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An Exploratory Analysis of the Impact of Macroeconomic Variables on Corporate Venture Capital Activities

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Abstract

In an increasingly tight competitive landscape, innovation represents that edge that many companies strive to beat the competition. Corporate Venture Capital is now one of the most widely used investment tools for companies in their quest for innovation and related competitive advantage. Despite the great interest in Corporate Venture Capital, the current literature has not thoroughly addressed macroeconomic issues and their impact on Corporate Venture Capital. To fill this gap, this thesis aims to investigate macroeconomic issues from the perspective of Corporate Venture Capital by analysing an ad-hoc database of 156 Corporate Venture Capital deals. The research method used consists of two types of analysis: a descriptive analysis, aimed at highlighting the characteristics of our sample, and an exploratory analysis, through an Ordinary Least Square (OLS) regression model, aimed at exploring possible relationships between Corporate Venture Capital activity and some macroeconomic aspects. Furthermore, this thesis aims to be a starting point for further studies on these issues to enrich the current literature.

Key Words: Corporate Venture Capital, Exploratory Analysis, Innovation, Macroeconomic Factors

Abstract (Italiano)

In un panorama concorrenziale sempre più serrato, l'innovazione rappresenta quel vantaggio che molte aziende ricercano per battere la concorrenza. Ad oggi, il Corporate Venture Capital rappresenta uno degli strumenti di investimento più utilizzati dalle aziende nella ricerca dell'innovazione e del relativo vantaggio competitivo. Nonostante il grande interesse per il Corporate Venture Capital, l'attuale letteratura non ha affrontato a fondo le questioni macroeconomiche e il loro impatto sul Corporate Venture Capital. Per colmare tale lacuna, la presente Tesi di Laurea si propone di indagare le questioni macroeconomiche dal punto di vista del Corporate Venture Capital analizzando un database appositamente costruito di 156 operazioni di Corporate Venture Capital. Il metodo di ricerca utilizzato consiste in due tipologie di analisi: un'analisi descrittiva, volta ad evidenziare le caratteristiche del nostro campione, ed un'analisi esplorativa, attraverso un modello di regressione dei minimi quadrati, volta ad esplorare eventuali relazioni tra l'attività di Corporate Venture Capital ed alcuni aspetti macroeconomici. Inoltre, questa tesi si pone l'obiettivo di essere un punto di partenza per ulteriori studi su questi temi, per arricchire l'attuale letteratura.

Parole Chiave: Corporate Venture Capital, Analisi Esplorativa, Innovazione, Fattori Macroeconomici

Executive Summary

The present study focuses on the Corporate Venture Capital, an investing phenomenon that acquired huge interest between corporations in the last decades. Corporate Venture Capital, briefly said CVC, consists in minority equity investments done by one or more corporations into small companies, usually start-up.

CVC is not a completely new phenomenon among corporations. According to the literature (CB Insights, 2017), the earliest traces of CVC activity date back to the early 1900s, when Pierre S. Dupont, president of the chemical company, invested in the new-born General Motors ("GM"). The DuPont investment in GM is regarded as the first CVC investment, blended with mixed financial and strategic objectives (CB Insights, 2017). Such a phenomenon has grown during the years, always acquiring more and more space among corporations. However, it is in recent decades that this phenomenon has gained momentum in terms of business volumes. In fact, in recent years, CVC activities have grown rapidly and increased their role in the overall venture capital industry.

The present work has therefore started from a broad literature analysis of the overall CVC field, with an initial focus on the concept of Open Innovation (Chesbrough, 2003) that it is core to understand the idea of the CVC. The CVC phenomenon has been extensively studied over the years by various researchers and practitioners, who have often highlighted its strategic role for investing firms and its importance in terms of innovation. However, our review of the literature pointed out that there are still no specific studies that relate Corporate Venture Capital to certain

macroeconomic or national factors. Therefore, in the second part of the work, an **exploratory analysis** taking the energy industry has been performed with a statistical analysis of 156 deals in the time span 2018-2020.

Literature Review

The following literature review provides a comprehensive overview of Corporate Venture Capital, including its key traits and objectives. To this end, our analysis begins by focusing on the concept of innovation as the central concept of Corporate Venture Capital. We therefore analysed the Open Innovation model as a corporate strategy for innovation. Specifically, we contrasted the Closed Innovation model and the Open Innovation model. After identifying and analysing the main characteristics that these two models possess, we delved into how one can move from one model to the other to concretely implement the concept of innovation. Building on these initial concepts, we then delved into the study of Corporate Venturing as a phenomenon strongly aligned with the concept of Open Innovation. In particular, we analysed the phenomenon of Corporate Venture Capital as a key component of Corporate Venturing. Exploring the studies conducted so far on Corporate Venture Capital, several interesting points emerged, and this analysis allowed us to understand how, globally, studies have evolved over time. To understand this phenomenon even better, we compared and analysed Corporate Venture Capital with Corporate Venturing to understand its objectives and strategies.

Our analysis then explored which factors are relevant in the analysis of a corporate venture capital operation. Thus, we found out which factors carry the most weight in the analysis of a CVC operation: the company, the industry, and geography.

Next, to further explore the concept of a CVC operation, we delved into the different perspectives from which a CVC operation can be analysed. It turned out that these are mainly: individual level, organizational level, and market level. However, we found that each of these three perspectives can be further deepened to get an even more accurate and timely version of the phenomenon in its entirety.

Next, we wanted to lay the groundwork for understanding how CVC operations behave and the trend they have in Europe and America, as we knew that these would be two geographic areas from which it would be easy to extract CVC data for our future analyses. From here we were able to understand the main trends and characteristics typical of these two continents. Next, the literature review considered the aspect of technological discontinuities and linked it to the concept of Corporate Venture Capital.

Reading several articles, however, we realized that we had not considered an aspect that may be of interest when considering a CVC transaction, namely the organizational structure of the companies involved. For this reason, we decided to take a closer look at this concept and its impact. Therefore, we added a section explaining and analysing the operational models of CVC transactions. This section allowed us to understand the three main types of operating models that can be identified, namely the "Balance Sheet," the "GP Model," and the "LP Model." Each of these three models was then explored in more depth, with the goal of providing a complete picture, from an intentional strategic perspective, of what it means to choose one model or another. To support the analysis of the operational models, we delved into the topics of purpose, structure, talent, measures of success, and examples, to have a complete overview of the phenomenon.

Finally, we decided to study the energy sector, as it is highly active in Corporate Venture Capital. Therefore, we first analysed the sector in general, investigated

CVC operations in that sector, and hypothesized a possible future development of that sector.

The literature analysis has pointed out the main characteristics and objectives of the CVC, highlighting the key concept behind such a phenomenon. However, it also pointed out the lack of studies that relates macroeconomics concept (as the Level of Country Development and Education) to CVC.

Hypotheses and Methodology

Therefore, the second part of the thesis has focused on setting up the hypotheses and a methodology framework for studying the link between macroeconomics variable and the Corporate Venture Capital.

We first developed our hypotheses from a fundamental concept for Corporate Venture Capital, namely the concept of innovation. From several studies, we have seen how the concept of innovation is strongly related to a country's level of development and education. For this reason, we then decided to investigate a possible link between these two elements and Corporate Venture Capital, trying to understand whether the value of a certain CVC deal is affected. Therefore, we ended up developing two hypotheses according to which we positively associate the Deal Size to the Country Development and Educational Level.

