for facilitating knowledge exchange between firms. In particular, the rise of technology-based business models, such as in the ICT sector, has led patentable knowledge to become a key driver of success (No et al., 2015). In this way, innovative regional clusters like Silicon Valley are a magnet for new investment from domestic firms and foreign multinationals (Teece, 1992).

Prior literature identifies that the distribution of innovation has a disproportionate spatial concentration in a few locations worldwide, illustrated as *spikes*. Some countries have higher innovation rates or specialization as technological leaders. Other countries must act as followers in searching for and adopting these innovations, and their actions might be crucial to business survival (Bahar et al., 2023).

Phene et al., (2006) have stated that the benefits of becoming part of local networks consist of unique technology search approaches and site-specific innovation systems. Hence, the increasing presence of foreign firms in the regions of the United States raises questions about the patterns of knowledge acquisition and sharing by these multinational firms, particularly in critical high-technology industries (Almeida, 1996). However, one critical consideration in this discourse is the geographic distance that can hinder effective knowledge acquisition from the investments and set new paradigms of innovation dynamics (Hu & Jaffe, 2003; Rosenkopf & Almeida, 2003). This makes the international setting a pertinent focus of inquiry.

3.3 The Exchange of Complementary Assets

Restricting this exemplary research stream to our field of interest, knowledge is particularly relevant in Corporate Venture Capital (CVC) investments as it involves the exchange of strategic complementary assets. In fact, the distinctiveness of Corporate Venture Capital (CVC) investments compared to IVC investments lies in the strategic objective beyond just monetary gains. Complementary assets are essential resources for the commercial exploitation of innovation, encompassing manufacturing and distribution capabilities, complementary technologies, and after-sales service (Narayanan et al., 2009; Teece, 1986b).

Foreign CVC investments in US venture targets often aim to access the startup's knowledge (Gonzales & Ohara, 2019). Consequently, as an embodiment of FDI, these investments present a crucial setting for the knowledge transfer (Tallman & Phene, 2007). In this context, CVC activities play a valuable role in tapping into the knowledge of the ventures and provide the investor with an insightful view of technological trends and a window on potential innovations (Chesbrough & Tucci, 2004).

Vice versa, startups can benefit from the foreign incumbents' complementary assets to sustain their innovative capabilities, acquire distant knowledge, and commercialize their products (Dushnitsky & Lenox, 2005b; McNally, 1997; Siegel et al., 1988). Corporations offer ventures

internal specialized knowledge and resources, involving manufacturing plants, distribution channels, technology (H. W. Chesbrough, 2002), human capital, such as the inventors (Di Lorenzo & van de Vrande, 2019), and the halo effect of a known brand (Sauvage et al., 2022). Access to assets and resources can positively affect the overall performance of the venture (Alvarez-Garrido & Dushnitsky, 2016). These connections enable ventures to take advantage of distinctive opportunities, accumulate knowledge, and consolidate resources unavailable in their home market (Chetty & Holm, 2000), fostering innovation.

External knowledge acquisition through CVC has positively affected the learning and business development of both the corporate investor and the target ventures (Dushnitsky & Lenox, 2005a). Hence, the knowledge transferred in CVC investments often encapsulates cutting-edge innovation characterized by patents. As such, patents offer a proxy for the diffusion of knowledge.

3.4 The Liability of Distant Search

In the current innovative landscape, ventures and CVCs with valuable knowledge are often far. The increase in global competition intensified the need to search for knowledge and capabilities outside local technologies (Davis & Meyer, 2004; Hsu et al., 2015; Penner-Hahn & Shaver, 2005).

If we conceptualize CVC activities as explorative tools that allow incumbents and startups to access each other's knowledge, geographical and technological distance are a valid environment to measure the effects on innovation performance. Therefore, in the case of CVC, knowledge acquisition can be described as a ***distant search*** practice. The distance can be considered from an industrial and a geographical perspective, where different geography stands for a different entrepreneurial environment and diverse expertise in the technology (Grant, 1996). Hence, geographical expansion enhances distance, exacerbating the positives and pitfalls of distant search.

There are two main advantages of distant search. First, expanding the search scope increases the chance of learning (Fleming, 2001). Second, a more expansive search scope enhances the variety of knowledge and the variance of outcomes, increasing the number of radical solutions found (March, 1991).

While localness offers inventors a familiarity with technologies and components and is associated with exploitative goals, distant search tends to be explorative. It puts the inventor in touch with novel technological elements (March, 1991). However, the more diverse and distant the knowledge, the higher the costs associated with learning and coordination and the higher the resource constraints (Keil, 2004).

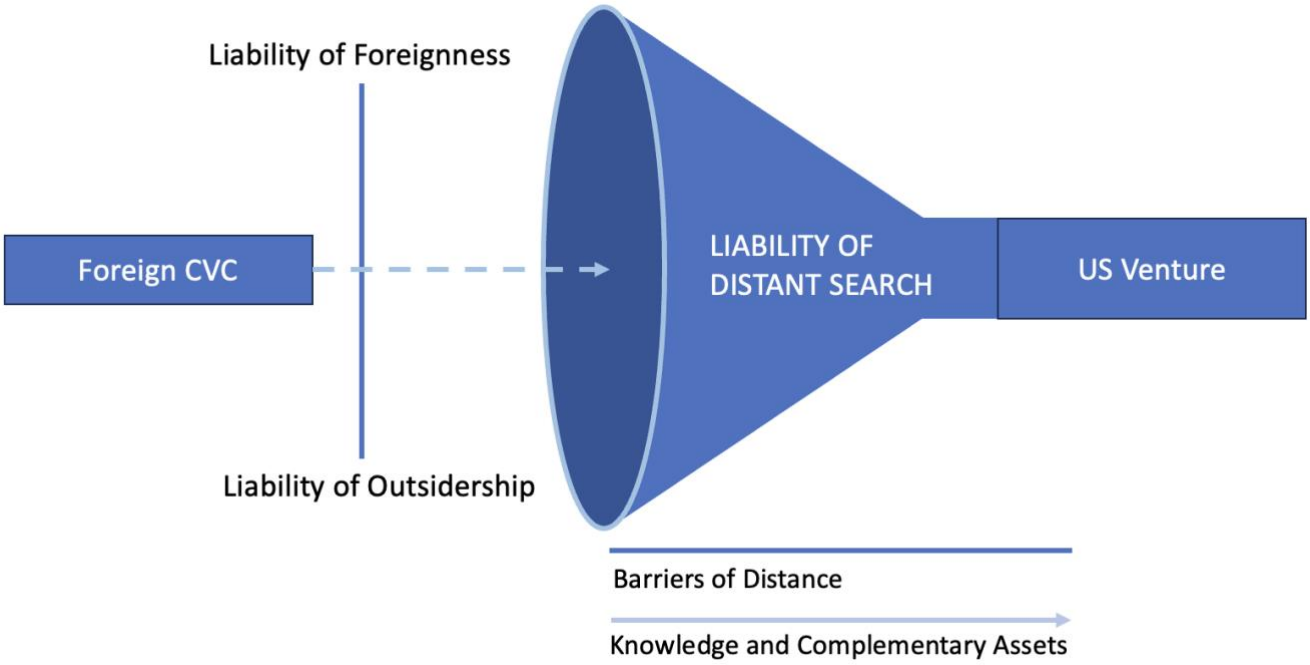
Therefore, the barriers introduced by geographical, cultural, and institutional distance often impede the effective transfer of complementary assets (Hennart, 2009). Traditional international business theories identify problems related to the ***liability of foreignness*** (Zaheer, 1995) and the ***liability of outsidership***, which links knowledge creation and trust-building in a foreign location to the web of relationships and networks in the foreign market (Johanson & Vahlne, 2009). This implies two main drawbacks for distant search practices

- Foreign firms are disadvantaged due to their lack of familiarity with the local business environment, which is distant in culture, geography, and institutional setting. This makes it challenging to identify suitable investment opportunities, understand the needs of start-ups, and so transfer complementary assets appropriately (Zaheer, 1995). For instance, institutional differences between the corporate investor and the start-up can lead to misunderstandings and misalignments, thereby inhibiting the fruitful exchange of complementary assets (Xu & Shenkar, 2002).
- Foreign firms are outsiders to the relevant local business networks. Hence, they face logistic challenges in transferring tangible assets, while the tacit nature of intangible assets requires proximity and frequent interactions for an effective exchange (Johanson & Vahlne, 2009).

Managing these challenges necessitates a deep understanding of the foreign environment, cultivating local knowledge and networks, and developing adaptive capabilities to transfer complementary assets across borders. This underscores the need for research to continue exploring the mechanisms and dynamics of complementary asset exchange in foreign CVC investments and the strategies for mitigating the associated challenges. Best practice suggests that the information asymmetry faced in the pre-investment phase must be offset by proper due diligence over the venture's business plan and technology (Dushnitsky & Lenox, 2005b). In addition, the investor must implement relational practices that allow closeness to the venture and effective knowledge exchange (Bottazzi et al., 2004; Zahra et al., 2000).

Under this condition, it is postulated that the formation of efficient ties between the CVC investor and the distant venture is compromised and requires effective integration mechanisms to overcome the obstacles posed by the *liability of distant search*.

Figure 1: The Liability of Distant Search in Action



3.5 Research Questions

Considering the unexplored boundary condition of foreignness, the CVC as a learning mechanism faces new challenges to explore. Notably, the phenomenon of foreign CVCs investing in U.S. startups has witnessed significant weight, involving large corporations in several industries to start a CVC unit in the US. Despite the large volume of cross-border investments, our understanding of their implications still needs to be improved, particularly on the innovation outcomes of the targeted U.S. ventures and the integration mechanisms that allow them to boost their innovative performance. This research aims to fill this gap by posing the overarching research question:

How do foreign CVCs influence the innovation performance of U.S. startups?

Our inquiry is based on the assumption that foreign CVCs, through their strategic investment decisions, can alter the innovation trajectory of the startups they back (Alvarez-Garrido &

Dushnitsky, 2016; Chemmanur et al., 2014; H. D. Park & Steensma, 2013; Yang, 2012). To assess the mechanisms through which this influence is materialized, we decompose our main research question into sub-questions based on a different instance of relevant literature. Given the geographical distance and potential industry disparities that foreign CVCs need to face, the role of proximity is of particular interest. In particular, research on the spatial distribution of IVC investments found that information about investment opportunities and technological knowledge tends to circulate within geographic and industry boundaries (Sorenson & Stuart, 2001). Therefore, the following sub-question is developed

a) *How do foreign CVCs' industrial and geographical proximity affect the innovation outcomes of U.S. startups they invest in?*

Popular studies on the relationship between proximity and innovation argue that geographical proximity cannot be assessed in isolation but should always be studied along with other elements that address the problem of coordination and information asymmetry (Boschma, 2005). Therefore, there needs to be more than geographical proximity to study the complexity of inter-organizational learning. Drawing on network theory, it has been posited that investors' relational structure can profoundly influence their investment's success (Sorenson & Stuart, 2001). As such, attributes like syndication, multiple CVC ties, and portfolio size, which determine the relational configuration of foreign CVCs, might shape the startups' innovation outcomes. This leads us to a second sub-question:

b) *How do the relational ties of foreign CVCs influence the innovation performance of U.S. startups?*

In addition, the stage at which venture capitalists choose to invest in startups has been widely recognized as crucial in determining investment outcomes (Gompers, 2002), which also holds for corporate venture capital (S. Kang et al., 2021). While early-stage investments offer the opportunity to shape the strategic trajectory of a startup and capture novel, high-risk innovations, later-stage investments allow CVCs to leverage more mature, market-ready technologies, which may align better with their corporate strategies and risk profiles (Dushnitsky & Lenox, 2005b; Dushnitsky & Shapira, 2010; Lane & Lubatkin, 1998).

Moreover, the issue of timing is particularly relevant in addressing the *liability of distant search*. For instance, foreign CVCs might opt for later-stage investments to mitigate these risks

by investing in more established startups with proven track records. Conversely, early-stage investments in foreign startups could provide CVCs with valuable experiential learning and networks, enabling them better to navigate the foreign ecosystem in the long run. In line with previous research by (S. Kang et al., 2021), this aspect is included in the investigation, and the third research question is formulated as follows:

c) *How does the timing of foreign CVC investment influence the innovation performance of U.S. startups?*

To answer these questions, six hypotheses are elaborated in the next chapter. These hypotheses are tailored to the research questions and backed by relevant literature, allowing us to test the effect of explicit proximity factors, relational ties, and investment timing on the venture's innovation performance. As a final goal, these questions will help to elaborate on the tools that are more effective for a foreign CVC unit to mitigate the barriers posed by the liability of foreignness. At the same time, they will provide insights for US ventures to recognize the enabling characteristics of a foreign CVC investor when willing to leverage its resources to pursue innovation-enhancing goals.

4. Conceptual development

The positive effect of the unit's location

Even though new digital means of communication have emerged, Li et al. (2023) define geographical proximity as crucial for exchanging knowledge and resources to build trust, facilitate information collection, and detect tacit information. The authors find that even though digital communication tools can mitigate disadvantages, they will never resemble the benefits of physical relationships in bonding with the network and capturing tacit knowledge.

A common practice in CVC investments is establishing a wholly-owned subsidiary empowered with governance autonomy. Practical examples show the tendency of many parent corporations to open or expand CVC subsidiaries in the United States. This choice embraces the fundamentals of this research by establishing CVCs locally to moderate the barriers linked to distance.

Research on IVC and CVC has confirmed the positive influence of being located in a highly innovative geographical area on investment performance (Chen et al., 2010; S. Kang & Hwang, 2019). Therefore, the location of an investment unit is a fundamental choice to increase familiarity with one entrepreneurial ecosystem, market, and regulatory environment.

Accordingly, proximity to innovative clusters has been linked with superior exposure to new ideas, technologies, and investment opportunities (Agrawal et al., 2006). Therefore, it is hypothesized that foreign CVC units in the United States have better access to quality deals and have higher chances of establishing closer ties with the ventures they invest in. Vice versa, ventures that receive a foreign CVC investment will profit more from the investor's resources if the CVC unit is in the United States.

> *Hypothesis 1: The physical location of a CVC unit in the United States positively influences the innovation of the US-ventures compared to CVC units based abroad.*

The positive effect of industry proximity

While questions about knowledge misappropriation can hamper the CVC relationship with the startup and prevent the exchange of information (Katila et al., 2008b), industry proximity can offset the liability of foreignness presented by physical distance. Rosenkopf & Almeida, (2003)

suggest that a similarity in the technological field can facilitate the transfer and adoption of knowledge. Industrial proximity sets a common ground of shared language and conceptual structures that increase the likelihood of exploitation of collaborative innovation opportunities.

When a foreign CVC and a startup operate in related industries, the CVC may better understand the startup business model, technology, and market, enabling it to provide more relevant strategic guidance and resources (Dushnitsky & Shaver, 2009). Moreover, industrial proximity can serve as a means to reduce the perceived risks related to foreignness, promoting trust, facilitating communication, and ultimately increasing innovativeness (Inkpen & Tsang, 2005; Shuwaikh & Dubocage, 2022; C. Weber & Weber, 2010). Therefore, it is hypothesized that

> *Hypothesis 2: Industry proximity positively impacts the startup's innovativeness when receiving a foreign CVC investment*.

The positive effect of syndication

Standard practice for CVCs is deploying syndication with local IVC networks as a strategic tool to reduce information asymmetry, search costs, and access specialized knowledge (Keil et al., 2010). Distance is generally associated with lower syndication since it makes collaboration harder, outweighing the benefits associated with local partnerships. Nonetheless, relational activities with other investors decrease the unfamiliarity and adverse selection created by local inexperience (N. Dai & Nahata, 2016).

However, this practice can lead to an *information exchange paradox* due to higher risks of knowledge spillovers, suggesting a general preference for a *maximizing isolationist strategy* (Anokhin et al., 2011). In our research, this is a crucial element to consider. The superior knowledge flows and consequent knowledge spillovers suggest that the recipient venture can get superior resources when the CVC is part of large syndicates. Since the unit of study takes the venture's perspective, it is hypothesized that for a foreign CVC, undertaking a *minimizing centralist strategy* positively affects the innovativeness of the investment recipient. Therefore,

> *Hypothesis 3: The level of syndication in foreign CVC investments positively influences the innovativeness of the recipient ventures*.

The Negative effect of multiple CVC ties

An increasing trend of syndication is the involvement of more than one corporate investor in funding the same startup (Anokhin et al., 2011). Theoretically, ventures can benefit from the involvement of multiple corporate investors, given the increased access to knowledge and resources that can help them overcome development and commercialization constraints (Katila et al., 2008b; Wadhwa & Basu, 2013). In a knowledge-based logic, this can positively affect the innovative outcome the venture will reach after establishing such multiple relationships.