The next step has been the selection of the industry into which run our analyses, such as the Energy Industry. This sector is going into radical innovation, and it has therefore been considered as significant examples for carrying out an exploratory analysis. In addition, it is one of the industries more active as regarding CVC activities.

A subset of 156 deals has therefore been selected in the time span 2018-2020. Per each deal a set of variables has been selected. In particular, we collected the size of each deal in terms of Money Raised and we used it as Dependent Variable in our model. Moreover, the Funding Round, the Strategy pursued, and other variables have been selected with the perspective of using them as Control Variable. Then, we collected the data about the Gross Domestic Product (GDP) and the Educational Attainment Rate (EAR) per each country, respectively as numeric variables for the Country Development and Educational Level. Therefore, using all the data collected, we built up our database to run a statistical analysis.

To test our hypotheses and thus test for a possible link between our dependent and independent variables, we considered **Ordinary Least Square (OLS) Regression** to be the most appropriate model. We also tested our variables so that those were aligned to the OLS model assumptions.

Main Findings

Our statistical analysis did neither verify nor disprove our hypotheses. Indeed, the OLS model did not show a significant relation between our independent variables and the dependent one. However, ours is just an exploratory analysis, with the aim of setting some ideas for future research. In addition, our model presents some limitations that could affect strongly the results obtained.

Despite these limitations and despite the fact the model did not verify our hypotheses, the analysis gave some interesting insight that left the doors opened for future research.

Indeed, our analysis showed some significant correlation that links our country variables to some variables related to the CVC deals.

In particular, we found that there is a positive and quite strong correlation between the GDP and the number of investors in a deal, that seems to indicate that CVC

companies preferer to move their capital in more developed countries. Another interesting correlation is the positive one between the GDP and the Funding Round, that seems to indicate that the start-up based in developed countries are more alike to reach later stages and therefore raise up more funds.

Limitations

The outcomes of the application of our econometric model and the methodologies used provided intriguing new information about the relationships between CVC investments and macroeconomic factors. The present dissertation does, however, have some limitations, just like any other research paper. These limitations can be broadly divided into two categories: limitations related to the data and methodology used, as well as the industry chosen.

Starting with the selection of industry to which the CVC deals belong, there are two main typologies of sectors: defensive and cyclical. A sector is defined as cyclical when it is strongly influenced by trends in the business cycle (such as movements in GDP or industrial production). In contrast, defensive sectors are little correlated with the business cycle and are less affected by any growth slowdowns or recessions. From the information just provided, it is possible to infer that the decision to focus our analysis on the Energy sector, which is a part of the Defensive Sector category, has some implications and might even constrain it. The selection of a defensive sector, which has little correlation with the economic cycle and is thus less affected by slowdowns or recessions and macroeconomic variables, may actually be controversial given the purpose of the current study, which refers to understanding the impacts of macro-economic variables on CVC deals.

On the other hand, it should be noted that our database does not include all potential CVC deals that might have taken place in the three-year period between

2018 and 2020, which is one of the limitations related to the variables used and the methodology used. In fact, it would have been appropriate to use multiple sources and make use of multiple databases in order to have a broader perspective of all the CVC deals that took place.

The variables we thought about and used for the analysis were selected based on the data from the CrunchBase and OECD databases. Undoubtedly, additional variables could have been retrieved with the aid of other databases, enhancing the analyses that were conducted. Additionally, our dependent variable, the deal size, only takes into account the money collected in the CVC Deal under consideration and ignores all other factors. In fact, a more thorough approach might have taken into account additional variables that are part of the dependent variable (e.g., minority stake acquired).

Moreover, political and economic factors also play a role in the chosen time horizon, which is the three-year period from 2018 to 2020. These factors undoubtedly affected the quantity and variety of CVC deals. The layout of the search engines on the websites also imposed some limitations. We weren't aware of how the sites were constructed, so we only selected the categories we felt were most appropriate. The main challenge should be to comprehend how the categories were defined in order to choose all of those that contain CVCs. In fact, one has the choice to choose and filter the data using a few predefined categories during the filtering stage. This unquestionably weakens our work because we are more likely to have missed some aspects that might have been relevant to our search.

Therefore, additional directions for improving the current dissertation might include broadening the dataset to include other industries and assessing the use of additional databases, which would allow for the consideration of more variables, as well as more CVC deals.

To sum up, we believe that this paper demonstrates that understanding CVCs requires much more than simply examining the amount of invested capital and a few macroeconomic variables. When analyzing a CVC deal, it is important to take into account the investing company's larger innovation context. Any assessments of the effectiveness of CVCs should look beyond the financial returns on the investments in the venture portfolio and consider the extent to which these investments have aided the expansion of the investing company.

We hope that this paper will spark new and intriguing directions for further study in this field.

Practical and Theoretical Implications

Several implications emerged from our analysis, mainly involving investors and practitioners.

Starting from our first hypothesis, it turned out that it is not statistically verified, but a positive correlation was noted between the variable Deal Size and the GDP of the target company's country. This result, albeit partial, could be the starting point for further and more in-depth analyses, which could also use a more structured database, a larger number of deals and a longer time horizon.

As for the second hypothesis, it has been neither disproved nor confirmed by our econometric model. Therefore, again, expanding the boundaries of our analysis, i.e., increasing the number and type of data available (including both the number of CVC deals and additional macroeconomic variables), could lead to identify new correlations, which would enrich our analysis.

It is now possible to explore implications for potential investors of corporate venture capital deals. In particular, investing companies must quickly adapt their

operating models and mindsets to realize the value of early-stage and middle-stage CVC investments. Indeed, CVC deals demand a higher risk tolerance, quicker decision-making, and a longer investment horizon than what most corporate acquirers are used to. A committed investment team with proven expertise is the first crucial component for companies interested in CVC. The company's reputation in the venture capital community will increase as a result of the hiring of individuals with extensive experience in corporate venture capital. Hence, it is possible to say that two crucial aspects of venture capital are network and reputation as a trustworthy investor.

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Introduction

In today's dynamic and ever-changing world, companies are facing increasing challenges in the environment in which they operate. To meet this, companies must be flexible and able to innovate to adequately respond to these challenges. According to March (1991), a common way for companies to successfully adapt to such a changing environment is by learning from exploratory initiatives, which enables firms to change and improve their way of operating and competing (Guth & Ginsberg, 1990). In this way, companies can improve their dynamic capability by integrating the knowledge originated outside their boundaries and the internal one (Teece et al., 1997; Henderson and Cockburn, 1994).

The search for innovation outside the company boundaries was first theorized by Henry Chesbrough, through the concept of open innovation. Chesbrough (2003, 2011) asserts that open innovation takes place when a company combines external knowledge with internal knowledge to produce value for the organization. This theme has opened the door to a new mode of investment by companies, which seek innovation from entrepreneurial ideas.

Indeed, the concept of Open Innovation is closely aligned with the idea of Corporate Venturing, which entails a collaboration between established companies and innovative entrepreneurial firms (Siota et al., 2020). Corporate venturing may greatly influence the development of a company's corporate strategy by creating new skills and enterprises that enable renewal, stimulate strategic change, and increase a company's profitability and growth in both local and foreign markets (Ireland et al., 2001; Zahra and Hayton, 2008). Corporate Venturing enables

companies to respond quickly to changes in markets by gaining better insight into opportunities and threats. In this context, Corporate Venture Capital (CVC) is one of the tools of Corporate Venturing. Corporate Venture Capital is a minority equity investment by an established corporation in a privately held entrepreneurial venture (Dushnitsky G. 2012). Such an investment pursues both strategic and financial objective, even if the former prevails on the latter (Basu, Phelps, & Kotha, 2011). Corporate Venture Capital enables performance improvement in terms of innovation (Wadhwa, 2006), market value (Dushnitsky & Lenox, 2006) and financial returns (Allen & Hevert, 2007). Corporate Venture Capital investments are heavily linked to the industry's dynamisms, which are characterized by rapid technical progress, intense competition, and low appropriability (Basu et al., 2011).

In this Master Thesis, we focus on the Corporate Venture Capital phenomen, investigating possible correlations and links between CVC activities and macroeconomic and national variables, with particular regard to the Energy Sector.

First, the choice of the Energy Sector is related to the radical innovation the industry is going into, as well as the fact that such an industry is one of the most active regarding Corporate Venture Capital activities, even due to the crucial role played by innovation.

As for the choice to study macroeconomic variables from the perspective of Corporate Venture Capital, it goes back to the historical moment we are all living through. Indeed, in recent years, many events have radically changed our lives, as well as those of the companies themselves. Companies have been facing quite complicated and peculiar situations, to name a few, the war on tariffs between the U.S. and China, the Covid 19 pandemic, and lately even war in Ukraine. In addition, few studies have been conducted regarding a particular link between the Corporate Venture Capital activities and macroeconomic variables. Therefore, through our

exploratory analysis, we attempt to address this gap by opening new research questions.

We analysed 156 deals that occurred in the Energy Industry in the historical period 2018-2020, with the aim of testing our hypotheses concerning a possible link between certain macroeconomic variables and the Corporate Venture Capital activities.

Our work is structured as follows. First, a literature review focusing mainly on Corporate Venture Capital was conducted. The literature review first focuses on Corporate Venture Capital in general, to get a comprehensive view of the phenomenon itself, and then focuses on the energy sector. To present a clear and reliable summary of what Corporate Venture Capital is and represents, we decided to start with the broader phenomenon from which it is generated: Open Innovation. In fact, the concept of Open Innovation can be seen as the preliminary step to understanding the phenomenon we have studied. Next, we studied the main characteristics of Corporate Venture Capital, focusing on its goals, strategies, and numbers. We highlighted the different operating models and organizational structures that companies adopt in implementing Corporate Venture Capital activities.

After the literature review, we developed our hypotheses, with the aim of bridging the gap in the literature regarding a partial lack of consideration of the macroeconomic issues. We then built our database using Crunchbase for data extraction on Corporate Venture Capital activities and OECD for macroeconomic data. We then reprocessed the data, arriving at a final database that includes 156 deals that occurred in the energy sector between 2018 and 2020.

We then began to build our model for exploratory analysis. We first tested our variables so that they were in line with the assumptions of the Ordinary Least Square regression model. Once the variables were tested, we made the necessary adjustments and performed our exploratory analysis. Alongside this, we performed a descriptive analysis of our database on different dimensions to highlight potential sample characteristics. In particular, four dimensions have been analysed, which are: strategy, target market, year and funding stage.

The explanation and analysis of these results is presented in the results section. Based on the results obtained, the practical and theoretical implications, implications for investors and for practitioners, and the limitations of our work were then discussed. Eventually, final considerations and possible future research directions, which could be developed from our work, were presented.

1 Literature Review

The following literature review aims at giving a wide vision of Corporate Venture Capital and its main characteristics and objectives. To achieve this goal, our analysis starts focusing on the concept of Open Innovation as a corporate approach to reach innovation. Also, an analysis has been conducted on Corporate Venturing, a phenomenon of which Corporate Venture Capital represents a fundamental component, with the aim of deepening the underlying success factors and relevant aspects concerning such an innovation strategy.

1.1. Open Innovation

The Corporate Venture Capital (CVC) phenomenon is a key tool for the broader corporate ***Open Innovation Approach***. In this respect, it is not possible to study Corporate Venture Capital without having a clear picture of open innovation in mind. CVC is considered a key phenomenon in the world of Open Innovation as Venture Capital practices are crucial in promoting the shift from the traditional Closed Innovation paradigm to the new Open Innovation one. The traditional concept of innovation has been reformulated as a result of the change in economic processes brought on primarily by globalization. This new economic environment, where market technology convergence has made innovation processes riskier and integrated markets have shortened product lifecycle averages, has prompted a revision and updating of the idea of innovation. Henry Chesbrough was one of the first to respond to this need. In his essay "The era of Open Innovation" from 2003,

he focuses on how the traditional innovation model, also known as "closed innovation," is currently undergoing change and contrasts it with new paradigms that encourage openness in the pursuit of innovation outside the confines of the company.

1.1.1. Closed Innovation Model

A company creates, develops, and commercializes its ideas, products, knowledge, and technologies under the Closed Innovation Model. The model places a strong emphasis on knowledge and technology control as well as their course in the future.

For the majority of the 20th century, several top industrial companies' innovation processes were governed by such a self-reliance philosophy.

In a Closed Innovation model, companies come up with the ideas themselves and then develop, produce, sell, and distribute them. It is important to note that they handle every aspect of the process themselves. The fundamental principle of Closed Innovation is that companies believe they must have total control over the innovation process to produce successful innovation (H. Chesbrough, 2011).

The Closed Innovation paradigm states that successful innovation requires control and ownership of intellectual property (IP) (Chesbrough H. ,2003). A company should control the creation and management of ideas. The roots of Closed Innovation go back to the early 20th century when universities and governments were not involved in the commercial application of science (Meige, 2009).

According to such framework, the entire product development cycle was then integrated within the business, allowing for "closed" and independent innovation.

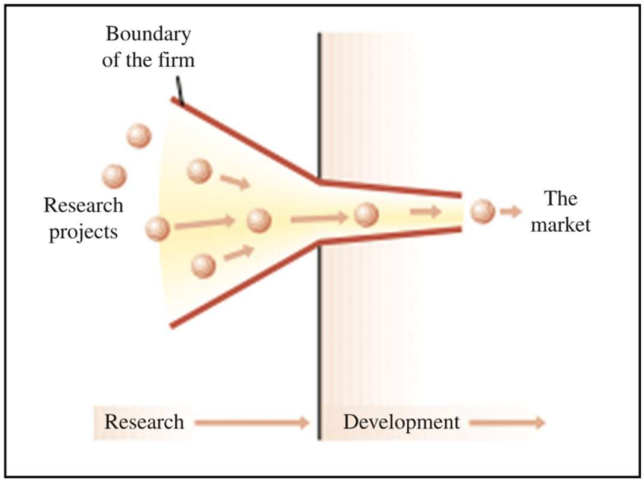

Figure 1: Model of Closed Innovation. Chesbrough (2003).

1.1.2. Open Innovation Model

"Open innovation is a paradigm that states that companies can and should make use of external ideas, as well as internal ones, and access markets both internally and externally if they want to advance their technological competence" (Henry Chesbrough, 2006).