However, the multiplicity of corporate participants in the investment syndicate can result in potential inefficiencies. A suitable explanation can be found in the extension of the *paradox of corporate venture capital* (Dushnitsky & Shaver, 2009). As the significant threat of a single corporate investor in establishing strong ties with a startup is its knowledge misappropriation, the presence of more than one corporate investor can have a multiplicative effect on this tendency. This increases the likelihood that control mechanisms arise to prevent the flow of knowledge with their partners (Child et al., 2005).

In addition, the stakes of multiple corporates must be carefully balanced. Corporations can have diverse objectives; financial, innovative, sustainable, and related to economic growth (Battisti et al., 2022; Bendig et al., 2022; Dushnitsky & Yu, 2022; McNally, 1997; Siegel et al., 1988; Sykes, 1990b). Divergent objectives increase coordination costs and make cooperation a difficult achievement. This phenomenon is particularly relevant when dealing with foreign corporate investors with stakes dependent on their country-specific resources and needs. Hence, foreign investors joining a syndicate with other corporate investors must deal with additional coordination costs given by pursuing private interests, with a detrimental effect on the venture's performance. Hence,

> *Hypothesis 4: The presence of a foreign corporate investor in a syndicate with multiple corporate investors negatively impacts the innovative performance of the venture*.

The negative effect of portfolio wideness

The portfolio theory sees diversification as an effective strategy for risk mitigation of investments. A large portfolio distributes the risk exposure from any venture's potential failure (Markowitz, 1952). However, the strategic nature of a CVC investment must go beyond financial considerations. Indeed, Dushnitsky & Lenox (2005a) found that the value added by the CVC to its portfolio companies decreases with the diversification of investments.

A reason for this performance drop lies in the dilution of resources the corporate investor can deploy to foster innovation in its portfolio (Chemmanur et al., 2014; Wadhwa & Kotha, 2006). Additionally, wideness is also a symptom of a lack of industry specialization, which can result in a limited understanding of opportunities, challenges, and needs, so reducing the strategic guidance that the CVC can provide (Basu et al., 2011; M. Maula et al., 2005). Hence, for a US startup, receiving foreign investment from a CVC portfolio will likely lead to superficial engagement and knowledge sharing, constraining access to corporate resources and reducing innovation opportunities (Ernst et al., 2005). Therefore, we hypothesize that

Hypothesis 5: The wideness of the foreign corporate investor's portfolio negatively impacts the recipient startup's innovation.

The Negative effect of uncertainty

Literature on absorptive capacity has shown that the ability of firms to recognize, assimilate, and apply new knowledge is a critical prerequisite for their innovative capabilities (Cohen & Levinthal, 1990). A pre-existing and consolidated knowledge base is a good indicator for ventures to acquire complex knowledge from the external environment. Because CVCs often invest in early-stage ventures, the question of their ability to incorporate new knowledge arises. In particular, they face several learning barriers since they are younger, smaller, and have limited capacity to absorb and leverage the resources provided by the investor (Lane & Lubatkin, 1998).

Furthermore, entrepreneurs in early-stage ventures tend to be skeptical about sharing their knowledge and routines due to concerns about misappropriation (Dushnitsky & Shapira, 2010). This leads to protective behaviors that can prevent the development of strategic ties and the flow of knowledge (Dyer & Singh, 1998). Investees tend to avoid misappropriation by building safeguards that prevent social interactions and, consequently, the exchange of knowledge (M. V. J. Maula et al., 2009). The barriers posed by the foreign context are expected to exacerbate these already rigid mechanisms, adding complexity to the trust-building process with early-stage ventures. Therefore, the following hypothesis is derived.

Hypothesis 6: The innovativeness of ventures that receive a foreign CVC investment in their early stage is less pronounced than later-stage ventures.

5. Methodology

5.1 Research Philosophy and Design

This study is based on an objective approach that assumes a discernible and measurable reality based on the epistemological tenets of positivism (Saunders, 2015). It aspires to uncover novel insights in an under-explored area of research by focusing on patterns and relationships found in observable, empirical data. The data is collected and analyzed neutrally, believing it accurately reflects reality and provides a pathway to meaningful academic contributions.

The starting point of the methodological journey is a deductive approach to theory formulation. The research question is constructed based on established CVC literature theories. The analysis of prior works develops an argument structure that considers certain boundary conditions posed by foreignness in undertaking CVC investments, thus developing testable hypotheses based on past evidence. Finally, a rigorous quantitative empirical evaluation assesses the validity of these hypotheses. To facilitate a comprehensive understanding of their implications in a broader context, the study aims to deconstruct the variables into basic elements, distinguishing between different parts. The results will either confirm or contradict them, depending on the empirical data observed.

Emphasis is put on accurate data collection and is based on the belief that the observed relationships and variables exist independently of the study (Saunders, 2015). To achieve this objective, data for this study were extracted from several reputable secondary sources, including Eikon, Compustat Global, Compustat North America, and PatentsView. These sources provide a comprehensive analytical lens whose utility offsets biases associated with using secondary data (Johnston, 2014). To further ensure the quality of this research, meticulous attention has been paid to maintaining the reliability and validity of the data collected and the statistical models employed throughout the study.

Quantitative regression analysis is the main analytical tool used in this study, allowing for an in-depth examination of the relationship between foreign CVC investments and the US venture's innovativeness. The study aims to shed light on the dynamics of foreign CVC investment, focusing on the issue of distant search and foreignness as impediments and providing valuable insights for foreign companies willing to approach CVC investments in the United States.

5.2 Data Collection

Investment deals from Eikon Thomson Reuter

To avoid data biases, this study partially follows a standardized methodology proposed by (Röhm et al., 2020), that offers a replicable data-cleaning procedure based on an appropriate CVC definition: define CVC units as wholly-owned subsidiaries of nonfinancial corporations that invest in start-ups on behalf of their corporate parent (e.g., (Chemmanur et al., 2014; Souitaris et al., 2012). An initial sample of CVC investments from January 2002 to December 2022, with investors from Europe, Asia, and the Middle East, was retrieved from Eikon Thomson Reuter. The resulting sample contained information about 20.323 deals classified by Eikon as CVC deals and involving US ventures as targets (Appendix 6). The choice of the US as the sole location of the target ventures has the following rationale:

1. The extraction of CVC investments made by funds located in Europe, Asia, and the Middle East shows that over 50% of foreign CVC deals have USA ventures as an investment target.
2. The information on granted patents and patent citations in the USA is public and free to access through centralized databases such as PatentsView. Conversely, databases covering other regions do not offer these characteristics (e.g., EUIPO, PATSTAT). The parties involved, especially the ventures, will likely patent their technologies in the US first.

These data were agglomerated with another extraction from Eikon, including USA CVC investors investing in USA startups to use as a comparison. This added 22.198 deals to the final investment database, totaling 42.521. This represents all the US startups that received CVC investments in the last 20 years. As Röhm et al. (2020) suggested, this was followed by removing undisclosed investors, unknown investors, alternative investors (e.g., NGOs, Universities, Independent Venture Capital), and outside limited partners. However, contrary to Röhm et al. (2020), the following exclusion criteria were not applied.

1. CVC deals operated under the name of the corporate parents. For instance, 3M Corporation operates CVC deals through the CVC unit 3M Ventures, but some are classified under 3M Corporation.

2. CVC deals that do not overlap with the parent company's geography. One example is Samsung AG, which operates through Korea-based CVC (Samsung Venture Investment), US-based CVC (Samsung Next), and under the name Samsung AG.

This choice is justified by the nature of the research that monitors the CVC activities of foreign CVCs in the US market. This avoided excluding relevant and prestigious CVC funds that are geographically separated from the parent corporation.

Selection of public investors with Compustat

As private companies do not always disclose their data, the second phase consisted in pairing each CVC to the parent company, eliminating those funds whose parent company is not publicly traded. To ensure the public nature of the parents, each CVC unit was manually looked up through CVC websites and financial pages such as Crunchbase. The resulting parent was then looked up manually in both Compustat Global and Compustat North America, assigning a unique GVKEY.

Compustat names were matched with Eikon data, associating every CVC fund with the corporate parent. This allowed the exclusion of private funds and respective deals (Wadhwa et al., 2016). The purpose of this process was to enhance the quality of the data. Compustat contains solely data about public companies, resulting in a sample from which a large amount of financial and other public information can be retrieved and included in the regression. This choice ensures data homogeneity and reliability, preventing large portions of information from being missed. Along with the GVKEY and the parent company's name, the company's primary industry was extracted, as defined by the Standard Industry Classification (SIC) code.

Patent data extraction

Literature has widely used patent data in both the study of knowledge patterns and the strategic performance of corporate venture capital. Pioneered by the studies of Schmookler (1996) and Schrerer (1965), patents have been considered a measure of technological performance and an indicator of economic and innovative development.

The most relevant feature of patents is their function as legal instruments to disclose and protect innovation, which is why they are gathered systematically and provide detailed information. In

addition, patent data have been collected and stored over decades, so it is possible to extract an enormous amount of data and assess their evolution over time (Rosenkopf & Almeida, 2003).

Three major data bulks were extracted from PatentsView (Appendix 7). These contained information about the patents and their inventor's names along with corporate assignees, the information on the applications that were later granted, and the information on the citations that each patent made to previous patents.

The extraction was followed by constructing two samples consisting of application and citation information. This manual adjustment was needed due to the heterogeneity of information contained in the patent databases. In particular, the information concerning corporate assignees is fundamental to the completion of this research. The USPTO does not track inventors and assignees over time. They apply for a patent as a singular event without any requirement to keep a consistent format for the inventor's name, the assignees, and the location of the application. Even though PatentsView follows a four-step disambiguation protocol to cope with the heterogeneity of denominations, their algorithms still leave large portions of mistaken denominations (Disambiguation Overview | PatentsView, s.d.).

Therefore, this phase focused on manually associating every *Assignee ID* with the parent corporation's name identified in Compustat. This process avoided the exclusion of mistaken assignee names (e.g., *Novo Nordisk* and *Novo Nordiks*), abbreviations (e.g., *BMW* and *Bayerische Motoren Werke*), and parts of conglomerates (e.g., *Mercedes-Benz Group AG* and *Daimler*), which is a frequent issue with databases of large size.

To assist in the manual identification of Assignee IDs, the assignee names given in PatentsView were matched with the list of parent names derived from Compustat, manually enriched with abbreviations and parts of conglomerates. Therefore, the Stata command *reclink2* was used to perform a fuzzy matching of the assignee name, assigning a probability score for each match of the same variable contained in each dataset (e.g., Assignee Name) and reporting in the master dataset the correspondent denomination of the using dataset.

The result of the manual identification supported by *reclink2* allowed us to assign the correct parent's name (as nominated in Compustat) to each Assignee ID to a highly reliable degree. The Assignee IDs were then merged into each Patent Application that was later granted, which allowed to build each parent organization's patent portfolio. Accordingly, each Patent ID, was combined with the citing patents of the citation database, reconstructing the portfolio of each

company's backward citations. Finally, this process found a common denomination to easily assign and merge data from Eikon, Compustat, and PatentsView to each investor.

Innovation Rates and Industry Selection – Descriptive Considerations

The previous procedures allow for the execution of descriptive analysis and considerations on the most innovative industries based on the rate of patent applications, citations, and their industrial family, according to the SIC codes provided by Compustat for each parent corporation. The following resulted from the analysis, aiming to uncover the most knowledge-intensive and CVC-active industries and narrow the research focus to a significant sample.

Table 1: Most CVC Intensive Industries with respective Knowledge-Intensity

	SIC code	N CVC deals	% Foreign investments	N Patents
Pharmaceutical Preparations	**2843**	**3041**	**74%**	85,787
Semiconductors	**3674**	**2040**	24%	**342,626**
Computer Programming	7370	1487	15%	207,565
Electronic & Other	**3600**	989	**71%**	**312,778**
Prepackaged Software	7372	747	13%	70,698
Motor Vehicles	3711	338	80%	113,739
Electronic Components	**3670**	81	**100%**	**131,739**
Office Machines, NEC	3577	25	28%	174,887

SIC codes appear to be a commonly used criterion in the CVC literature, which historically focuses on the semiconductor and electronics industry (e.g., Alvarez-Garrido & Dushnitsky, 2016; Pahnke et al., 2015; Park & Steensma, 2013) and life science (e.g., Kang et al., 2021; Van de Vrande, 2013) as these are the industries with the highest knowledge intensity and CVC investments.

This trend is confirmed here, showing descriptive evidence that firms in the Pharmaceutical, Semiconductor, and Electronic industries undertake the majority of CVC deals. While the pharmaceutical sector is the most CVC-intensive, it cannot compare with the number of patents applied and granted in the other two industries. Nonetheless, the pharmaceutical industry proves to be an extremely relevant target for this research since most CVC deals come from investors outside the US.

Since the first two digits of the SIC code identifies the primary industry group and the research is focused on foreign investments, it is considered appropriate to include a broader selection of firms to represent a particular industrial category. Therefore, the target choice falls on the broader *Chemicals and Allied Products* (SIC 28--) and *Electronic and other Electrical Equipment and Components, Except Computer Equipment* (SIC 36--). This choice allows us to narrow to a reasonable sample of startups while maintaining a broad range of foreign investors in knowledge-intensive industries (Appendix 8).

Creation of the Final Dataset

The data extracted from Eikon were organized by CVC deal. However, several CVC investors might target the same startup during the same round. This would result in duplicate observations. Therefore, the final sample was constructed by considering each round and associated target startup as a single observation. At the same time, the multiplicity of CVC was represented in the computation of every variable.

Financial data were retrieved from Compustat and were merged with Patent data to their respective deal. Foreign exchange rates of financial information were converted into USD dollars by extracting the yearly average currency exchange from Compustat. This allowed the creation of reliable, comparable economic data along geographically diverse firms.

The multiplicity of CVC investors was mitigated by maximizing some variables (e.g., financials, innovation quality) and cumulating other variables (e.g., total investment) according to the characteristics of all CVCs participating in the same round. This choice allowed to cut off further parts of the original extraction while still considering the presence and relevance of US-based investors as an influential component of the deal.

Next, only the deals with at least one foreign CVC investor were included in the statistical analysis, separating US-based investors. A further reduction has been made by limiting the year of investment to 2018 to measure the patent applications of startups under the same timeframe of five years. This choice resulted in an additional reduction of the observations, fully satisfying the research scope. The final sample is therefore composed of 1615 observations of investment rounds attended by 64 foreign CVCs for 918 unique startups.

5.3 Description of Variables

5.3.1 Dependent Variable

Innovation is the recombination of technologies resulting in novelty, utility, and no obviousness. To understand the potential impact of foreign CVCs on a startup's innovative capabilities, this research uses patent count as a close and representative measure of innovation. The choice of this metric has been widely employed throughout the CVC literature, which sees patents as a mirror of the ability of a firm to encapsulate and create knowledge, contributing to the technological landscape (Alvarez-Garrido & Dushnitsky, 2016; Chemmanur et al., 2014; Keil, Maula, et al., 2008; Pahnke et al., 2015; Park & Steensma, 2013; Wadhwa et al., 2016; Wadhwa & Kotha, 2006).

Critiques of this approach highlight the need for more quality and impact indicators for a given patent. Other methods, such as citation-weighted patent count, have been used in previous literature to measure the innovativeness of a given enterprise (Dushnitsky & Lenox, 2005b; Trajtenberg, 1990; Wadhwa et al., 2016), as they incorporate the relevance of innovation.

Given the relatively large period of deals (2002-2018), it has been considered appropriate to confront all the investment rounds across the same years to avoid earlier investments prevailing and distorting the data. This choice, however, may also present some drawbacks. Some innovations, especially in high-tech industries, may require several years of research and development before they can be patented. Therefore, the period considered may penalize those companies that tend to present significant but episodical innovations.

Another major limitation of using this measure lies in the impossibility of isolating the effect on innovation given solely by the CVC influence. By theorizing innovation as the recombination of several technologies and knowledge, the variable is probably affected by several other endogenous and exogenous factors that might increase the innovation rate of the firm. For instance, the startup may undertake internal innovation initiatives, environmental factors, and other external partnerships not detected here.

5.3.2 Explanatory variables

The choice of independent variables aligns with the research questions and the rigorous testing of the hypothesis, aiming at best explaining the CVC features that reinforce or mitigate relational barriers between the parent investors and the US ventures. The elements presented

are a good theory-backed representation of mechanisms that can create closeness (positive effect on innovation) or increase foreignness (adverse effect on innovation). This choice allows for an examination of the differential effects of specific features of the investor, the investee, and the contingency of the deal.

The Location of the CVC Unit:

In line with *Hypothesis 1*, this variable assesses whether the CVC is based in the United States or outside. It was constructed by manually browsing the website of every foreign CVC unit. The presence of a CVC unit in the US was considered true in two cases; (1) the unit has been explicitly established to address the US market through public announcements; (2) the unit has at least one office in the US and listed on its website. This variable is binary.

- 1 if the specified criteria confirm the unit's presence in the US
- 0 if not, assuming the unit is in the headquarters country of the parent.

This variable has been constructed by taking inspiration from Alvarez-Garrido & Dushnitsky (2016), that compute *accessibility* as the regional overlap between the venture and the CVC location. We apply the same criteria and adapt the variable to our context, considering a venture *accessible* if the CVC unit is in its country (i.e., the United States).

Industrial Proximity:

Since different regions offer different entrepreneurial environments and technological expertise, industrial and geographical perspectives must be included (Belussi et al., 2010). The computation of the variable is similar to that of Dushnitsky & Shaver (2009), who measure industry overlap using a binary variable that takes the value 1 if the corporate investor and the venture operate in the same four-digit NAICS code and 0 otherwise. Since this research is operating in the study of two intervals of SIC domains, it is appropriate to increase the level of detail. Therefore, the variable takes the following values

- 4 if the investor and investee have the same SIC code, indicating an industrial match
- 3 if they present the same three-digit SIC code
- 2 if they present the same two-digit SIC code
- 1 if they present the same one-digit SIC code

- 0 if they present different one-digit SIC codes, indicating no industrial proximity

Critiques have been moved against the use of SIC codes to measure industry-relatedness. First, many parent corporations are big conglomerates operating in diverse industries through diverse business divisions. Even though some SIC codes of multi-business conglomerates have been adjusted according to an argument for ambiguity in their core business, the analyzed CVC unit may be controlled by a division different from what was assumed. Second, ventures are often hard to classify, and SIC attribution is optional. Therefore, many ventures still need a SIC code, making the comparison not possible (Dushnitsky & Shaver, 2009; Fan & Lang, 2000). In this case, 29 observations do not present their SIC code, making their incidence negligible.

Syndication Level:

VC syndication is theoretically defined as two or more VC firms joining forces to take an equity stake in an investment (Tian, 2012). In this study, the definition of VC syndication maintains a broad interpretation. If two or more VCs fund the entrepreneurial firm, the firm is classified as syndicated. This variable is operationalized as a discrete and non-negative variable that returns 1 if the syndicate is not present (i.e., the CVC is the only investor participating in the round), and then *2,3,4,…,n* resulting in the number of investors that participate in the investment syndicate (Dushnitsky & Shapira, 2010).

The rationale behind this choice instead of a categorical variable that indicates the presence of syndication is that only 74 observations present a case of non-syndication, making a dichotomous variable less explicative of the impact of syndication on innovativeness. Computing syndication level, instead, allows the detection of whether large or small syndicates influence the dependent variable, treating the analysis of the *information exchange paradox* in a more flexible way (Anokhin et al., 2011).

Multiple CVC Ties:

Syndication can involve more than one corporate investor funding the same startup (Anokhin et al., 2011). Theoretically, ventures can benefit from this configuration due to increased access to knowledge and resources. However, this type of syndication can also be characterized by a divergence of goals and a consequent lack of cooperation (Katila et al., 2008b; Wadhwa & Basu, 2013).

The third variable under consideration is Multiple CVC Ties, which quantifies the number of foreign and local corporate CVCs that have participated in the funding of the venture. This variable is engineered to study the effects of interacting with multiple CVCs and describe the impact of one additional foreign CVC on the investment syndicate. This computation reflects upon *hypothesis 4*, by assessing the effect of multiple CVCs and the impact of an additional CVC on the startup's innovative performance.

Portfolio Size:

This variable helps to assess the impact of the diversification strategies on the innovation performance of the portfolio companies. The diversification level of the CVC portfolio is crucial in determining the value-added a venture can get from the investor (Chemmanur et al., 2014; Dushnitsky & Lenox, 2005b). Therefore, the size of the portfolio is measured as a continuous and non-negative variable computed as the number of investments that the CVC entity made in the year of investment. In the case of multiple CVC investors in the syndicate, this variable has been averaged by the size of all the investor's portfolios. This adjusts for the financial interests of some highly diversified investors against the strategic interests of others.

Uncertainty:

Uncertainty measures a venture's development stage and indicates the risk associated with the investment. This variable has been used in many phases of the CVC literature (Chemmanur et al., 2014; Dushnitsky & Shapira, 2010; S. Kang et al., 2021). Although many instances compute it as a discrete variable considering different stages of the startup (Dushnitsky & Shapira, 2010), in this research, it is computed as a binary variable, with 1 indicating seed and early-stage ventures and 0 indicating later-stage ventures. This aligns with other pioneering studies on geographical proximity and the liability of foreignness, which are more similar to this case (S. Kang et al., 2021).

5.3.3 Control variables

Other firm-specific factors and characteristics of the deal can impact the level of knowledge creation within a firm. Several control variables commonly used in similar CVC research have been identified and included in the study to capture these elements in the model.

Investor-level controls

Investor's patent quality is a widely used metric to determine the quality of a strategic investor. This measure is computed as the average forward citations made to the patent portfolio of the investor in a year. It captures the overall level of citation activity that builds on the investor's patents and serves as a proxy to determine its innovativeness (Gomes-Casseres et al., 2006).

Total assets reflect the size and financial capacity of the investor (Chemmanur et al., 2014; Schildt et al., 2005b). Larger investors may have more resources to employ innovation activities and influence the innovativeness of the targets (Cohen & Levinthal, 1990). The choice of total assets as a measure of size lies in the broad availability of data compared to other metrics, such as employee count. **Return on Assets (ROA)** is measured as Net Income (Loss)/ Total Assets. The higher the ROA, the better the investor manages its assets and resources (Chemmanur et al., 2014).

R&D on Assets (R&D ratio), computed as R&D Expenses/ Total Assets, represents the R&D intensity of the investor (Bahar et al., 2023; Benson & Ziedonis, 2009; Schildt et al., 2005b). The higher the ratio, the more the investor focuses its resources on innovation, possibly influencing the innovation of its partners (e.g., target ventures). **Debt on Equity (Leverage)**, computed as Total Debt/ Total Equity, provides a measure of the financial stability of the investor (Dushnitsky & Lenox, 2006). High leverage may constrain the investor's resources, influencing its ability to support its investments effectively.

Venture-level controls:

Venture Patents Pre-Investment is the number of patents owned by the startup before receiving the investment, which measures its pre-existing innovative capabilities (Schildt et al., 2005b). This can influence the selection process of the CVC and the perceived value-added. **Total Investment in the Round** accounts for the potential effects of funding size on the venture's ability to innovate (Alvarez-Garrido & Dushnitsky, 2016; Gompers & Lerner, 1998).

5.3.4 The Formal Model

As a result of the selection of variables, the following model has been derived:

$$\text{PatentsPost5y} = \beta_0 + \beta_1 * (\text{IndustryProximity}) + \beta_2 * (\text{CVClocation}) + \beta_3 * (\text{SyndicationLevel}) + \beta_4 *(\text{MultiCVCties}) + \beta_5 * (\text{Uncertainty}) + \beta_6 * (\text{PortfolioSize}) +$$

$\beta_7 * (\text{PatentsQuality}) + \beta_8 * (\text{Assets}) + \beta_9 * (\text{ROA}) + \beta_{10} * (\text{R\&DAssets}) + \beta_{11} * (\text{Leverage}) + \beta_{12} * (\text{PatentsPre5y}) + \beta_{13} * (\text{TotInvestment}) + \varepsilon$

This theoretical model has been tested under several conditions to select the best statistical method.

5.4 Selection of the Statistical Model

The dependent variable under study is a count variable whose typical distribution is right-skewed. The selection process of a statistical model consists of analyzing and confronting the appropriateness of other regression models. In this section, a preliminary evaluation of four models is presented.

The Jarque-Bera test is a popular method to assess the normal distribution's goodness, which is required to apply a classical linear regression model. The null hypothesis states that the skewness of the dataset respects the normal distribution. The test is significant on our dependent variable, suggesting the non-normal data distribution by rejecting the null hypothesis (Jarque & Bera, 1987). In addition, the histogram of the variable indicates the data are right-skewed, with a high frequency close to the zero value (Appendix 9). Hence, we proceed with other statistical models for non-normally distributed counts.

The Poisson regression has been widely adopted in count data due to its simplicity and interpretability. This model increases its goodness when the events of interest are rare, the population is large, and the mean and variance are approximately equal (i.e., equidispersion: $E(y_i)=Var(y_i)=\lambda(y_i)$) (Cameron & Trivedi, 2013). However, the assumption of equidispersion is rarely met in practical events, resulting in data overdispersion (i.e., the variance is larger than the mean) (Johnson, 2012). Equidispersion can be tested through Stata's *estat gof* command, which compares the observed distribution with the distribution predicted by the Poisson distribution. The null hypothesis is that the data follow a Poisson distribution (Stata, n.d.). The test's significance leads to rejecting the null hypothesis, suggesting the assessment of alternative models (Appendix 10).

The Negative Binomial Regression (nbreg) model is a popular alternative with data overdispersion since it allows the variance to exceed the mean value (Cameron & Trivedi, 2013). The nbreg model can be tested in Stata with the command *nbreg*. When running the

model, an alpha test is run along with it, with the implicit null hypothesis of equidispersion. Our alpha test results are significant, confirming the unsuitability for the Poisson model.

Still, even a Negative Binomial model can suffer biased estimations, especially when the data distribution presents an excess in the frequency of zero counts. Zero-inflated versions of both the Negative Binomial and Poisson models offer a solution to deal with many zeros by using a mixed-model approach, which separates the probability of non-zero counts from that of the zero counts (Staub & Winkelmann, 2013). An exam of the frequency of zeros in the dependent variable shows a 42% of the count are zeros. This supports the argument to investigate further zero-inflated statistical models for count data.

The Akaike Information Criterion (AIC) is adopted here to ensure a good comparison. This measure assesses the trade-off between the models' complexity and explanatory power. The lowest the AIC, the best the model explains the predictors while minimizing the information loss (Akaike, 1998). The comparison of the four AICs suggests that a zero-inflated negative binomial model is preferred (Appendix 11, Appendix 12).

6. Analysis

6.1 Descriptive Overview of the Variables

A descriptive overview of the variables can help in drawing some preliminary considerations. For instance, 'PatentsPost5y' shows a high standard deviation of 25.92, indicating a wide dispersion of data around the mean (Table 2). This suggests a significant variation in the number of patents startups apply after receiving CVC funding. This is consistent with the high number of zeros identified during the model selection. Still, it also indicates there could be differences in industries or strategic objectives of the invested companies. Some target industries may generate more innovation than others due to structural reasons.

In addition, our dichotomous variables show an even distribution of both the geography of the CVC subsidiary and the timing of investment, as the mean is close to 0,5, making the selected sample an interesting case. Also, Industry Proximity presents a mean of below the 2-level, suggesting that many investments target industries far from the core business.

Moving to the *Correlation Matrix* (Table 3), the overall results indicate no particular risk of multicollinearity in the data. The positive correlation between PatentsPost5y and PatentsPre5y suggests that startups that are already successful in patenting their technology before investment happens and that the least successful startups may remain unsuccessful, as the high count of zeros suggested. Another significant correlation is the strong positive relationship between CVClocation and PatentsQuality. This could indicate that foreign CVCs with a record track of innovative quality tend to locate in the US.

The negative correlation between MultiCVCties and CVClocation suggests that foreign CVCs in the US tend to establish ties with other corporate investors. Lastly, the positive correlation between ROA and PortfolioSize indicates that firms with larger returns tend to have an extensive portfolio of startups. This might be due to higher resources to invest in external R&D.

Table 2: Summary of Variables

Variable	Obs	Mean	Std. dev.	Min	Max
PatentsPost5y	1,615	8,686068	25,92449	0	602
PatentsPre5y	1,615	5,048297	12,56473	0	233
IndustryProx	1,615	1,287307	1,612891	0	4
CVClocation	1,615	0,4452012	0,497142	0	1
Syndication	1,615	8,271827	4,724876	1	37
MultiCVCties	1,615	3,986378	3,413083	1	26
Uncertainty	1,615	0,4557276	0,4981904	0	1
Portfoliosize	1,615	17,28991	13,69032	0,0588235	67,42857
Patentsquality	1,615	2,64332	3,665916	0	23,25969
Assets	1,615	87130,77	78158,04	1775,651	751216
ROA	1,615	0,0373222	0,0387845	-0,077598	0,1814326
R&DAssets	1,615	0,0358867	0,0263693	0	0,1454441
Leverage	1,615	1,871697	2,972001	-1,450448	68,60791
TotInvestment	1,615	34,76272	44,96172	0	540

Table 3: Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) PatentsPost5y	1,0000													
(2) IndustryProx	0,0771	1,0000												
(3) CVClocation	0,0263	-0,0638	1,0000											
(4) Syndication	0,1003	0,1267	0,0012	1,0000										
(5) MultiCVCties	-0,0177	0,0924	-0,3557	0,1415	1,0000									
(6) Uncertainty	-0,0407	-0,0428	-0,0392	-0,2251	0,0947	1,0000								
(7) PortfolioSize	-0,0265	0,0156	-0,0999	0,1189	0,3399	-0,0062	1,0000							
(8) Patentsquality	-0,0107	-0,0115	0,4377	0,0220	-0,2664	0,0838	-0,0500	1,0000						
(9) Assets	0,0060	-0,0700	0,2458	0,0716	0,0365	0,0621	0,2301	0,1202	1,0000					
(10) ROA	0,0057	0,1961	-0,0662	0,1652	0,1257	0,0227	0,3822	-0,0018	-0,0569	1,0000				
(11) R&DAssets	-0,0242	0,1744	-0,0211	0,1878	0,0678	-0,0746	0,1989	-0,1038	-0,2821	0,5586	1,0000			
(12) Leverage	0,0057	-0,1281	0,0619	0,0334	-0,1144	-0,1338	-0,1809	-0,0127	0,0754	-0,1839	-0,1559	1,0000		
(13) PatentsPre5y	0,5372	0,0797	-0,0272	0,1284	0,0635	-0,1575	0,0303	-0,0658	-0,0276	-0,0155	-0,0127	-0,0024	1,0000	
(14) TotInvestment	0,1439	0,0722	0,0427	0,2650	0,1809	0,0871	0,1471	0,1587	0,1157	0,0996	0,0348	-0,0710	0,0471	1,0000

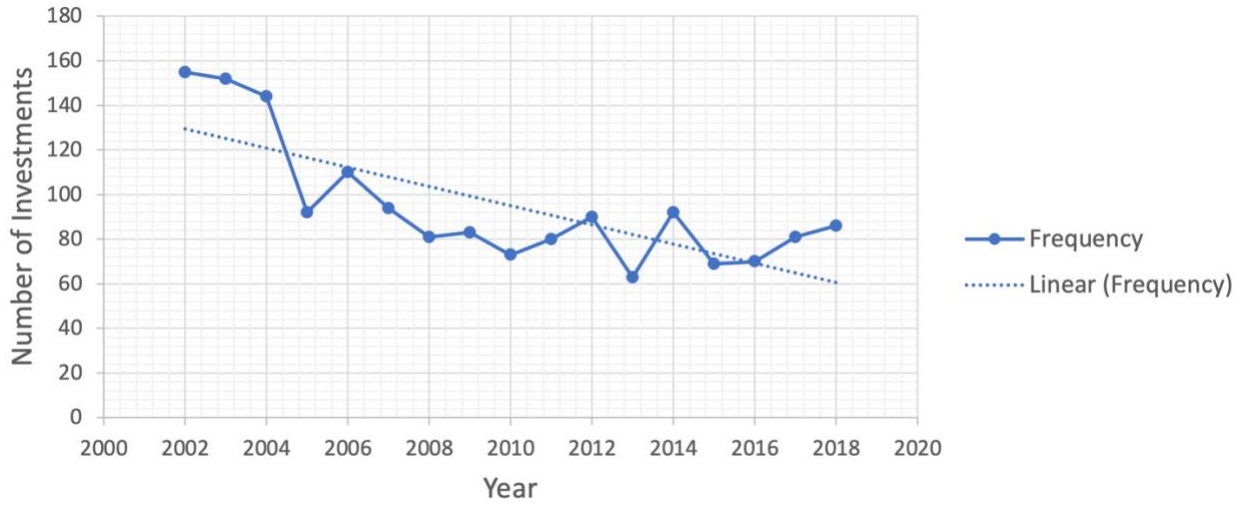
6.2 Descriptive Overview of International CVC Investments

Stable in Time and Clustered in Location

The table presents a timeline of foreign CVC investments made in the US every year from 2002 to 2018. In 2002, the number of foreign CVC investments was at its peak, with nearly 160 deals. However, by 2005 foreign CVC investments had fallen to fewer than 100 deals annually. Interestingly, the decreasing trend stabilized after 2006, with the annual number of deals fluctuating between 60 and 90 for the following years.

The data tells a story of a dynamic foreign CVC market that experienced an enthusiastic boom, a significant reduction, and a period of relative stability. This trend is in line with that presented in the history of CVC, which stabilized when the dot com bubble burst. Therefore, it can be confirmed that foreign CVC investments are still relevant to analyze.