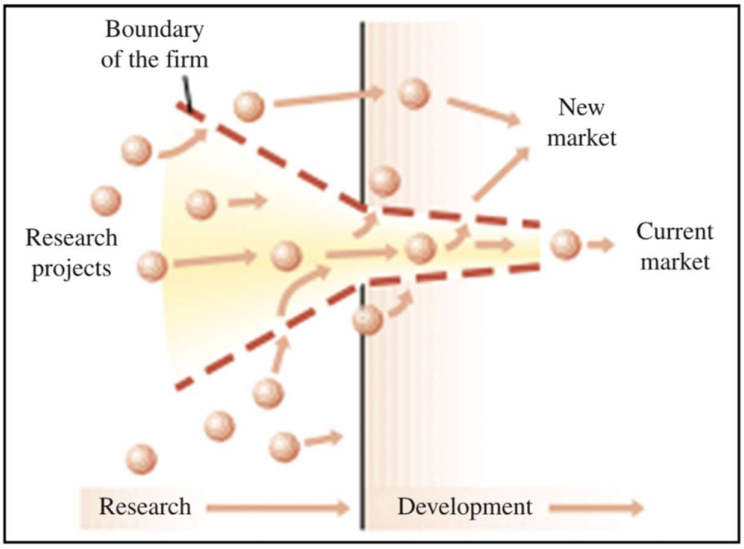

Figure 2: Model of Open Innovation. Chesbrough (2003).

The core idea behind the Open Innovation Model is to open up the innovation process and accelerate it by combining two different types of flows: inbound process innovation, which involves using knowledge from the outside world to boost internal innovation, and outbound process innovation, which involves using knowledge from the inside world to boost the market for external innovation (Huizingh, 2011).

In an Open Innovation model, a company leverages both its technologies, ideas, and knowledge, as well as those coming from other corporations. By using channels outside of its current business and forging strategic alliances, the model aims to find ways, tools, and strategies to bring its own ideas, technologies, and knowledge to market.

A company that chooses to implement an Open Innovation strategy typically seeks to license out its innovative and creative ideas to other businesses or start-ups, for example, in order to make R&D investments while maintaining its business focus and mitigating multiple risks. In addition, the adoption of such a model is motivated by the desire to acquire technology licenses and engage in joint development with outside parties in order to acquire knowledge and ideas rather than just ready-to-use technologies.

However, firms engaged in Open Innovation strategies concretely face the so-called "Paradox of Openness". According to such vision, on one hand, the firm has to open, at least up to a certain point, to several external actors, to design, develop and commercialize valuable products and services. On the other hand, the concerned company must wisely decide how and to what extent it should protect knowledge in order to reap the benefits. Since knowledge, in all of its forms, is easily reproducible, the business may not be able to maximize its financial benefits. Additionally, skills and knowledge can cross over, for instance through employee

mobility between corporations and vicarious learning. A partial solution consists of *"selective openness"*. The phrase implies that companies must maintain exclusive control over a few crucial parts in order to derive value from their system of goods and/or services.

The Open Innovation approach presents itself differently for small and large companies. According to Lindegaard (2011a) the main characteristics that link these differences are:

- Speed in decision-making --> Decisions are made more quickly in small businesses because there is less bureaucracy. Open innovation is practiced more slowly in small businesses than in large businesses, though. The former is pressuring the latter to react earlier than them.
- Risk attitude --> The entire operation of a small business is risky when it is just getting started. Similar to speed, both types of companies might not get along well when it comes to open innovation because of their differences.
- Resource allocation --> In small companies, every characteristic is relevant to its business, whereas, in large corporations, this narrow view of the importance of resources is more malleable.

1.1.3. Transition to Open Innovation Model

Innovation is an important concept for the expansion and improvement of businesses and the communities in which they are based. It also plays an increasingly important role in ensuring the competitiveness and prosperity of businesses and companies.

In contrast to local specialization and the densification of production activities in locations that offer specific competitive advantages, the business organizations are

involved in a process of globalization that reorganizes industrial production systems in an increasingly global production.

The traditionally proprietary and vertically integrated approach, "Closed Innovation", has significant limitations, given that the concept of innovation is now strongly linked to interactions between the internal dimension of the company and the sources of knowledge and learning present outside it.

In this context, there is a new paradigm called "Open Innovation" that was first introduced in the early 1990s as a new model of innovation management. Henry Chesbrough, who first used the term, said that it leverages a company's use of outside sources of technology and innovation to spur internal growth. This idea is supported by knowledge flows that go both ways, which are meant to speed up internal innovation and expand the markets for the use of innovation from outside. Open Innovation refers to the idea that companies should use more outside concepts and technology in their operations, allowing other companies to capitalize on their untapped potential.

This process of shifting from a Closed Innovation approach to an Open Innovation one, requires companies to adopt an open business model that lets ideas and technologies flow from outside the company to inside the company and from inside to outside. These procedures include "inbound" and "outbound" actions that take place during the acquisition and disposal of licenses, patents, and other types of intellectual property owned by the company.

Companies that pursue open innovation must untangle themselves from a complex web of stakeholders, find the best fit for their needs, and develop a methodical co-innovation strategy.

Innovation should not come exclusively from internal research centers in a world where knowledge is widely disseminated and distributed and the boundaries between a company and its environment are becoming increasingly permeable. Instead, ideas developed by external resources, such as public or private research centres and other companies, should also be taken into consideration. According to this viewpoint, the flow would be bilateral: unused ideas from within the company would travel outside to be used as resources by outside parties for a flow of ideas coming in from the outside world.

Their primary risks include management and organizational complexity, rising costs, a lack of qualified and frequently devoted staff, a low perception of benefits, and risks involving intellectual property.

However, partnerships are developed between the company and a variety of innovation-generating entities, such as clients and suppliers, businesses operating in different industries, universities and research institutions, governmental organizations, organizations supporting innovation, and rivals. The objective is to increase the company's performance in terms of innovation by expanding and making the company's skill base more flexible, lowering and sharing risks, and reducing costs.

However, it is important to understand that nowadays numerous companies struggle with the closed or open innovation choice, and it is still unclear which strategy is the ultimate best.

1.2. Corporate Venture Capital

Corporate Venture Capital (CVC) is a minority equity investment by an established corporation in a privately held entrepreneurial venture. Every CVC has three common characteristics: strategic purposes are concealed behind the financial intents; the funded ventures are privately held and have no relations with the investors; and last, the investing firm obtains a minority equity stake in the venture (Dushnitsky, 2012).

1.2.1. Previous Research on Corporate Venture Capital

Although CVC units have increased recently, the roots of corporate venture date back to the beginning of America's 20th-century business titans. The president of the chemical and plastics company DuPont, Pierre S. du Pont, made an investment in General Motors in 1914. The board of directors of DuPont invested $25 million in GM in the hope that the financial boost would hasten GM's progress and increase demand for DuPont products like fake leather, plastics, and paints. DuPont's wager on GM combined financial and strategic goals; this hybrid approach would later define more formal corporate venture capital units (CB Insights, 2017).

Throughout its history, CVC's development could be divided into four main phases. Three major factors influenced the first one, which occurred in the 1960s: first, a trend toward corporate diversification took hold (Dushnitsky, 2012); second, investing companies had excess liquidity (Fast, 1978); and third, pioneering independent venture capital funds were experiencing phenomenal financial success alongside their portfolio companies (P. Gompers & Lerner, 1998).

About one-fourth of the Fortune 500 had a corporate venturing program in the 1960s and the early 1970s (Fast, 1978). But in the late 1970s, these were largely dismantled.

The following two waves, with more than 400 CVC programs, occurred in the 1980s and 1990s, respectively. Companies rekindled their interest in corporate venturing at the beginning of the 1980s, as the market for independent venture capital expanded once more. Following the 1987 market downturn, these initiatives were once more abandoned. Then, as the 1990s bull market picked up steam, companies resumed corporate venturing (Yost, 1994). The final phase began at the turn of the century, and even during this final phase, the common traits largely remained the same. CVC is now a widespread phenomenon on a global scale, enabling thousands of funds to operate and play a critical role in the growth of new start-ups and innovation.

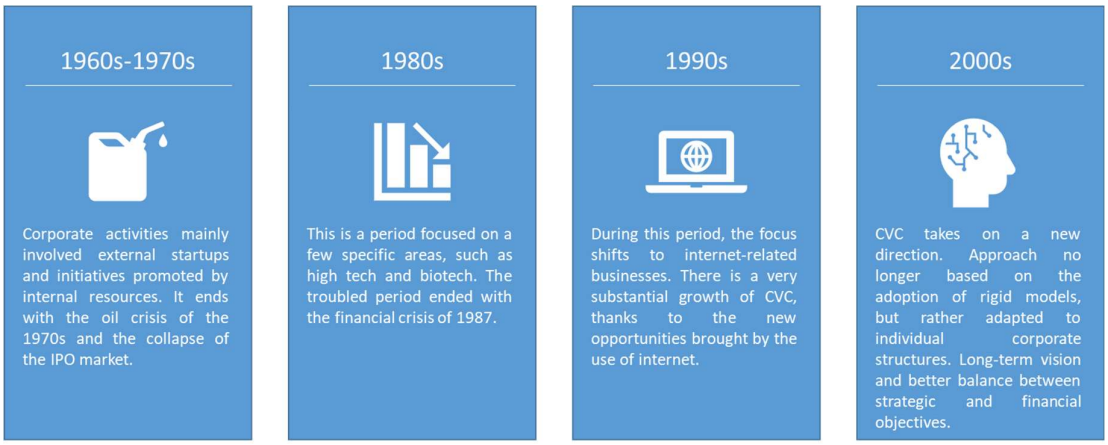

Figure 3: CVC main historical phases

Delving into details, Von Hippel (1973, 1977) discovered that the new venture company had a much higher chance of success when the parent company had a significant amount of prior experience in that particular industry. He also detailed the challenges sponsors of risk organizations faced in creating and maintaining internal support for new initiatives. Fast then identified a third issue that new venture divisions within an organization deal with: the issue of new venture success. Successful New Venture Divisions were frequently perceived by the author as posing a threat to the parent company's established businesses. The potential

conflicts of interest between the sponsor firm and the new firm were then examined by Rind (1981). Particularly, the parent company may restrict the firm's marketing activities if the firm targets a particular industry that the parent company already serves. Rind also discovered the issue with the venture's temporal governance within the parent company.

The CVC phenomenon was also examined in 1987 by Block and Ornati. They specifically looked at how companies handled compensation when creating new venture divisions within the parent company. They found that most companies that use corporate venture programs do not pay venture managers any differently from other managers. They emphasized maintaining internal equity in compensation as one of their main responses. If a manager at the same level received a disproportionately higher level of compensation due to the success of the new venture unit, managers at similar levels elsewhere in the company would view this as unfair. An incident like that would cause conflict both within the parent company and with other companies.

Prior to Chesbrough's (2002) Framework, Siegel and MacMillan (1988) examined the potential tension between the financial and strategic drivers of new firm formation. The study claims that the sole strategic goal is to take advantage of the hidden additional growth potential within the parent company. On the other hand, the financial goal is to increase profits and revenues from the new business venture itself. The study also discovered that companies must give the managers of the new venture total autonomy in order to maximize the financial return from the venture. Ed Roberts and his associates carried out another investigation into venture organizations that came from businesses and universities in the 1990s. As a result, many of them had excellent financial performance.

After gathering information from more than 25,000 funding rounds, Gompers and Lerner (1998) compared the returns on corporate venture capital investments with those earned by private VC investments. They discovered that companies could match the returns of private VC funds when they invested in projects related to their core business. As opposed to corporate investments in related businesses, the study found that corporate investments in unrelated businesses generated lower returns. Ginsberg et al. (2002) discovered that having a strategic corporate investor in the business provided important advantages to entrepreneurs in new business ventures in the 2000s. In addition, the study also discovered that start-ups that had listed with a corporate investor experienced higher long-term rate of return.

A further consideration was made by Chesbrough (2002), who noted that CVC programs that invest in assets unrelated to their strategy and capabilities invariably end up wasting the money of their shareholders. The study made the point that shareholders may invest in private equity opportunities on their own when companies fail to add value for their shareholders by diversifying their business lines. Furthermore, the extensive use of the financial resources of shareholders can only be justified by CVC investments that address the company's strategy or capabilities.

1.2.2. Numbers of Corporate Venture Capital

The pattern of Corporate Venture Capital has been very cyclical. 25% of Fortune 500 companies in the 1960s and early 1970s had a corporate venturing program. However, in the latter half of the 1970s, these were largely disbanded. Then, as the independent venture capital market started to expand once more in the early 1980s, corporations started to show a renewed interest in corporate venturing. Following the 1987 market downturn, these initiatives were once more abandoned. Then, as

the long bull market of the 1990s gained strength, businesses once more started engaging in corporate venturing activities. Corporations once more made their way out after the Internet "bubble" burst and the general decline in the public equity markets (Chesbrough et al, 2004).

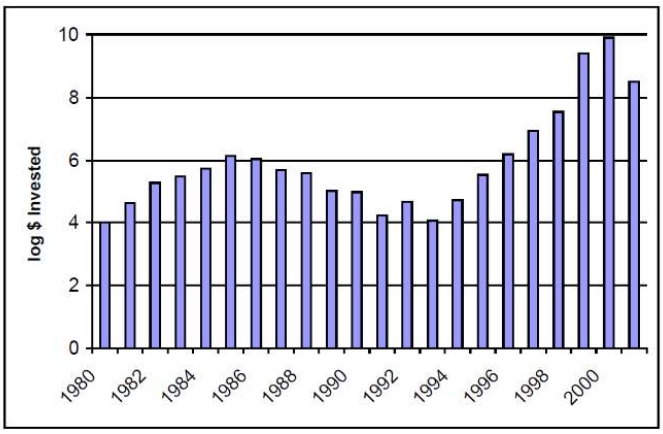

Figure 4: Dollar amount of CVC investments year by year, 1980-2001 (CB Insight)

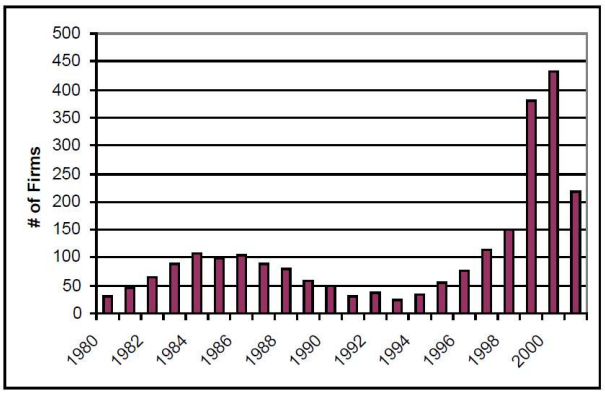

Figure 5: Number of companies with active CVC programs, 1980-2001 (CB Insight)

CVC programs have proliferated over the past ten years all over the world. For instance, corporations invested in more than 20% of all equity investments made in the US between 2000 and 2002. CVC programs continued to participate actively in the private equity market even after the 2000 US stock market crash. In 2004, both the percentage of deals in which CVC participated and the percentage of companies funded in which CVC participated stabilized at 16–19%. Similarly, in 2001 and 2002,

European equity investments with corporate participation made up about 10% of total investments. More than 130 Fortune 500 companies have CVC programs as of this writing (V.K. Narayanan et al, 2009).