Table 4: The Historical Development of foreign CVC in the US

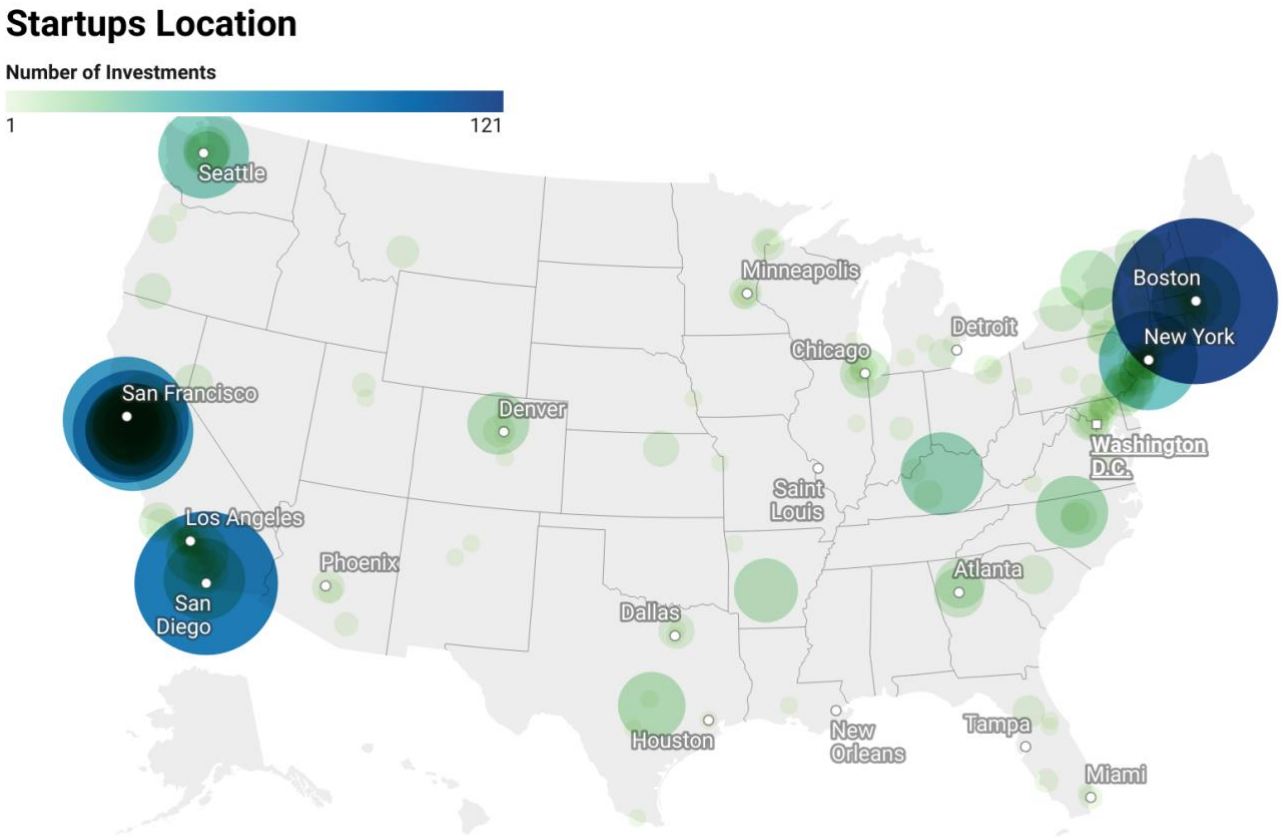


The geographic clustering of startup activities in certain regions, particularly Boston, and California, has been widely discussed in academic literature. There are several reasons why these areas have become hot spots for innovation, especially in the industries under analysis.

Boston has a long-standing reputation as a world-class life sciences hub. The presence of prestigious educational institutions like MIT and Harvard provides a continuous stream of research and highly skilled graduates. These universities also foster a supportive environment for spin-offs and startups. Academic literature confirms that proximity to these knowledge centers positively impacts one's innovation outcome (Audretsch & Lehmann, 2005).
California, with the San Francisco area hosting Silicon Valley, and the Southern Area promoting favorable local government policies, is renowned for its high-tech innovation and

entrepreneurship. The region is home to world-leading universities such as Stanford and UC Berkeley, and renowned high-tech firms, contributing to a rich talent pool and continuous innovation. Robertson, (1995) has described how the unique culture of knowledge sharing, high mobility of skilled workers, and venture capital activity has created a highly innovative environment, making it a sweet spot for knowledge-sourcing activities. Minor clusters can be identified in the New York area and Seattle. This outlook suggests that foreign CVCs are focused on specific regions of the country, making it relatively powerful to increase their proximity with targeted tools such as a local CVC unit in one of the clusters.

Table 5: Geographical Distribution of the Target Startups



Investor's Location

Foreign CVC investments in U.S. startups are broken down by the investing countries and the recipient startups' industry, specifically, Life Science (28) and Electronics (36). The highest number of investments comes from Switzerland, totaling 311 investments, out of which an overwhelming majority (303) are directed toward the Life Science industry. The second largest investing country is the United Kingdom, with 245 investments, all of which are focused on the Life Science industry. Germany and Japan follow closely behind, with 223 and 221 total

investments, respectively. However, these are evenly distributed between the two industries. Other notable investors are Denmark, with 185 investments, all in Life Science, and France and South Korea, both majorly investing in the Electronics industry, with 124 and 136 investments, respectively (Appendix 13).

Location of the CVC Unit

Another relevant descriptive consideration shows there are 35 unique foreign investors who have their CVC unit located in their headquarters country (i.e., Foreign). These investors were responsible for 896 investments, 55.48% of the total foreign CVC investments. This indicates a tendency among most foreign investors to manage their investments from their home country. On the other hand, 29 foreign investors opened their CVC units in the United States. These investors conducted 719 investments, accounting for 44.52% of the total foreign CVC investments. This underscores the heterogeneity in governance strategies among foreign CVCs investing in U.S. startups.

Table 6: Investors and Deals by CVC Location

	By Investor	Frequency	Percentage
0 (Foreign)	35	896	55,48
1 (United States)	29	719	44,52
Total	64	1615	

Industrial Focus

Another interesting insight consists in the distribution of the target ventures' industries. For the Life Science sector (28), the industries that received the highest concentration of foreign CVC investments are Chemicals and Allied Products (448 investments), Engineering, Accounting, and Research (291), Miscellaneous Manufacturing Industries (98), and Business Services (43). In the Electronics family, the most popular targets are Business Services (308 investments), Electronic and Other Electrical Equipment (164), Miscellaneous Manufacturing Industries (36), Industrial Machinery and Equipment (27), and Communications (25) (Appendix 14).

This suggests that CVCs often invest in far industrial fields. Therefore, it is interesting to look at the industrial proximity of foreign CVC investments. 917 investments (56.78%) fall into the industry mismatch category (0), meaning more than half of the foreign CVCs choose to invest

in startups operating in completely different industries. This can indicate diversification strategies or exploration of opportunities outside the core operations.

Only 78 investments were made by CVCs in startups that have minimal overlap with their industry (1) and 115 for level 2. This is the smallest category, representing an aggregate of 12% and suggesting a polarization of industrial proximity characterizes the sample. 249 investments (15.42%) are made in the (3) category. CVCs in this category may be seeking startups that provide technological or business model innovations within their broader industry domain. Finally, 256 investments (15.85%) are in the (4) category, suggesting these CVCs are looking for strategic investments that can directly support or enhance their core business.

Table 7: Number of Investments by Industrial Proximity

Industrial Proximity	Number of Investments	Percentage
0	917	56,78
1	78	4,83
2	115	7,12
3	249	15,42
4	256	15,85

6.3 Empirical Results

A step-by-step construction has been followed to assess the goodness of every regressor on the dependent variable. This approach can efficiently help in selecting the largest number of predictors, that then have been combined into a joint model. All the regressors alone present a significant p-value<0.1, making them an interesting topic of study from an isolated perspective. When applying the Akaike Information Criteria to compare the models, the joint presence of the selected variables suggests the best balance between the effectiveness and complexity of the model. The model has a high chi-squared value (LR chi2(13) = 416.98), indicating that the model significantly improves the fit compared to an empty (intercept-only) model. The small p-value (Prob > chi2 = 0.0000) further reinforces the model's significance, indicating the joint significance of the selected variables.

A consistent portion of observations (Frequency=42%) is a zero count. Multiple reasons can cause this. For instance, the startup may deal with products and services that are not patentable,

the product may require a longer development phase than the five years considered in the research, the IP strategy tends to rely on trade secrets, hence not disclosing its technology.

Thanks to the zinb model, it is possible to identify if one variable is a good predictor for the likelihood of observation to be a certain zero. A startup that has a structural reason not to patent (e.g., technology not patentable or trade secrecy) is referred to as a *certain zero*. A standard negative binomial model does not distinguish the two processes. A zero-inflated negative binomial model responds to this case by analyzing the dataset with two distinct processes. First, it generates a logit model that predicts the likelihood of certain zero cases (i.e. firms with 0 patent applications despite receiving CVC investment), and then a negative binomial model that predicts the count of patents that are not certain zeros.

Hence, the analysis of the model will consider the joint effect of the logit and negative binomial model by analyzing for each variable both the direction, the marginal effect at the mean, and the effect on certain-zero likelihood. All the models have been run by applying the *irr* function of Stata, which transforms the coefficient to their *incidence rate ratio*. Therefore, all the coefficients illustrated here must be interpreted as already transformed in their e^{β} form.

Table 8: Models Comparison

	Model 1		Model 2		Model 3		Model 4	
VARIABLES	**PatentsPost5y**	**inflate**	**PatentsPost5y**	**inflate**	**PatentsPost5y**	**inflate**	**PatentsPost5y**	**inflate**
IndustryProximity	0.0484* (0.0251)	-0.180*** (0.0584)						
CVClocation			0.318*** (0.0920)	0.108 (0.204)				
SyndicationLevel					0.0288*** (0.00994)	-0.0649*** (0.0233)		
MultiCVCties							-0.0480*** (0.0106)	-0.0137 (0.0333)
Uncertainty								
PortfolioSize								
PatentsQuality	0.00682 (0.0113)	-0.0730*** (0.0251)	-0.0135 (0.0119)	-0.0807*** (0.0292)	0.00760 (0.0113)	-0.0715*** (0.0265)	-0.00641 (0.0109)	-0.0763*** (0.0270)
Assets	-1.22e-06* (6.32e-07)	1.21e-06 (1.31e-06)	-1.84e-06*** (6.34e-07)	1.27e-06 (1.37e-06)	-1.56e-06** (6.31e-07)	1.71e-06 (1.35e-06)	-1.14e-06* (6.25e-07)	1.54e-06 (1.32e-06)
ROA	2.665** (1.111)	3.817 (2.947)	3.066*** (1.116)	2.970 (2.923)	2.554** (1.109)	3.686 (2.956)	3.166*** (1.104)	3.047 (2.901)
R&DAssets	-6.371*** (1.808)	-8.161* (4.706)	-6.766*** (1.827)	-9.649** (4.832)	-6.828*** (1.815)	-7.205 (4.797)	-5.937*** (1.781)	-9.127* (4.667)
Leverage	0.0403* (0.0217)	0.00168 (0.0282)	0.0176 (0.0181)	0.00895 (0.0300)	0.0256 (0.0199)	0.0217 (0.0347)	0.0168 (0.0185)	0.00894 (0.0303)
PatentsPre5y	0.0499*** (0.00388)	-2.183*** (0.428)	0.0506*** (0.00387)	-2.217*** (0.429)	0.0499*** (0.00387)	-2.293*** (0.443)	0.0507*** (0.00384)	-2.179*** (0.420)
TotInvestment	0.00487*** (0.000901)	-0.00170 (0.00188)	0.00513*** (0.000901)	-0.00179 (0.00183)	0.00439*** (0.000897)	-0.000424 (0.00187)	0.00557*** (0.000915)	-0.00169 (0.00185)
Constant	1.758*** (0.120)	1.021*** (0.250)	1.817*** (0.113)	0.859*** (0.246)	1.657*** (0.128)	1.141*** (0.277)	2.027*** (0.122)	0.905*** (0.267)
lnalpha		0.371*** (0.0553)		0.363*** (0.0554)		0.374*** (0.0550)		0.350*** (0.0558)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

	Model 5		Model 6		Model 7	
VARIABLES	**PatentsPost5y**	**inflate**	**PatentsPost5y**	**inflate**	**PatentsPost5y**	**inflate**
IndustryProximity					0.0412*	-0.186***
					(0.0244)	(0.0602)
CVClocation					0.169*	-0.107
					(0.0953)	(0.223)
SyndicationLevel					0.0296***	-0.0939***
					(0.00966)	(0.0258)
MultiCVCties					-0.0436***	-0.0165
					(0.0117)	(0.0376)
Uncertainty	0.176**	-0.522***			0.259***	-0.703***
	(0.0802)	(0.185)			(0.0806)	(0.200)
PortfolioSize			-0.0127***	0.00755	-0.00711*	0.00493
			(0.00345)	(0.00810)	(0.00363)	(0.00859)
PatentsQuality	0.00681	-0.0685***	0.00203	-0.0704***	-0.0194*	-0.0680**
	(0.0114)	(0.0252)	(0.0113)	(0.0255)	(0.0117)	(0.0326)
Assets	-1.32e-06**	1.62e-06	-6.81e-07	1.00e-06	-1.26e-06*	1.63e-06
	(6.19e-07)	(1.31e-06)	(6.53e-07)	(1.36e-06)	(6.67e-07)	(1.47e-06)
ROA	2.846***	3.613	3.939***	1.743	3.855***	5.336*
	(1.101)	(2.929)	(1.149)	(3.036)	(1.153)	(3.151)
R&DAssets	-5.497***	-11.02**	-5.382***	-9.128*	-6.949***	-6.394
	(1.774)	(4.832)	(1.800)	(4.683)	(1.869)	(4.928)
Leverage	0.0363*	-0.00375	0.0193	0.0157	0.00600	-0.00535
	(0.0211)	(0.0280)	(0.0193)	(0.0325)	(0.0153)	(0.0286)
PatentsPre5y	0.0522***	-2.214***	0.0514***	-2.223***	0.0513***	-2.169***
	(0.00396)	(0.397)	(0.00385)	(0.431)	(0.00384)	(0.378)
TotInvestment	0.00483***	-0.00168	0.00493***	-0.00221	0.00477***	0.000274
	(0.000913)	(0.00183)	(0.000903)	(0.00187)	(0.000905)	(0.00196)
Constant	1.948***	0.807***	1.948***	0.807***	1.705***	1.970***
	(0.119)	(0.254)	(0.119)	(0.254)	(0.143)	(0.364)
lnalpha		0.364***		0.361***		0.307***
		(0.0548)		(0.0553)		(0.0558)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9: AIC Comparison

	N	ll(null)	ll(model)	df	AIC	BIC
Model 1	1615	-4166.796	-3980.411	19	7998.823	8101.177
Model 2	1615	-4173.331	-3982.241	19	8002.481	8104.836
Model 3	1615	-4165.924	-3977.519	19	7993.038	8095.393
Model 4	1615	-4173.315	-3979.178	19	7996.356	8098.71
Model 5	1615	-4168.291	-3980.803	19	7999.606	8101.961
Model 6	1615	-4172.101	-3980.36	19	7998.719	8101.074
Model 7	1615	-4149.84	-3941.349	29	**7940.698**	8096.924

Table 10: Marginal Effects of Model 7

	dy/dx	std. err.	z	P>|z|	[95% conf. interval]	
IndustryProximity	.3695098	.1912388	1.93	0.053	-.0053114	.744331
CVClocation	1.366306	.7532763	1.81	0.070	-.1100887	2.8427
SyndicationLevel	.2565981	.0751892	3.41	0.001	.1092299	.4039662
MultiCVCties	-.341288	.0948777	-3.60	0.000	-.5272449	-.1553311
Uncertainty	2.212344	.6452824	3.43	0.001	.947614	3.477075
PortfolioSize	-.0574441	.0286502	-2.01	0.045	-.1135975	-.0012907
PatentsQuality	-.1377927	.0919219	-1.50	0.134	-.3179563	.042371
Assets	-.0000104	5.24e-06	-1.98	0.047	-.0000207	-1.15e-07
ROA	29.26009	9.269205	3.16	0.002	11.09278	47.4274
R&DAssets	-53.50219	15.02179	-3.56	0.000	-82.94435	-24.06003
Leverage	.0487819	.1207453	0.40	0.686	-.1878745	.2854384
PatentsPre5y	.9163536	.0425121	21.56	0.000	.8330315	.9996757
TotInvestment	.0377177	.007524	5.01	0.000	.0229709	.0524644

The Illustration of Empirical Results in Relation to the Hypothesis

Model 7 supports *Hypothesis 1*, which proposed that the physical location of a Corporate Venture Capital (CVC) unit in the United States positively influences the innovativeness of invested ventures compared to those funded by CVC units based abroad. The empirical findings suggest that the geographical proximity of CVC units to the recipient venture positively impacts its patent count by 1,366 units on average, holding all other factors constant, with a $p<0.10$ significance level. The same effect is presented when the variable is tested alone, confirming its significance and direction (Model 2). The location, however, is insignificant in predicting certain-zero instances (Table 8, Table 9, Table 10).