The number of CVC units that were active doubled between 2012 and 2016, confirming the possibility of such a phenomenon.

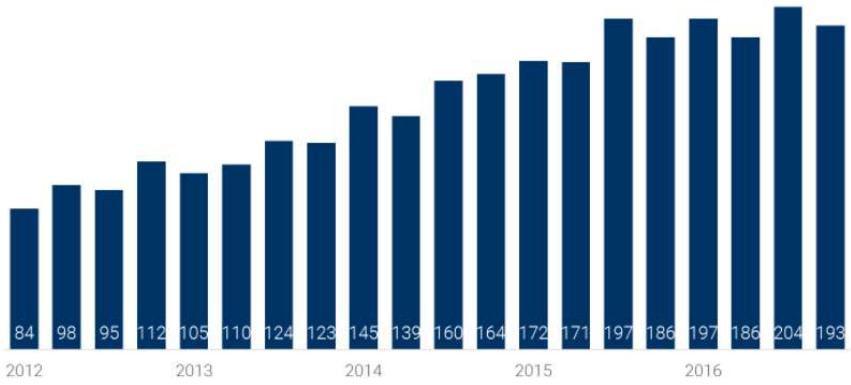

Figure 6: Quarterly Global Active Corporate VC Investors Q1'12-Q4'16 (CB Insight)

After 2016, this trend persisted, demonstrating its durability. However, in 2020, CVC-backed deals fell from a record high of 3,416 in 2019 to 3,359 for the first time in 5 years. The slight year-over-year (YoY) decline of 1.7 percent can be attributed to a slowdown in deals in the first half of 2020, which were down 5 percent from levels in 2019, before they recovered in the second half of 2020. In spite of the overall decline in CVC-backed deals, CVC-backed funding soared to an all-time high of $73.1B in 2020, up 24 percent from 2019.

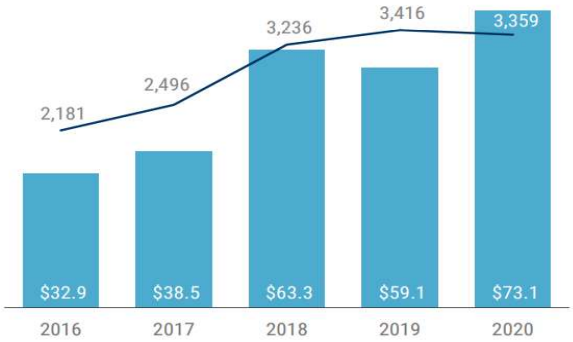

Figure 7: Annual global disclosed CVC-backed deals and funding, 2016-2020

Despite a decline in the number of CVC-backed deals from 3,416 to 3,359, the CVC-backed funding has experienced a 22 percent CAGR since 2016, reaching $73B in 2020. Record-breaking CVC investment activity occurred in 2021, with CVC-backed funding rising by 142% year over year to an all-time high of $169.3B. The record number of CVC-backed deals (2,099) in the first half of 2021 attests to the fact that businesses are increasingly turning to CVC as a means of innovating and making financial investments that will pay off.

1.2.3. Corporate Venturing and Corporate Venture Capital

Companies all over the world are aware that genuine innovation cannot be developed solely internally, but frequently looks for growth opportunities outside of the typical governance dynamics of large corporations. For this reason, establishing Corporate Venturing activities enables companies to react more quickly to changing situations and circumstances, but it also sometimes enables them to anticipate, if not initiate, new technological development paths, allowing them to quickly change their strategic direction in order to adapt to changing market conditions. Corporate Venture Capital, which is distinguished by the endowment of a structure that carries out this activity in a way that is

complementary to the objectives of the company, occupies a central position when considering the Corporate Venturing instruments. As a result, before delving deeper into the primary characteristics of corporate venture capital, we examine the primary characteristics of corporate venturing as a whole. Indeed, a crucial and well-liked element of corporate venturing is corporate venture capital (V.K. Narayanan et al, 2009). As a result, CVC and corporate venturing have some similarities and some differences.

Corporate venturing denotes the establishment by a parent company of a unit that is tasked with making investments in or developing new businesses (Birkinshaw and Hill, 2005). There are mainly two types of corporate venturing: *(i)* internal venturing and *(ii)* external venturing (MacMillan et al, 2008). Internal means typically include innovation and new business incubation. External means usually include licensing, joint venturing, acquisitions, and corporate venture capital (CVC). Corporate Venturing is closely linked to both innovation and strategic renewal. Some CV activities frequently expand upon the company's innovations by launching new products or in new markets. Other CV initiatives could result in significant adjustments to a company's operations, business plan, or competitive positioning (V.K. Narayanan et al, 2009).

Corporate Venturing operations can be divided into various phases, with consideration for the fact that in some cases the company is already active on the market and in others the project is still in its infancy or even exists only on paper:

- Seed Financing: Often referred to as the "start-up" phase because it occurs before the start-up of the business idea, this is the first stage of the investor's company selection process. The investor's job is delicate and challenging, but not because of the amount that needs to be funded (which is small compared to the investor's resources), but rather because of the viability of the concept

and the simplicity of the marketing of the good or service. The US market typically provides more opportunities for those without the necessary funding to support a new business idea. On this last point, we refer to Google, which buys small companies and start-ups through its corporate venturing arm: Google Alphabet.

- Early Stage: Although the financing is still in its early stages, the company in question is already in operation and requires the funding to make a firm development. It can be assumed that the concept and a basic level of organization already exist; however, professional assistance from the financial and managerial sides is still necessary. The goal is to implement the growth phase and make the concept viable from a business standpoint.
- Mid Stage: In this stage, an entrepreneur must increase sales by making new investments with the help of a venture capital firm in order to increase the value of his business. The intervention is expensive for the financing company in terms of capital used, and it might not even be profitable.
- Late Stage: Due to the company's size and potential need for funding to expand into new international markets, the demand for capital rises during this phase. The intervention may occasionally be intended to achieve a listing on regulated markets.

The CV enables quick changes in strategic direction and quick adaptation to shifting market conditions, allowing the company to react more quickly to changing situations and circumstances and, in some cases, anticipate or even pioneer new technological development paths.