This study hypothesized a positive relationship between industry proximity and a startup's innovativeness upon receiving foreign CVC investment (*Hypothesis 2*). The results show that as the industrial overlap between a startup SIC and its foreign investor SIC codes increases, the startup's post-investment patent count increases as a single effect (Model 1) and jointly (Model 7). Specifically, every unit increase in industry proximity, approximated by an overlap of one more SIC digit, boosts the expected patent count by 0.37 units, on average, with all other factors being constant ($p<0.10$).

Moreover, the findings from the logit part of the zinb model highlight that industry proximity significantly reduces the likelihood of a startup being a certain zero. With an increase in industry proximity, the odds of a startup being a certain zero decrease by a factor of 0.8305, at a statistically significant 0.01 level.

The results also provide empirical support for *Hypothesis 3*, which posits that the syndication's size positively influences recipient ventures' innovativeness when deciding to involve a foreign CVC. The results are significant at $p<0.01$, demonstrating that syndication size consistently benefits startups receiving foreign CVCs. Specifically, the model showed that an increase in the syndication level by one unit boosts the expected patent count by an average of 0.25 units, with all other factors held constant. This effect is highly statistically significant ($p < 0.01$), both in Model 7 and Model 3 with syndication alone, indicating that not only the presence of syndication is beneficial, but the magnitude of syndication—embodied in the size of the syndicate— progressively enhances the startup's innovative performance.

Furthermore, the results show that each additional investor in the syndicate reduced the odds of the startup's post-investment patent count falling into the certain-zero category by a factor of 0.94. This result, statistically significant at the 0.001 level, underscores that syndication in foreign CVC investments can substantially enhance the likelihood of a startup's innovative success.

The model finds compelling support for *Hypothesis 4*, which states that the presence of a foreign corporate investor within a syndicate with multiple corporate investors harms the innovative performance of the venture. Accordingly, findings indicate a decremental effect on venture innovativeness as the number of previous CVC ties increases. Hence, with each additional foreign CVC investment a venture receives, an average decrease in the post-investment patent count by 0.341288 units ($p < 0.01$) is observed. This suggests that ventures face a decline in future patent applications for every additional tie established with a foreign corporate investor. The effect is also confirmed by Model 4, which shows a significant negative effect of the variable along with the controls.

Hypothesis 5 states that the wideness of a foreign corporate investor's portfolio negatively impacts the innovativeness of the recipient startup. The empirical results from our analysis substantiate this hypothesis. Data reveal that each additional investment made by the investor in the year of investment is associated with a decline in the post-investment patent count by 0.057 ($p < 0.05$) on average. In simpler terms, the success of a venture's innovativeness in the post-investment period is negatively influenced by the total number of rounds the CVC accomplishes in the same year.

Hypothesis 6 states that the innovativeness of ventures that receive a CVC investment in their early stage is less pronounced than those in later stages. However, the direction is the exact opposite of what was expected. Specifically, the data shows an increase in the patent count by 2.212 units at the mean if the startup is in the early stage, assuming all other factors remain constant ($p < 0.001$). This indicates that the early stage of the startup at the time of the investment round is significant and positive in determining the level of innovativeness associated with receiving a foreign CVC investment.

This variable is also significant in the certain-zero logit part. Early-stage startups receiving foreign CVC investments are less likely to fall into the *certain zero* patent category. The odds of landing in this category decreased by a factor of 0.7 for startups in the early stage ($p < 0.01$),

thus emphasizing the importance of early foreign CVC investments in shaping the startup's innovative trajectory.

The Effects of Control Variables:

To ensure a complete view of the model, the results of control variables are reported and discussed, by taking as a reference Model 7. Some indicators are significant in explaining our dependent variable and determining the certain zero group.

PatentsPre5y: For every additional patent application filed before investment, we expect, at the mean, everything else equal, an increase in one patent in the previous five years increases the expected patent count in the post-investment period by 0.916 units. This effect is statistically significant ($p<0.001$). The positive effect indicates that the patent portfolio of a venture before the CVC investment positively influences the post-investment period. Therefore, the level of innovative contribution of a CVC investment is positively predicted by the historical innovative capabilities of the venture. Moreover, for each additional pre-investment patent application, the odds of falling in the certain-zero group decrease by about a factor of 0.1144. In other words, the higher the number of pre-investment patent applications, the less likely the venture is a certain zero in the post-investment patent applications. This result is significant at a 0.001 level. It is also logical to see that many startups presenting a 0-patent output before the investment are likelier to have a lower to 0 output post-investment period. This reasoning makes it plausible to consider this variable a good predictor of the likelihood of certain zeros.

Total investment: On average, all else equal, an increase in total investment by one unit increases the expected patent count by 0.038 units. This effect is statistically significant ($p< 0.001$). This implies that the amount invested in the round in which a foreign CVC attends predicts the innovativeness rate of the venture after the investment.

Patentsquality: On average, an increase in the investor's yearly citations-weighted patents by one unit decreases the expected patent count by 0.138 units, holding all other factors constant. However, this result is not statistically significant. The low significance suggests a careful interpretation of the negative effect of patent quality on the venture’s innovation receiving a foreign CVC investor.

Assets: For each additional unit of average assets of the investor, we expect a negligible decrease in the post-investment patent count. On average, an increase in the investor's average assets by one unit decreases the expected patent count by 0.0000104, holding all other factors constant. This effect is statistically significant ($p < 0.05$). The value of the investor's assets, also considered a good proxy of the investor's size, has quite a neutral impact on the venture's count of patents after the investment.

ROA: On average, an increase in the investor's return on assets (ROA) by one unit increases the expected patent count by 29.260, holding all other factors constant. This effect is statistically significant ($p < 0.01$). ROA is commonly considered a good indicator of a company's efficiency and productivity, which results in superior profits. Such kind of CVC investors has an extremely positive effect on the strategic success of the venture. However, in this case, questions arise on the size of this effect. Extreme positivity can be explained by a high incidence of zeros or negative values in this variable that may distort its effect (Appendix 15). Compustat data, in fact, are not always available for the Net Income measure (part of the ROA=Net Income/ Total Assets), making the number of 0s an important factor in determining the reliability of this measure. ROA also shows to be a significant predictor of certain zeros. For each additional unit of return on assets (ROA), the odds of an "extra" zero decrease by about exp(-2.692794) = 0.0677. This result is significant at the 0.001 level. In other words, investments from a foreign CVC with efficient management of efficiency and profitability decrease the odds that the venture falls is a certain zero.

RDAssets: On average, an increase in the investor's R&D intensity by one unit decreases the expected patent count by 53.502, holding all other factors constant. This effect is statistically significant ($p < 0.001$). Therefore, the R&D intensity of the investor is negatively associated with the startup's innovative performance after the investment. In this case, the variable presents a high frequency of 0s, since R&D expenses are not always present in the Compustat extractions, presenting a large amount of zero values (Appendix 16). R&D intensity is also a good predictor of certain zeros. For an additional increase of 1% point of the investor's R&D intensity (R&D/assets), the odds of an extra zero increase by a factor of 12.0274. This result is significant at the 0.001 level. A high R&D intensity of the investor predicts a higher likelihood of the venture falling in the certain zero group.

LeverageDebtEquity: results display a positive effect of this variable on the count of patents. However, this is not statistically significant ($p > 0.10$).

This model shows the impact of a variety of factors on both the likelihood and count of a venture's patent applications following a CVC investment. Many factors have a significant impact, suggesting that the venture's history, the investment level, and the investor's characteristics all play important roles in the post-investment innovativeness of the target venture. By using a zero-inflated negative binomial model, we can account for both overdispersion and excess zeros in the data, explaining the effects of the foreign CVC characteristics on the predicted innovation outcome of the US ventures and also the factors that contribute to a venture not filing any patents post-investment.

6.4 Robustness Test

After describing the model results, the next step in the assessment is assuring the model outcomes are consistent and reliable across various conditions. Robustness checks are a useful tool to stress the model and verify that it appropriately captures the investigated phenomenon without being just contingent on the chosen data sample. A common practice is studying how certain coefficient estimates behave when modifying the model specification by adding or removing regressors (X. Lu & White, 2014).

An infinite range of robustness tests can exist. In this research, the *structured permutation test* approach is followed by selecting a set of plausible alternative specifications to some core variables (Neumayer & Plümper, 2017). Hence, four tests that seem the most convincing and exhaustive for the sake of this research have been conducted.

First, two crucial explanatory variables are computed by many researchers in different ways. In fact, it has been considered appropriate to measure syndication and multiple CVC ties as discrete non-negative variables in this research. Therefore, one model is built by substituting syndication level with syndication presence. This categorical variable counts for 1 in case of more than 1 investor participating in the deal and 0 if only one investor is present. Then, a second model is built by substituting MultiCVCties with the variable Multiple CVC, computed as the presence of multiple CVC in the observed investment syndicate computed as 1, and 0 in the case of a single CVC investor.

The second step consists of using a different measure of innovativeness and checking the effect the model's regressors have on it. Previous literature identified forward citation-weighted patents as a significant measure of innovativeness that is more accurate in disclosing the quality of a given patent. Patents that receive many forward citations are likely to have a more significant and groundbreaking impact than those less cited. It is relevant to remember that later data (e.g., after 2018) can suffer weaker results from the later application time. The examiner reports citations in a later stage from one of the applications and so may not be reported yet in the PatentsView extractions. This may reflect imprecise and biased data.

The third step involves applying the model to a local sample of US-based CVC investors. This sample is not used for matching purposes (exact match is not verified), but rather to test the model on the local counterparts of foreign investors. Even though not matched rigorously, the US sample was constructed along with the foreign sample and separated from it just at the end of the process. This means the sample is built on the same investor's industries (SIC 28 and 36) and has been narrowed down following the same principles (see Methodology). However, in the case of the local sample, the variable CVC location is omitted since all the investors are all US-based and cannot be differentiated through this criterion.

Table 11: Most CVC Intensive Industries with respective Knowledge-Intensity

	(1) Syndication 1 0		(2) Multiple 1 0		(3) Cit-Weighted patents		(4) USA sample	
VARIABLES	PatentsPost5y	inflate	PatentsPost5y	inflate	Cit-Weighted	inflate	PatentsPost5y	inflate
IndustryProximity	0.0507**	-0.185***	0.0330	-0.196***	-0.0700**	-0.292***	0.0908***	-0.229***
	(0.0246)	(0.0598)	(0.0245)	(0.0614)	(0.0345)	(0.0668)	(0.0285)	(0.0748)
CVClocation	0.194**	-0.0948	0.272***	-0.0360	0.0923	-0.327		
	(0.0945)	(0.220)	(0.0927)	(0.220)	(0.150)	(0.249)		
SyndicationLevel			0.0274***	-0.0941***	-0.00680	-0.0681***	0.0574***	-0.0963***
			(0.00980)	(0.0262)	(0.0139)	(0.0245)	(0.00998)	(0.0205)
Syndication	0.513**	-1.559***						
	(0.244)	(0.492)						
MultiCVCties	-0.0391***	-0.0149			-0.0216	-0.0120	-0.0462**	0.374***
	(0.0117)	(0.0365)			(0.0187)	(0.0402)	(0.0227)	(0.0817)
Multiple			-0.230**	-0.424*				
			(0.102)	(0.252)				
Uncertainty	0.207***	-0.521***	0.233***	-0.687***	-0.925***	-0.612***	0.502***	-0.642***
	(0.0797)	(0.190)	(0.0803)	(0.203)	(0.126)	(0.217)	(0.0916)	(0.173)
PortfolioSize	-0.00780**	0.00514	-0.00858**	0.00637	0.000480	-0.00721	0.00748***	0.000633
	(0.00365)	(0.00858)	(0.00357)	(0.00852)	(0.00549)	(0.00937)	(0.00257)	(0.00549)
PatentsQuality	-0.0205*	-0.0672**	-0.0114	-0.0623*	-0.00335	-0.0134	0.0539***	-0.0118
	(0.0116)	(0.0297)	(0.0122)	(0.0331)	(0.0181)	(0.0300)	(0.0150)	(0.0294)
Assets	-9.74e-07	1.50e-06	-1.17e-06*	2.02e-06	-1.07e-06	3.67e-06**	-3.09e-07	-1.17e-06
	(6.64e-07)	(1.44e-06)	(6.76e-07)	(1.51e-06)	(7.83e-07)	(1.80e-06)	(5.37e-07)	(1.13e-06)
ROA	3.992***	4.437	4.274***	6.133*	1.851	3.773	-3.535***	3.006
	(1.152)	(3.130)	(1.176)	(3.225)	(1.870)	(3.427)	(1.204)	(2.627)
R&DAssets	-6.489***	-7.790	-6.160***	-5.112	-6.810**	-2.657	0.263	1.527
	(1.867)	(4.909)	(1.920)	(5.060)	(2.654)	(5.260)	(1.056)	(2.637)
Leverage	0.00956	-0.00584	0.0105	-0.00542	0.0719**	0.0845*	-0.0239	0.267**
	(0.0165)	(0.0281)	(0.0163)	(0.0284)	(0.0365)	(0.0496)	(0.0504)	(0.108)
PatentsPre5y	0.0524***	-2.225***	0.0511***	-2.232***	0.0224***	-2.221***	0.0462***	-2.103***
	(0.00388)	(0.407)	(0.00385)	(0.395)	(0.00635)	(0.305)	(0.00381)	(0.294)
TotInvestment	0.00525***	-0.00138	0.00471***	0.000859	-0.00350**	-0.00206	0.00233***	0.000976
	(0.000912)	(0.00196)	(0.000926)	(0.00202)	(0.00149)	(0.00270)	(0.000805)	(0.000773)
lnalpha		0.315***		0.323***		1.011***		0.587***
		(0.0556)		(0.0556)		(0.0517)		(0.0514)
Constant	1.389***	2.780***	1.533***	1.817***	3.892***	2.346***	1.171***	0.957**
	(0.263)	(0.558)	(0.145)	(0.358)	(0.176)	(0.393)	(0.206)	(0.486)
Observations	1,615	1,615	1,615	1,615	1,615	1,615	2,017	2,017

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

In Table 11, Model (1) suggests that syndication computed as a dichotomous variable has a positive significant effect on the count of the venture's patents. The substitution of this variable keeps the other regressors significant and consistent with their direction. Model (2) shows that the computation of Multiple CVCs as a dichotomous variable instead of a discrete non-negative variable not only shows that the presence of multiple CVCs with at least one foreign CVC in the syndicate has a significant negative effect on the innovative outcomes of the startup, but it also has a significant negative effect on its likelihood to be a certain zero. These results corroborate our previous finding of negative impact on the *level* of innovation but also show that the presence of multiple CVCs is associated with higher chances for the startup to present at least some innovativeness. However, the change in the computation of this variable determines the non-significance of Industrial Proximity, which remains significant in explaining certain zero likelihood. This shows that the model can work only when the description of Multiple CVC is computed as the effect of an *additional* one and not as the simple presence of more than one.

Model (3) shows that the validity of the model is constrained to the use of patent count as a proxy of the level of innovativeness. Changing the dependent variable into the citations-weighted count of patents provokes distortions in our results. Even though less common than the count of patents, this measure has been adopted as a *quality* indicator of innovativeness. However, when used in our model, it shows that the effect of some key regressors is not significant anymore (e.g. CVC location, Syndication Level, Multiple CVC ties, Portfolio Sie), or their direction may change (e.g. Industry Proximity, Uncertainty). This opens observations on the comparability of the two measures, which are similar in intent but structurally different in computing their values. Therefore, our reported results are valid solely for the contingency of cumulative patent count within five years from the investment. It is fundamental to acknowledge that these results have a different intent to explain the *quality* of the innovative output that the venture can achieve after receiving a foreign CVC investment.

Model (4) shows the application of the model on the local sample of CVCs, which was built with the same criteria as the foreign sample. It is important to acknowledge that omitting the variable CVC location may influence the accuracy of the following considerations. Nonetheless, applying the same model shows significance for the rest of the explanatory variables, but with slightly different effects. A major change is presented in the direction of the

Portfolio Size, which positively impacts the count of patents of the venture after receiving a US CVC investment. This suggests that local CVCs benefit from a wide local presence, that allows for the effective management of a wider set of ventures in their portfolio. Conversely, foreign startups need to adopt a focus strategy to be appealing to US ventures that seek their resources and knowledge.

7. Discussion

The principal goal of this study is to investigate the impact of foreign CVC investments on the innovation performance of U.S. startups, which is of primary relevance because a consistent portion of CVC investments come from overseas and suffer a *liability of distant search*. Building on the classic CVC literature, this study aims to elaborate on the mechanisms and strategies foreign CVCs can employ to foster innovation in their U.S. startups under this boundary condition. Simultaneously, the study seeks to provide insights for U.S. startups, aiding them in identifying foreign CVC investors that could enhance their innovation capabilities. The main research question guiding the research journey is:

- *How do foreign CVCs influence the innovation performance of U.S. startups?*

This question is further elaborated through three sub-questions, each representing different aspects of the foreign CVCs' strategic investment decisions and their effects on the innovation of the startups they back. The discussion section's primary purpose is to interpret and analyze the results obtained considering the research questions. This section draws the consequences of the findings along with the theoretical existing literature. Furthermore, it describes the managerial outcomes by interpreting them within the contingency of foreign CVC investment in U.S. startups.

The study identifies three broader mechanisms that influence the innovation of U.S. startups receiving a foreign CVC investment by testing six hypotheses. These mechanisms explain the elements to consider influential when coping with the *liability of distant search*.

7.1 Proximity Factors

How does the industrial and geographical proximity of foreign CVCs affect the innovation outcomes of U.S. startups?

With this question, the basis for discussing proximity mechanisms was set, starting with foreignness as a boundary condition (Zaheer, 1995). As noted in much of the research on international management and CVC, low accessibility to the firm can undermine the exchange of complementary assets at the basis of a strategic relationship (Alvarez-Garrido & Dushnitsky, 2016). In this study, we confirm that distance does matter.

First, geographical proximity emerges as a fundamental mechanism to mitigate knowledge stickiness (Von Hippel, 1994) and enhance the flow of complementary assets to the recipient firms. We show that establishing a CVC unit in the US positively affects the firm's innovation performance when choosing a foreign CVC. This finding aligns with the broader literature, which argues that establishing a presence in innovation hubs can provide superior access to new ideas, technologies, and investment opportunities, enabling the development of a closer relationship with local partners (Agrawal et al., 2006; Chen et al., 2010).

Second, industrial relatedness shows to be a relevant component in overcoming foreignness barriers. Although the *paradox of CVC* suggests that industrial proximity may make startups reluctant to establish strong ties with a CVC in the same industry, the benefits they get from industrially close investors are significantly superior. Overall, our findings do not contradict the postulation of Dushnitsky & Shaver (2009), which offers a contingent interpretation. The risk of imitation is alleviated with the industry's tight IP regime. Therefore, this research aligns with this theoretical exception showing that the life sciences and electronic sectors present an IP regime that dilutes concerns over imitation. This highlights that geographically distant search is more effective in contexts of industrial relatedness for the analyzed industries, while further increasing distance with poor industrial relatedness yields lower benefits.

This effect provides empirical support to the theoretical propositions of Rosenkopf & Almeida (2003), where industry proximity facilitates knowledge transfer and reduces foreignness liability. Indeed, the results corroborate that industry proximity can foster the development of a common language between a startup and its foreign investor (Dushnitsky & Shaver, 2009), enhancing the likelihood of innovation outcomes. Such proximity allows a foreign CVC to understand better the startup's business model, technology, and market, offering more pertinent strategic advice and resources.

Another finding on proximity factors suggests that a foreign investor whose industrial domain is close to the venture increases the startup's resilience against non-innovativeness by promoting trust and facilitating communication (Inkpen & Tsang, 2005). However, the location of the CVC unit is not determinant in preventing ventures from showing a lack of innovation. This implies that although the location of the CVC unit can influence the intensity of a startup's innovation output, it does not directly impact the likelihood of a startup innovating at all. Nonetheless, this indicates that foreign CVCs establish their subsidiary also to pursue

objectives suggested in the CVC literature other than knowledge sourcing (e.g., growth, sustainability, financial performance) (Döll et al., 2022; Dushnitsky & Yu, 2022).

The descriptive analysis of industrial proximity corroborates this argument. Many investments are made in industries far from the ones of the investor and do not present innovative activity. Similar findings are highlighted in recent studies conducted by Dushnitsky & Yu (2022), who find a change in the institutional context a determinant factor in shifting CVC objectives. For instance, Chinese corporations tend to adopt CVC investments not for the sake of innovativeness but rather for the sake of economic growth.

In this research, we need more elements to speculate on why foreign CVCs decide to invest in beyond knowledge-intensive ventures. Still, we can determine the nature of their favorite industries. Investors in the Lifescience and Electronic industries tend to invest in Business Services, Engineering Services, and Manufacturing Industries. A possible explanation is rooted in the need for exploring and incorporating complementary assets and complementary knowledge (e.g., manufacturing, products) from a distant institutional context characterized by a high level of innovativeness (i.e., the U.S.), as highlighted in Gonzales & Ohara (2019) for Chinese CVCs.

7.2 Relational Ties

How does the relational structure of foreign CVCs influence the innovation performance of U.S. startups?

Another boundary condition has been investigated by building on a network perspective of the liability of foreignness. Foreignness implies that firms are structurally outsiders to the relevant local business networks. Hence, they face logistic challenges in transferring knowledge and complementary assets, known as the *liability of outsidership*. This relational barrier has been confirmed to be a relevant issue in overseas CVC activities. CVCs must build strong ties with local communities to reduce adverse selection during the scouting process and avoid moral hazards in the post-investment phase (S. Kang & Hwang, 2019; M. V. J. Maula et al., 2013; Yang et al., 2009).

To cope with this barrier, it is found here that the effect of the syndication level is beneficial and increases with the size of the syndication. This view gives a more relaxed perspective on the harmful effects of the *information exchange paradox* postulated by Anokhin et al. (2011).

Hence, in a foreign context, syndication is a powerful tool to increase familiarity through local networks.

This is not meant to contradict the *information exchange paradox* but to reinterpret it. We observe that the spillover effect given by a minimizing centralist strategy signals deal quality, improves trust, and lowers knowledge transfer barriers. Consequently, it has an innovation-enhancing impact on the start-up. This finding supports the literature that suggests CVC investors in large syndicates are less prone to knowledge misappropriation and tend to keep a collaborative relationship with the partners, stimulating cooperation with the venture (Kang & Hwang, 2019). It further confirms Dai & Nahata (2016)'s assertion that syndication can offset cultural and geographical barriers, facilitating knowledge and resource exchange.

We also found that a large syndicate is a powerful signal to prevent the startup from being non-innovative. Hence, the larger the syndicate, the more the chance for the startup to innovate after receiving a foreign CVC. This is a powerful indication for ventures willing to increase their innovative outcomes by selecting a foreign corporation, but also for foreign CVCs to consider large syndicates in case they want to establish strong ties with the venture.

Nonetheless, it is observed that not all relational ties are beneficial. Syndicates can harm the startup's innovation when some contingencies are met. For instance, relations with multiple CVCs turned out to have a detrimental effect on the startup's innovativeness.

Literature has recognized that ventures may benefit from the involvement of numerous corporate investors given the increased access to knowledge and resources, which alleviates constraints associated with the development and commercialization (Katila et al., 2008b; Wadhwa & Basu, 2013). However, the interplay of foreignness and multiple corporate involvement necessitates a re-evaluation of this stance. As hypothesized, multiple corporations may have divergent objectives that hinder healthy collaboration. Also, a startup with multiple corporate investments will likely increase coordination barriers to avoid knowledge misappropriation while preventing access to the investors' resources (Dushnitsky & Shaver, 2009).

This result underscores the downside of multiple corporate involvement, mainly when foreign investors are present. The multiplicity of CVC interactions unveils a new paradox. While the influx of diverse corporate investors may promise abundant resources, it could create an environment of non-cooperation and private interest pursuit, making innovation a goal that

takes extra costs. This detrimental impact is evident when the investors must deal with the *liability of distant search*, exacerbating the barriers to effective coordination.

A similar effect is attributed to excessive relational ties a foreign CVC established with its portfolio of US ventures. Indeed, we observed that the size of the investment portfolio in the US harms the venture's innovativeness. This implies that a diversification strategy is inefficient when foreign CVCs invest with strategic goals and the venture seeks innovative capabilities. When involved in increasing CVC investments overseas, the investor's resources suffer from overdispersion. This implies a lack of close attention to the dyadic relationship, making them less attractive to innovative ventures.

This conclusion builds on the fact that while diversified portfolios can mitigate financial risk, they might dilute the strategic value a corporate investor can provide to its portfolio companies. As the hypothesis suggests, a broad portfolio could lead to superficial engagement and knowledge sharing, consequently limiting the startup's access to crucial corporate resources and innovation opportunities (Ernst et al., 2005). Considering these findings, it can be confirmed that while diversified portfolios may provide financial stability for CVCs, this strategy neglects their investees' needs for strategic guidance and complementary assets. As a result, there is an evident need for foreign CVCs to find a balance between portfolio diversification and engagement with their partners to foster the innovative capabilities of their portfolio.

7.3 Timing of Investment

How does the timing of foreign CVC investment influence the innovation performance of U.S. startups?

Uncertainty is another fundamental issue. Its expected negative effect is not confirmed in this study. Instead, early-stage ventures get more significant benefits from foreign CVCs than later-stage ventures. This suggests that contrary to our hypothesis, they trust foreign firms and do not adopt unique protection mechanisms that prevent the flow of knowledge (M. V. J. Maula et al., 2009). This claim was built upon the understanding that early-stage ventures often need to overcome significant learning barriers due to their limited size, age, and absorptive capacities that prevent them from exploiting resources provided by corporate investors (Lane & Lubatkin, 1998).

The empirical findings on foreign CVC provide a twist to this narrative. The results suggest that ventures in their early stages experience a significant boost in their post-investment patent count compared to their counterparts in later stages. Consequently, the findings shed light on the hidden potential of early-stage ventures in learning from foreign CVC investments. Hence, despite their inherent limitations, early-stage startups can leverage foreign CVC investments to improve their innovative capabilities significantly. This finding also contrasts Park & Bae (2018), who found that an early CVC investment will likely lead to knowledge misappropriation and competitiveness from the corporation rather than value creation.

An opposite argument may explain this. Early-stage ventures are building their technologies and have a greater need for knowledge and resources from more experienced partners than later-stage ventures. Drawing on Almeida (1996), firms actively seeking knowledge and resources from foreign environments are likelier to learn than those lacking this motivation. On the one hand, we can state that later-stage ventures benefit from a developed technology and seek commercialization resources rather than knowledge to enable innovation. This makes them more concerned about establishing barriers to the flow of technical knowledge. On the other hand, early-stage ventures are willing to seek distant knowledge and resources, and their motivation outweighs their lack of developed absorptive capabilities.

7.4 Final Considerations

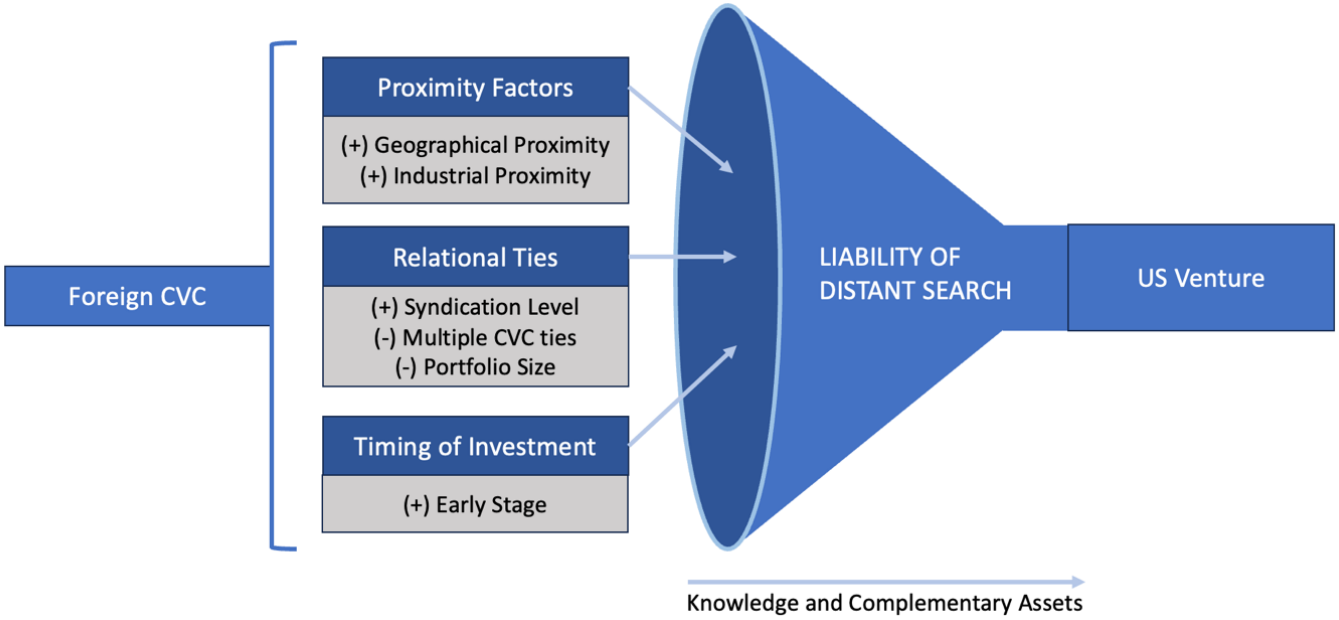
Finally, the three macro-factors described above have proven reliable and significant in explaining the dynamics that influence venture innovation when receiving a foreign CVC investment. Their subcomponents have been hypothesized and tested through our statistical model. Evidence supports the first five hypotheses, giving consistency to all the sub-elements used to explain Proximity Factors and Relational Ties. The sixth hypothesis, however, showed controversial results. Inconsistent with the mainstream CVC literature, early-stage ventures must be reconsidered in their absorptive capacities when dealing with foreign CVC investors. They proved to be a suitable target for such investments, which benefit from superior, innovative outcomes compared to their later-stage peers.

When dealing with barriers linked to the *liability of distant search*, CVCs must rely on mechanisms that moderate the obstacles of distance. Proximity Factors are a strong positive signal to build trust and information flows with the target venture. Relational Ties can increase

familiarity with the local players and provide networking opportunities in the scouting and post-investment phases. However, they are only sometimes beneficial and must be carefully assessed when deciding over syndicating with other CVCs or building a diversified portfolio of ventures to mitigate financial risks. Lastly, the Timing of Investment suggests that early-stage startups are better off learning and building on the resources of a foreign CVC.

Considering these elements, the following conceptual illustration is proposed:

Figure 2: An Illustration of the Findings



7.5 Implications

7.5.1 Managerial implications

The research provides practical implications for both corporations willing to undertake CVC investments overseas, for the ventures that receive such investments, and for the other stakeholders involved in a CVC deal of such a kind (e.g., IVCs, other CVCs).

Foreign corporations willing to tap into the US market by pursuing CVC investments are subject to barriers caused by the low proximity to the country; they need more familiarity with the culture, geography, and institutional setting and relational ties with the local business network. Therefore, their position is delicate, and they must take extra considerations on the CVC governance and the mode of investment. If their objective is strategic and they aim to build a strong exchange of knowledge and complementary assets with the target ventures, their CVC activities must consider the following recommendations.

The CVC unit is better established in a location close to the venture. Establishing at least a local subsidiary in the US improves bonding with the venture and increases the attractiveness of the unit. This first step favors close relationships and the CVC's contribution to the startup's innovativeness. Additionally, foreign CVCs should target ventures in high industrial proximity. These are the most suitable targets to foster learning by setting a common language fast. Conversely, investments in unrelated industries will likely determine that the startup is not innovative.

The foreign CVC's local presence and industrial proximity are potent signals for a startup that the relationship will benefit its innovative performance, compensating for the physical distance from the corporate headquarters. Therefore, accepting a foreign investor within the same industrial domain and with a subsidiary in the US has evident innovative advantages compared to those that do not.

Foreign CVCs are recommended to close deals in collaboration with large syndicates. This allows the foreign CVC to create trust in the local community and the venture. In fact, syndication is a positive signal that the foreign CVC can build a prolific relationship with the target venture. However, caution measures must be adopted. For instance, other CVCs must be assessed carefully, and extra agreements over shared goals must be made beforehand. Accordingly, startups must recognize that the multiplicity of CVCs is not always a goldmine of resources but can compromise the coordination between parties, making it a liability instead.

In addition, the number of investments must be well balanced to avoid overdispersion of resources. Regarding this last concern, focused investment in a few good startups is preferred over excessive diversification. Even though true that diversification covers risks of failure, it is harmful to the relationship with the portfolio. A focused strategy allows the building of fruitful mechanisms for exchanging knowledge and complementary assets, determining the innovative success of the venture. The same suggestion applies to the ventures that should put particular care into assessing the resource availability of the investor given by its level of commitment to other ventures.