A crucial element of corporate venturing is corporate venture capital. CVC focuses on providing the company with access to concepts that spring from outside its purview. With the help of CVC investments, incumbents can connect with start-up

and venture capitalist networks and learn vital information about the causes and characteristics of impending technological shifts. As a result, CVC enables incumbents to address potential technological changes that could fundamentally alter their markets. Making CVC investments has two key advantages for businesses: organizational learning and social capital (V.K. Narayanan et al, 2009). CVC gives established companies the chance to observe and engage with various start-ups, enhancing their comprehension of the shifting dynamics affecting the market, technology, and competition. This could help incumbents to learn more about emerging technologies since start-ups frequently create new technologies and use them to create new markets. As a result, we can see how CVC and Corporate Venturing share several advantages, mostly those that are related to innovation and other strategic advantages. However, CVC differs from Corporate Venturing in some respects (Cipolletta, 2018):

- While VC activity is carried out by seasoned investors with the sole purpose of generating a return to pay their limited partners, CVC activity is promoted and managed by a company with strategic and/or financial goals.
- When compared to a VC vehicle, the internal branch/fund of CVC has access to resources that are of captive origin (the corporate has invested the entire amount of the fund).
- CVC does not have a predetermined and legally binding time frame. The VC fund, however, has a predetermined, legally binding, and fixed duration.

1.2.4. Corporate Venture Capital Objectives

Corporate Venture Capital activities have mainly two objectives: *"innovation"* and *"financial return"*. Respectively, we are talking about purely strategic objectives and purely financial objectives.

- **Strategic Objectives**: CVC activities allow the company to bring innovation to the search for new ideas or technologies, through the development of new products or processes, entering new markets, or strengthening its position within the current one. These activities enable the company to generate revenues and profits related to its business activities.
- **Financial Return:** Investors seek high financial returns through CVC investments, which significantly close the gap between the activity carried out by the invested company and the corporate venture capital investors. With this in mind, one of the main parameters for assessing the performance of CVC activity is the Return on Investments (ROI).

1.2.5. The Chesbrough's framework

In order to analyze these types of investments, Henry Chesbrough conducted a number of widely used studies and works for Corporate Venture Capital, which are still widely used today. The most well-known and popular one in particular is referred to as *"Chesbrough's framework"*.

According to the above-mentioned model, developed (Chesbrough H., 2002) it is possible to describe CVC, analyzing two main dimensions:

- The **Corporate Investment Objective**, which depicts the two main strategic reasons behind a CVC activity, which are *strategic* and *financial*
- The **Link to Operational Capability**, which on the contrary can be *tight* or *loose*

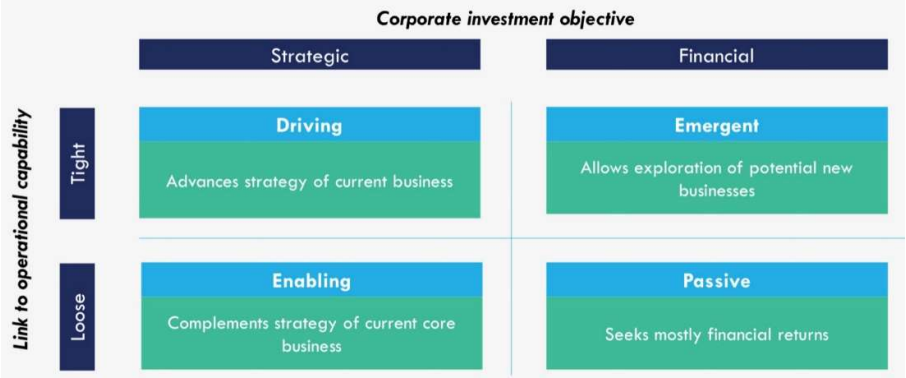

Figure 8: The Chesbrough's Framework (Henry W. Chesbrough & James, 2002a)

The primary goals of the Strategic Objective are to maximize potential connections and synergies with the target company, to enhance current performance, or to broaden and extend its scope. Instead, with a Financial Objective, the target appears to be a good opportunity to get a quick return on the investment, regardless of the industry or nature of the activity (Chesbrough H., 2002). The second dimension concerns the extent to which the investing company's resources and business procedures are connected to those of the target company. Delving more into details, about the four main ways to invest:

- **Driving** [*Tight link to operational capability, Strategic investment objective*]:

In this case, the investment is made for strategic reasons and in a way that is connected strategically to the company's current business model, knowledge, and market footprints. The primary goal is to strengthen the parent company's current business model. A strategic logic and close ties between a start-up and the operations of the investing company define this type of investment. Because of their close relationship, the investor may be able to strengthen their current business while reducing risk by integrating the target more quickly with their core goods and services. There are limits to what leadership investments can accomplish, despite the fact that many of them can advance a business strategy. These investments will

support the current strategy because they closely align with a company's existing processes. When a company needs to go beyond its current capabilities to respond to an environmental change, they are unlikely to help it deal with disruptive strategies or spot new opportunities (Chesbrough H., 2002).

- **Emergent** [*Tight link to operational capability, Financial investment objective*]:

Although the target in this case is directly related to the investor's current business, the overarching objective is primarily an economic return. This new venture could, however, unexpectedly turn out to be strategically valuable if the business environment or the company's strategy change. The company making the investment sees in the target a huge opportunity to take advantage of for a financial return by utilizing his expertise and knowledge of his market and the technology of the sector. In addition to the financial goal, this type of investment also offers the chance to view emerging technologies and opportunities. These investments are also essential for anticipating market and industry trends and acting swiftly to modify and adapt the company's strategy. A strong operational connection between a business and its start-up can also take many different forms, like sharing technology (Chesbrough H., 2002).

- **Enabling** [*Loose link to operational capability, Strategic investment objective*]:

This kind of investment does not strictly couple the company with its operations; instead, it underwrites an investment primarily for strategic reasons. The strategic objective is still clearly present, but from a variety of angles, including industry and/or product and service types, the investor and the objective are quite apart. Here, a company can take advantage of this idea by using its venture capital investments to encourage the growth of the ecosystem in which it operates. This ecosystem is made up of suppliers, clients, and developers from outside the company who produce goods and services that increase demand for the company's

offerings. Enabling investments also have their limits. They will only be justified if they can capture a substantial part of the market growth they stimulate (Chesbrough H., 2002).

- **Passive** [*Loose link to operational capability, Financial investment objective*]:

According to the last investment typology, the businesses that the parent company invests in are only tangentially related to its operational capabilities and unrelated to its strategy. As a result, the company lacks the resources necessary to use these investments to actively advance its business. In-depth analysis reveals that the parent company only seeks to realize a capital gain and lacks any strategic goals.

Chesbrough (2003) concluded his analyses by noting that spin-offs with CEOs who were insiders of the parent were associated with lower financial performance than spin-offs with a higher percentage of venture capitalists on their boards.

1.2.6. Relevant Factors

The benefits of CVC depend on the internal and external environment in which incumbents invest their CVC funds (Sahaym et al., 2010). There have been numerous studies that have questioned the primary variables influencing the phenomenon of corporate venture capital. Those studies treated mostly three factors: the company, the industry, and geography.

1.2.6.1. The Company

The first element to consider is connected to every aspect of a company. Size, age, ownership, culture, ethics, and level of internationality are just a few of the traits that, in different ways, can influence a company's decision regarding an investment and, consequently, CVC investments.