Lastly, foreign CVCs are advised not to consider the maturity of a venture as an impediment to learning. They instead show a superior, innovative outcome after a foreign CVC investment compared to later stages. Here the choice strictly depends on the type of resources the CVC is willing to commit. Knowledge and technological capabilities are welcomed within an early-

stage venture, motivated to develop its technology. Later-stage ventures show less innovative outcomes, seeking resources that help them commercialize an already established technology. Therefore, startups in early-stage phases are strongly recommended to partner with a foreign CVC, as it can be an excellent partner to improve their innovation capabilities.

7.5.2 Contribution to the Literature

Building on new interests in CVC investments overseas, this research advances the novel stream of international CVC investments (Belderbos et al., 2018; W. Dai et al., 2022; Dushnitsky & Shaver, 2009; Dushnitsky & Yu, 2022; Gonzales & Ohara, 2019; S. Kang et al., 2021; S. Kang & Hwang, 2019; Mazza & Shuwaikh, 2022) building on the burden that the foreignness condition creates. The research focuses on the innovative outcome of ventures associated with the CVC investment (Alvarez-Garrido & Dushnitsky, 2016; Chemmanur et al., 2014; H. D. Park & Steensma, 2013; J.-H. Park & Bae, 2018), adding a new boundary condition, distant learning, to the effective exchange of knowledge and complementary assets. Moreover, it investigates practical tools from the classical CVC literature (Anokhin et al., 2011; N. Dai & Nahata, 2016; Dushnitsky & Shaver, 2009; Katila et al., 2008b; M. V. J. Maula et al., 2009; J.-H. Park & Bae, 2018) to shed light on the mechanism that can help a foreign CVC contribute to a distant venture's innovativeness.

The research provided a substantial contribution to the inherent dynamics of CVC investments overseas, their characteristics, and their effect on the venture's innovative performance, identifying relevant levers in Proximity Factors and Relational Ties. In contrast with prior literature, the research finds evidence of a higher innovative performance achieved by early-stage ventures. Contrary to their disadvantage given by lower absorptive capacities (Lane & Lubatkin, 1998; M. V. J. Maula et al., 2009; J.-H. Park & Bae, 2018), they prove to be a valid target for the exchange of knowledge and complementary assets.

In addition, contrary to prior literature, we consider alternative models to the classic Poisson or negative binomial formulations. Zero-inflated models allowed us to address the problem of the excess of zeros, which were a consistent component in the sample, highlighting that foreign CVC is not always a matter of innovative performance but can have different strategic goals. We assume an excess of zeros is also a common concern for studying a different CVC sample. It is suggested that variables can offer a valid explanation for the likelihood of certain zero counts to deliver further insights into the implications of CVC characteristics.

7.5.3 Limitations of the Study:

Data Biases:

In the Methodology section, the data collection process is illustrated. It emerges that the process has been long and characterized by manual passages that allowed the merge of three databases that name the same firms differently. The process tried to be as objective as possible. However, some manual browsing procedures may still provoke data distortion. Furthermore, PatentsView names often need to be corrected or abbreviated. Even though the identification has gone through the simultaneous use of the reclink2 Stata function, human check, and the assignment of unique identifiers, this may have neglected other relevant Assignee IDs with a confusing denomination.

Selection of Variables:

An issue with patent data count is that it might not represent the full extent of one's innovation performance. First, many researchers argue that citation-weighted patent count is a more reliable measure of innovativeness since it also includes the quality of one patent (Dushnitsky & Lenox, 2005b; Trajtenberg, 1990; Wadhwa et al., 2016). Second, many firms rely on alternative mechanisms to protect inventions instead of patenting, such as informal protection (i.e., secrecy) (de Faria & Sofka, 2010). This directly affects many of the results we provided, as shown during the robustness test. Hence, a different innovation measure must be studied by considering the inherent implications of its computation on the research scope and interpretation.

Another minor limitation consists of the time horizon of this thesis. Later observations may lack later patent applications. PatentsView collects data from institutional databases and publishes them every year. However, it does not guarantee the completeness of used databases. To accomplish this, constant updates and disambiguation are provided, but the most recent years of the collection are likely to be less representative. This may have influenced the assessment of the most knowledge-intensive sectors on the computation of the dependent variable, the PatentsPre5y variable, and the PatentsQuality variable. To address these issues, less recent periods should be considered.

Choice of Sample:

The sample construction tried to include highly innovative industries with high CVC intensity. We took a broad frame of 23 SIC codes in the more comprehensive life sciences and electronic fields. While this choice represents a consistent international sample, the industrial mismatch may be relevant in returning results. Industry-specific dynamics may be identified by using single industries, changing the validity of our conclusions. Future research could narrow down the model to a single SIC code if interested in assessing the industry-specific dynamics.

8. Conclusion and Future Directions

This research explores an underexplored contingency of CVC practices. In particular, it drew insights on the underlying mechanisms that influence exchanging knowledge and complementary assets from a foreign CVC to overseas ventures. Employing a Knowledge-Based View, it frames cross-border CVC activities as a challenging practice that suffers impediments created by the *liability of distant search*.

Six crucial elements are influential in addressing the *liability of distant search*. Notably, geographical and industrial proximity is vital for overcoming distance challenges and fostering innovation in the recipient venture, underscoring that distance still matters. Secondly, the strength of relational ties presents varying effects, with a positive influence of syndication but a negative effect from multiple corporate investors and the size of the CVC portfolio. Lastly, early-stage investments surprisingly prove beneficial, deviating from existing literature suggesting uncertainty negatively impacts learning.

These findings shed light on the complexity of foreign CVC and suggest the need for tailored strategies to effectively face the challenges of distant search. The study's scope, covering U.S. startups and foreign CVCs within life sciences and electronics industries, can inspire future research in other institutional settings.

Future Directions

The international knowledge-sourcing domain is underexplored in the CVC literature. Therefore, similar research can be engineered in the opposite direction. CVCs have been described as profiting more than startups when building a strategic relationship. This aspect can be further investigated by inserting the superior absorptive capacities of the incumbent as an element of analysis.

This research leaves further space for influential factors of distant search. Behind CVCs lies a wide range of integration mechanisms that have been proven to increase inter-organizational learning. The effect of new elements can be studied by setting the boundary conditions of foreignness. For instance, the CVC unit’s governance structure, the parent's local presence, the presence of board members in the venture, and the inventor’s mobility.

Further, this research considered only a foreign sample without matching its performance with a local sample. Other statistical techniques, such as propensity score matching and differences-in-differences, provide a valuable tool to build twins of local observations (J.-H. Park & Bae, 2018), making a comparative analysis between the performance of foreign CVCs and local CVCs a fascinating subject.

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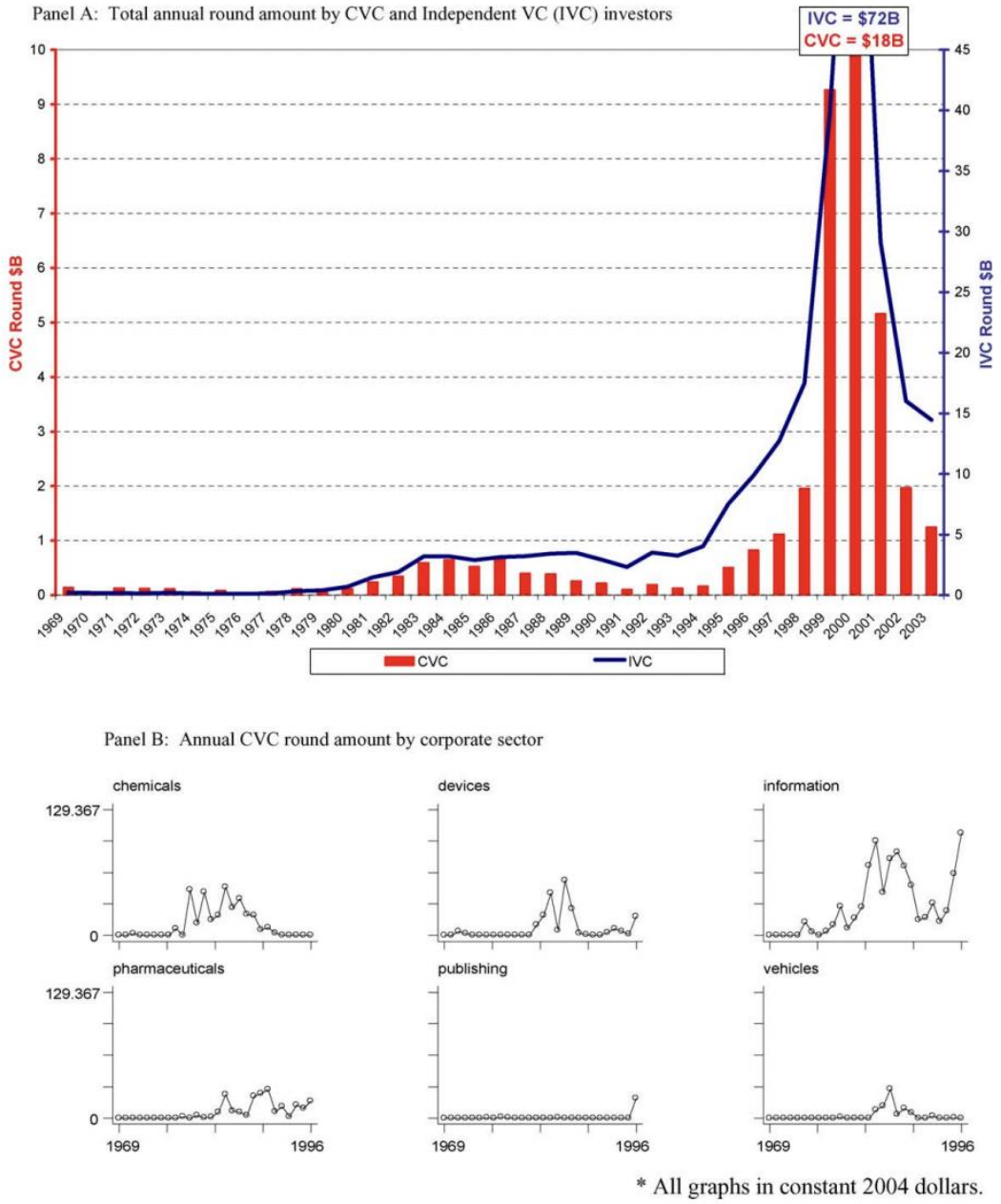
10. Appendix

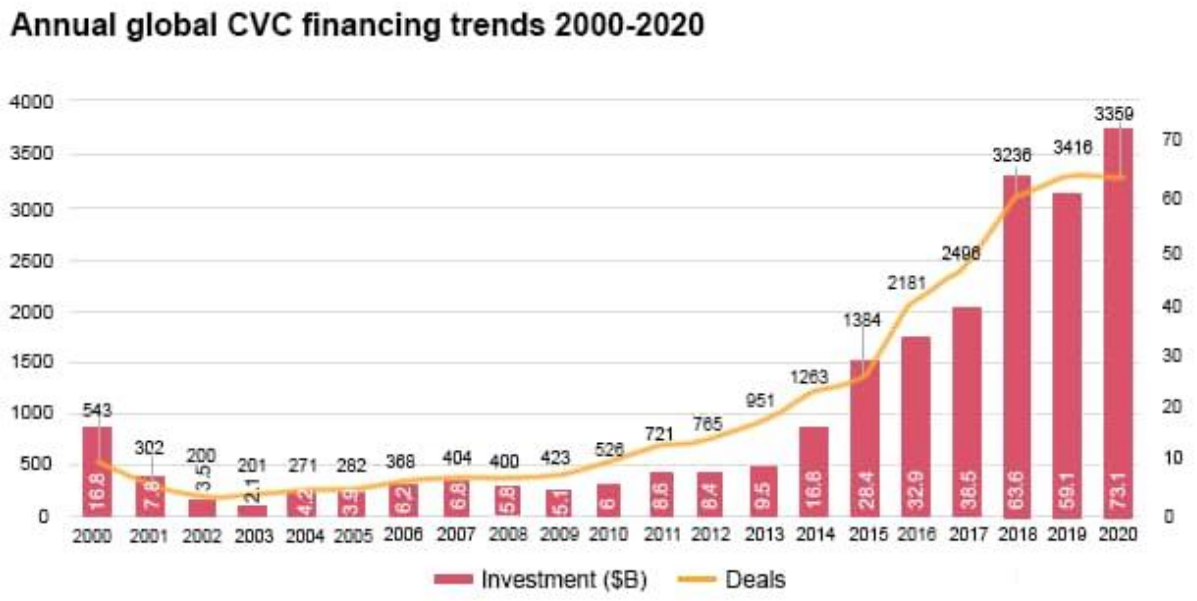
Appendix 1. Scopus Advanced Research

TITLE-ABS-KEY (corporate AND venture AND capital) OR TITLE-ABS-KEY (cvc AND investments) OR TITLE-ABS-KEY (cvc AND investment) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (SUBJAREA , "BUSI") OR LIMIT-TO (SUBJAREA , "ECON") OR LIMIT-TO (SUBJAREA , "SOCI")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (EXACTKEYWORD , "Corporate Venture Capital") OR LIMIT-TO (EXACTKEYWORD , "CVC") OR LIMIT-TO (EXACTKEYWORD , "Corporate Venture Capital Investments") OR LIMIT-TO (EXACTKEYWORD , "Corporate Venture Capital (CVC)") OR LIMIT-TO (EXACTKEYWORD , "CVC Investments"))

Appendix 2. CVC History. From Dushnitsky & Lenox, (2005b) p. 12

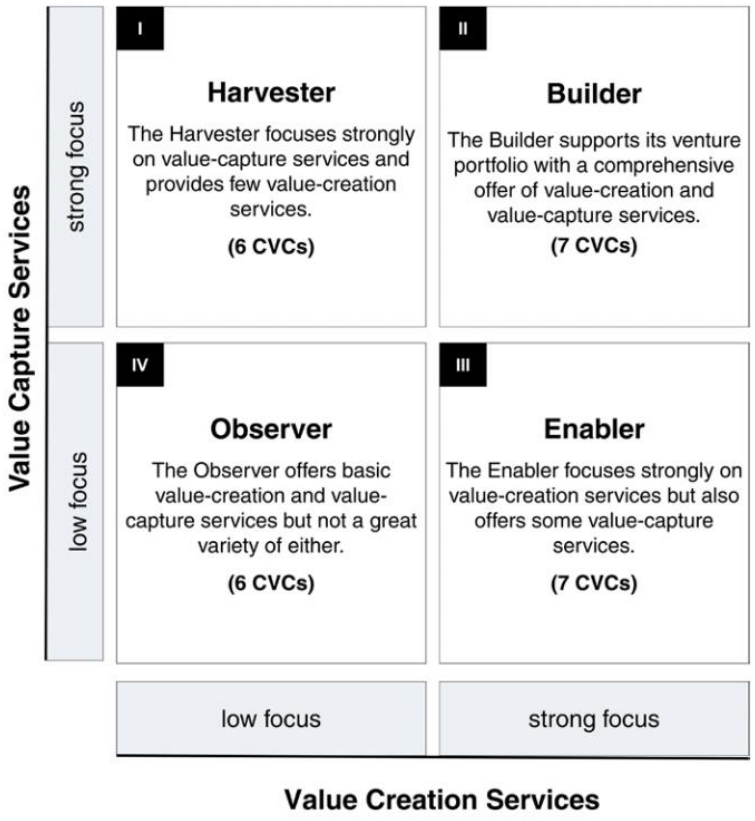


Appendix 3. From PricewaterhouseCoopers, (s.d.)



Source: CB Insights Report: The History of CVC

Appendix 4. Types of CVC units from Gutmann et al., (2019) p. 33



Appendix 5. from Belderbos et al., (2018), p. 22

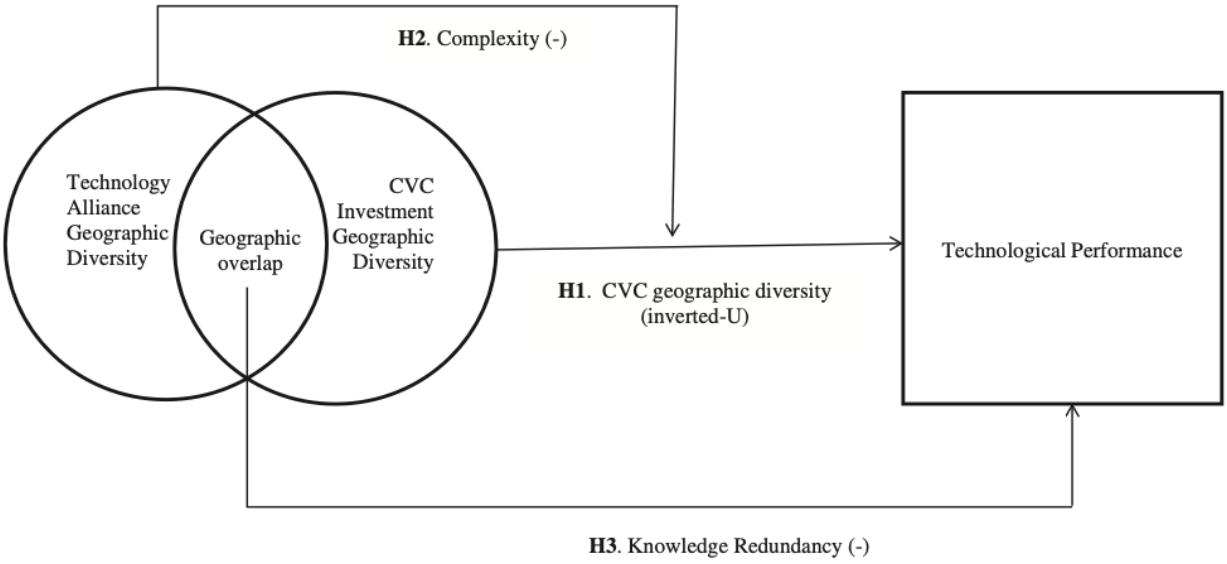


Fig. 1. Conceptual Model: Interplay of CVC Geographic Diversity with Technology Alliance Geographic Diversity.

Appendix 6. First Eikon Extraction

	Europe	Asia	Middle East	Japan	Total
Total Deals	8835	8093	866	2529	20323
Total CVC	590	604	131	174	1499
Total Startups	5474	5668	653	1816	13611
Deals Abroad	**5347**	**2672**	**510**	**1228**	**9757**
% Deals Abroad	**61%**	**33%**	**59%**	**49%**	**48%**
Deals USA	**2844**	**1302**	**232**	**604**	**4982**
% on Abroad	**53%**	**49%**	**45%**	**49%**	**51%**

Appendix 7. PatentsView Extraction

g_assignee_disambiguated	*Disambiguated assignee data*			
DATA ELEMENT NAME	DEFINITION	EXAMPLE	YEARS PRESENT	TYPE
patent_id	patent number	PP25533	all	varchar(20)
assignee_sequence	order in which assignee appears in patent file	0	all	int(11)
assignee_id	unique assignee ID generated by the disambiguation algorithm	00003f5c5d92354570b9bae01b3e7272	all	varchar(36)
disambig_assignee_individual_name_first	first name, if assignee is an individual	Ziyan	all	varchar(96)
disambig_assignee_individual_name_last	last name, if assignee is an individual	Liu	all	varchar(96)
disambig_assignee_organization	organization name if assignee is an organization	E-Z Anchor Bolt Template, Inc.	all	varchar(256)
assignee_type	classification of assignee (1 - Unassigned, 2 - US Company or Corporation, 3 - Foreign Company or Corporation, 4 - US Individual, 5 - Foreign Individual, 6 - US Federal Government, 7 - Foreign Government, 8 - US County Government, 9 - US State Government. Note: A "1" appearing before any of these codes signifies part interest	2	all	int(4)
location_id	unique location id generated by the disambiguation algorithm	d929a955-16c7-11ed-9b5f-1234bde3cd05	all	varchar(128)

g_application	*Information on the applications for granted patent*			
DATA ELEMENT NAME	DEFINITION	EXAMPLE	YEARS PRESENT	TYPE
application_id	application id assigned by USPTO	02/002761	all	varchar(36)
patent_id	patent number	D345393	all	varchar(20)
patent_application_type	patent application series code: 01-17 = utility application; 29 = design application; 35 = international design applications; 60-62 = provisional application; 90 = ex parte reexamination request; 95 = inter partes reexamination request; 96 = supplemental examination	2	all	varchar(20)
filing_date	date of application filing, ISO format: YYYY-MM-DD	1992-12-23	all	date
series_code	application series; "D" for some designs; (http://www.uspto.gov/web/offices/ac/ido/oeip/taf/filingyr.htm)	2	all	binary(0)
rule_47_flag	flag for inventor who was unable to be contacted at filing of patent	0 or 1	all	bigint(1)

g_us_patent_citation	*Citations made to US granted patents by US patents*			
DATA ELEMENT NAME	DEFINITION	EXAMPLE	YEARS PRESENT	TYPE
patent_id	patent number	9009250	all	varchar(20)
citation_sequence	order in which this reference is cited by select patent	622	all	bigint(22)
citation_patent_id	identifying number of patent to which select patent cites	8127342	all	varchar(20)
citation_date	first day of the month the cited patent (citation_id) was granted	2012-02-01	all	date
record_name	name of cited record	Boynton et al.	all	varchar(128)
wipo_kind	WIPO document kind codes (http://www.uspto.gov/learning-and-resources/support-centers/electronic-business-center/kind-codes-included-uspto-patent)	B2	2002 and After	varchar(10)
citation_category	who cited the patent (examiner, applicant, other etc)	cited by patent	2002 and After	varchar(64)

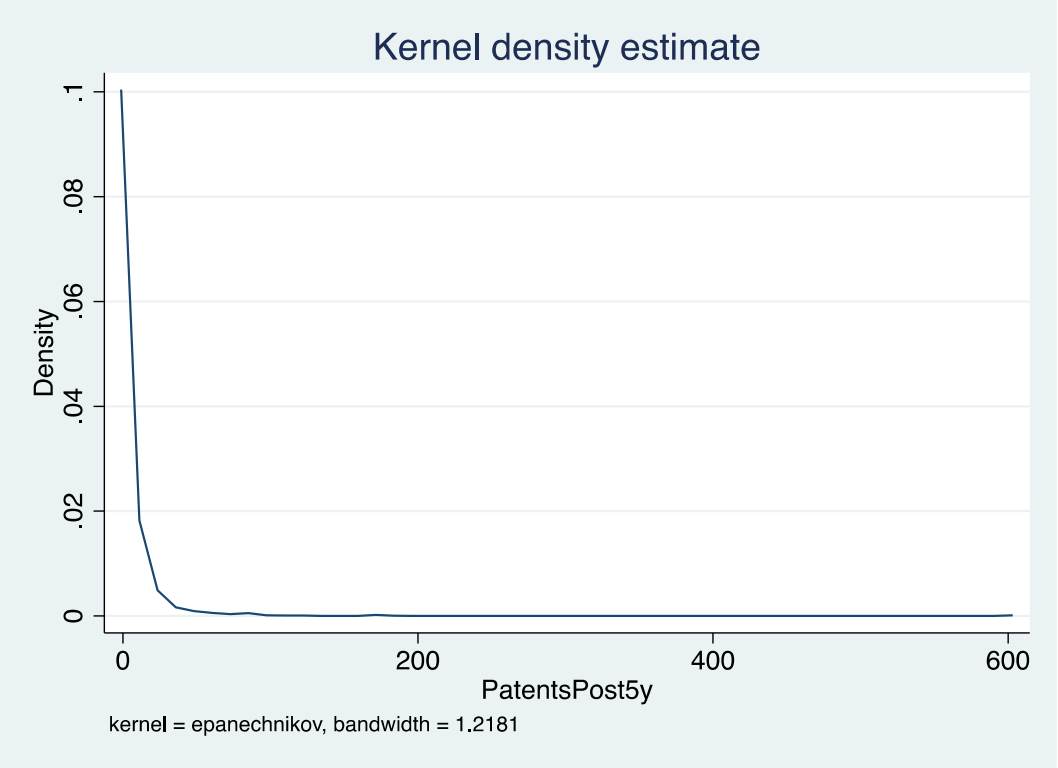
Appendix 8. Selected SIC Codes and Relative Characteristics

SIC	Patents	Frequence	Percentage	Investments
2800	33197	2,85	2,85	332
2810	5376	0,46	3,31	22
2820	1553	0,13	3,44	6
2821	18912	1,62	5,07	52
2834	85767	7,36	12,43	3041
2836	3472	0,3	12,73	168
2840	20128	1,73	14,45	143
2844	6522	0,56	15,01	14
2870	5211	0,45	15,46	57
2890	646	0,06	15,52	10
2891	484	0,04	15,56	7
3600	312762	26,84	42,4	989
3612	2266	0,19	42,6	83
3613	6239	0,54	43,13	42
3620	65152	5,59	48,72	36
3640	4680	0,4	49,13	8
3651	47	0	49,13	6
3661	12137	1,04	50,17	78
3663	65340	5,61	55,78	378
3670	131151	11,26	67,04	81
3672	661	0,06	67,09	39
3674	342618	29,41	96,5	2040
3677	11538	0,99	97,49	10

Appendix 9. Jarque-Bera Test and Patent Count density

Skewness and kurtosis tests for normality

Variable	Obs	Pr(skewness)	Pr(kurtosis)	Joint test chi2(2)	Joint test Prob>chi2
PatentsPost5y	1,615	0.0000	0.0000	2810.86	0.0000



Appendix 10. Goodness-of-fit of the Poisson Model and alpha test for Equidispersion

```
estat gof

        Deviance goodness-of-fit =  27633.21
        Prob > chi2(1601)        =    0.0000

        Pearson goodness-of-fit  =  49464.23
        Prob > chi2(1601)        =    0.0000
```

Alpha test

```
LR test of alpha=0: chibar2(01) = 2.3e+04                  Prob >= chibar2 = 0.000
```

Appendix 11. AIC confrontation

	Poisson	Negative Binomial	Zero-inflate Poisson	**Zero-inflated Negative Binomial**
N	1,615	1,615	1,615	1,615
ll(null)	-21580.7	-4402.108	-14777.09	-4149.84
ll(model)	-15584.69	-4170.41	-10784.39	-3941.349
df	14	15	28	29
AIC	31197.38	8370.819	21624.79	**7940.698**
BIC	31272.8	8451.625	21775.63	8096.924

Appendix 12. Comparison of Poisson, Nbreg, Zip, and Zinb models

Model:	**(1) Poisson**	**(2) Negative Binomial**	**(3) Zero-inflated Poisson**		**(4) Zero-inflated Negative Binomial**	
VARIABLES	PatentsPost5y	PatentsPost5y	PatentsPost5y	inflate	PatentsPost5y	inflate
IndustryProximity	0.126***	0.0836***	0.0862***	-0.127***	0.0412*	-0.186***
	(0.00542)	(0.0285)	(0.00549)	(0.0375)	(0.0244)	(0.0602)
CVClocation	0.226***	0.146	0.162***	-0.107	0.169*	-0.107
	(0.0204)	(0.109)	(0.0206)	(0.140)	(0.0953)	(0.223)
SyndicationLevel	0.0440***	0.0636***	0.0235***	-0.0412***	0.0296***	-0.0939***
	(0.00178)	(0.0117)	(0.00193)	(0.0141)	(0.00966)	(0.0258)
MultiCVCties	-0.0386***	-0.0253*	-0.0575***	0.0275	-0.0436***	-0.0165
	(0.00322)	(0.0147)	(0.00349)	(0.0217)	(0.0117)	(0.0376)
Uncertainty	-0.140***	0.257***	-0.0562***	-0.417***	0.259***	-0.703***
	(0.0188)	(0.0917)	(0.0186)	(0.125)	(0.0806)	(0.200)
PortfolioSize	-0.00873***	-0.00904**	-0.00467***	0.00493	-0.00711*	0.00493
	(0.000808)	(0.00412)	(0.000831)	(0.00521)	(0.00363)	(0.00859)
PatentsQuality	-0.0342***	-0.00629	-0.0339***	-0.0204	-0.0194*	-0.0680**
	(0.00312)	(0.0132)	(0.00311)	(0.0175)	(0.0117)	(0.0326)
Assets	-4.13e-07***	-2.20e-06***	-3.19e-07**	1.27e-06	-1.26e-06*	1.63e-06
	(1.23e-07)	(7.44e-07)	(1.33e-07)	(8.80e-07)	(6.67e-07)	(1.47e-06)
ROA	3.348***	3.163**	2.863***	-0.0241	3.855***	5.336*
	(0.301)	(1.387)	(0.289)	(1.977)	(1.153)	(3.151)
R&DAssets	-7.917***	-7.986***	-6.252***	1.101	-6.949***	-6.394
	(0.432)	(2.180)	(0.434)	(2.958)	(1.869)	(4.928)
Leverage	-0.00222	0.00601	0.00296	0.00240	0.00600	-0.00535
	(0.00336)	(0.0174)	(0.00256)	(0.0192)	(0.0153)	(0.0286)
PatentsPre5y	0.0201***	0.0817***	0.0163***	-0.313***	0.0513***	-2.169***
	(0.000155)	(0.00617)	(0.000166)	(0.0254)	(0.00384)	(0.378)
TotInvestment	0.00525***	0.00433***	0.00598***	-0.00276*	0.00477***	0.000274
	(0.000134)	(0.00108)	(0.000165)	(0.00141)	(0.000905)	(0.00196)
lnalpha		1.034***				0.307***
		(0.0446)				(0.0558)
Constant	1.668***	0.892***	2.339***	0.971***	1.705***	1.970***
	(0.0299)	(0.165)	(0.0309)	(0.211)	(0.143)	(0.364)
Observations	1,615	1,615	1,615	1,615	1,615	1,615

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 13. Foreign CVC investments in the US by country and by 2-digit SIC

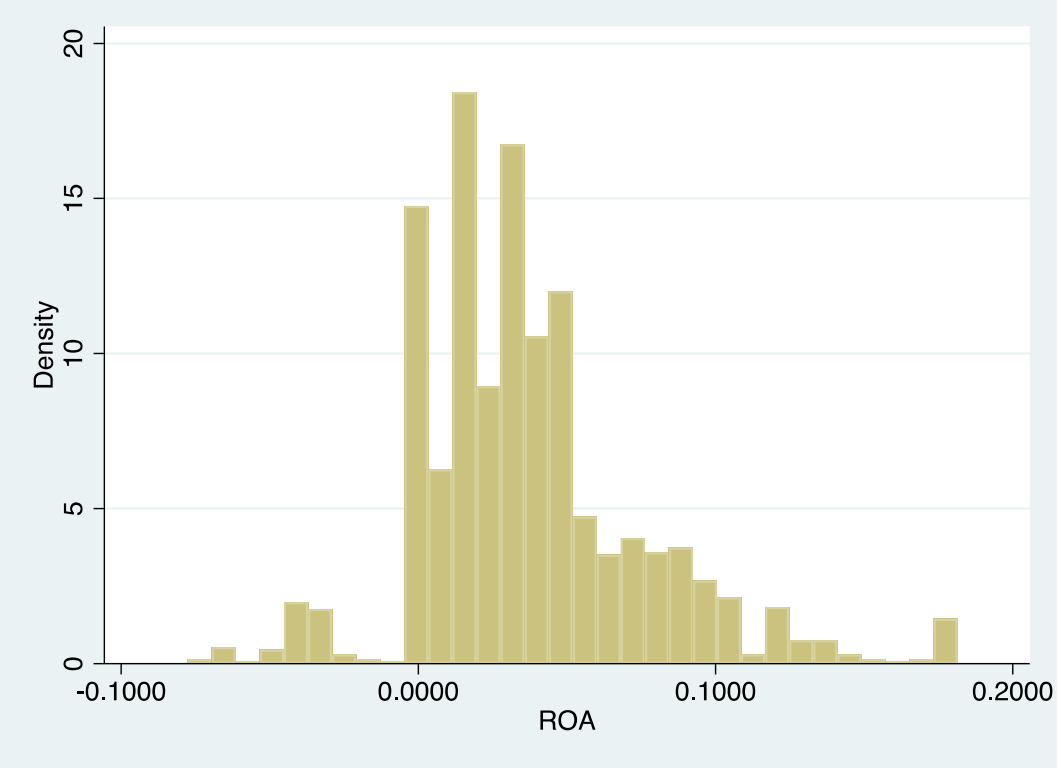
	28	36	Total
CHE	303	8	311
GBR	245	0	245
DEU	74	149	223
JPN	82	139	221
DNK	185	0	185
FRA	29	124	153
KOR	3	136	139
NLD	37	4	41
TWN	0	35	35
SGP	0	18	18
SWE	0	18	18
IRL	7	0	7
CHN	5	1	6
BEL	5	0	5
CAN	3	0	3
FIN	0	2	2
TUR	0	2	2
IND	1	0	1
Total	979	636	1,615

Appendix 14. Most Targeted Industries

	Industry	Sector 28
Chemicals and Allied Products	28	448
Engineering, Accounting, Research	87	291
Miscellaneous Manufacturing Industries	38	98
Business Services	73	43
Electronic and Other Electrical Equipment	36	22
Health Services	80	20

	Industry	Sector 36
Business Services	73	308
Electronic and Other Electrical Equipment	36	164
Miscellaneous Manufacturing Industries	38	36
Industrial Machinery and Equipment	35	27
Communications	48	25
Chemicals and Allied Products	28	21

Appendix 15. Density of ROA



Appendix 16. Density of R&D intesity