1.2.6.2. The Industry

One of the most fascinating areas of research to explore in order to comprehend the phenomenon of CVC investments is the industry environment. Regarding corporate venture capital investment, various industries display wildly disparate figures (Sahaym et al., 2010). The amount of technological change the industry is experiencing, according to Sahaym et al. (2010), has an impact on the volume of corporate venture capital investments. In fact, increased corporate venture capital activity follows higher levels of technological change in an industry (Sahaym, Steensma, & Barden, 2010). However, rapid technological advancement creates more technological opportunities, which frequently translate into higher financial returns (Dushnitsky & Lenox, 2006).

1.2.6.3. The Geography

Last but not least, geography is a relevant factor that may strongly affect the phenomenon of CVC. Numerous studies have demonstrated how strongly the investor's country of origin and all factors unique to that region can affect both the choice of the target and the long-term success of an investment (Coval & Moskowitz, 2001; Dunning, 1998). Indeed, the investor's location can significantly alter the intertemporal characteristics, value, and pay-out structure of dividends (John, Knyazeva, & Knyazeva, 2011). This also has to do with market knowledge and skills. A better understanding of the possibilities and variables that affect local realities, for instance, can help the focus on local investments minimize risks and lessen uncertainty (Landström & Mason, 2007).

1.2.7. Corporate Venture Capital Different Perspectives

Through the use of various viewpoints, researchers have thoroughly examined Corporate Venture Capital. Specifically, according to Drover (Drover et al., 2017), there are three main levels to consider: *Individual, Organizational,* and *Market Level*.

- Individual Level: Due to a lack of data and a focus on the dynamics of the predominate organizational level in the business context, there have not been many studies on CVCs at the individual level. According to Dokko and Gaba (2012) and Hill and Birkinshaw (2014), the primary topics to focus on are those pertaining to CVC personnel and their career paths, as well as the mindset and investment philosophy of corporate venture capitalists. Dushnitsky and Shapira (2010) also looked into the impact of individual compensation plans on prospective investing behavior.
- Organizational Level: Research on this topic has been divided into four main categories: studies that focus on the factors that influence CVC decisions, studies that analyze the structure of the CVC unit itself, studies that analyze CVC results, and studies that analyze CVC from the standpoint of the firm receiving the investment.
    a. **Antecedents**. A company must carefully consider and research both economic and behavioral factors before making a CVC investment. CVC investment can be seen as a component of a firm's ideal innovation strategy, where firms compare the marginal innovation output of CVC activity to that of internal R&D, according to research by Dushnitsky and Lenox (2005a). It is discovered that both firm-level resources, such as absorptive capacity and cash flow availability, as well as industry-level factors, such as technological ferment and patenting activity, the role of complementary activities, and the intellectual property regime,

actually stimulate CVC activity. Furthermore, Tong & Li (2011) claim that when faced with high exogenous uncertainty, such as when market uncertainty is high, a firm is more likely to engage in CVC activity than M&A activity. Additional research (Gaba & Bhattacharya, 2012) revealed that a firm is less willing to start new CVC initiatives or maintain current ones when innovation performance is higher than expected levels. The opposite is also true when performance is lower than the predicted value: a firm is less willing to launch a CVC unit.

b. **CVC Unit**. This classification describes CVC activity as being based in a specific area of the company. Goals, structure, personnel, and wages are the four aspects of this unit's operations that have been studied in previous work. It will not be thoroughly discussed here because the objective of corporate investors received considerable attention in early studies. According to studies (Dushnitsky & Shaver, 2009; Hill et al., 2009), CVCs also differ depending on the structure of the unit, the people it employs, and the kind of incentives that are in place. Additionally, there may be significant variation in CVC structures. There are primarily two options: the first is that the CVC unit follows VC funds. The second kind of CVC, on the other hand, is integrated into a business unit and is responsible for generating funding and application approval on a deal-by-deal basis. With strategic deals, where achieving financial results is not the main goal, such a structure is more effective.

c. **Outcomes of CVC Investment**. Investments in CVCs can affect the outcomes of innovation projects and financial performance by interacting with a company's alliance and acquisition activities. The best methods of innovation contribution to target partners in related

industries are CVCs, strategic alliances, and joint ventures. Furthermore, a comparison between companies that invest in CVCs and those that do not reveals that the former generate higher innovation rates (Dushnitsky & Lenox, 2005a). The ability of the unit to create and maintain strong relationships both internally and externally is crucial to success because, in this sense, CVC relationships are closely linked to early recognition of developing technological discontinuities. Additionally, there are advantages to having close ties with CVC firms and VCs. These advantages include access to lucrative investment opportunities and the chance to learn about various investment strategies. Last but not least, the performance of CVC units can show a variety of outcomes; many CVC units have negative returns, while very few of them have very high returns. In-depth, companies that choose to take part in CVC for strategic reasons contribute more to the parent company's financial performance. On the other hand, companies pursuing objectives comparable to those of the CVC run the risk of hurting the parent company's financial performance.

d. **Start-up's Perspective & Performance**. It is crucial to consider start-ups from their point of view in order to further investigate this phenomenon. Studies (Dushnitsky and Shaver, 2009) have shown that choosing to invest with an industry incumbent is not a simple decision. It is true that a CVC investment generally has a number of advantages, but it is also possible that the business will attempt to copy the invention. Specifically, it can happen when 1) the two are potential competitors in the same industry and 2) the industry's intellectual property regime is weak. As a result, entrepreneurs may forgo corporate venture capitalists altogether and seek funding from a

venture capitalist. Additionally, it has been discovered that situations where there are imitation concerns make CVC investment less likely. Because of this, when two start-ups offer complementary goods or services, they are typically more willing to collaborate with their corporate investor without adopting relationship guarantees. As a result, we observe that a beneficial CVC effect is more pronounced when the start-up is well-positioned to benefit from the company's complementary activities.

- Market Level: Market-level CVC research focuses on the broader trends and outcomes of CVC investment activity. According to the research, CVC has exhibited highly cyclical patterns over the past 50 years in terms of both the total amount of investments made and the number of companies that participate in CVC. When looking at CVC as a whole, researchers have demonstrated (Sahaym et al., 2010) that higher total R&D spending within an industry is linked to higher investment in CVC within that industry. In fact, CVC is increasingly spreading around the world, with many influential CVC investors based outside of North America or Europe. Many companies are choosing to implement CVC not just as a way to forge solid bonds with the outside world but also as a means of achieving high financial returns. Researchers have discovered that businesses located in nations with developed early-stage investment markets are typically more willing to use CVC, and that the popularity and growth of CVC funds is another factor influencing CVC adoption. The degree of internationalization has been shown to be relatively unaffected by local circumstances.

1.2.8. Corporate Venture Capital in Europe

Europe has produced 36% of the world's active start-ups over the past ten years (Foderi, 2021). When compared to the United States, which has 45% of all active start-ups, this number is significant. However, only 14% of "unicorns," or companies with a market value of over $1 billion, are based in Europe, as opposed to 50% in the US.

Three factors make it difficult for start-ups in Europe to succeed: the fragmented market, which makes it challenging to manage the many laws, languages, and cultural norms; the difficulty of obtaining funding because most investments come from governments and large corporations; and, finally, the talent shortage because starting a business is still viewed as a risky and unattractive career path compared to other options (Foderi, 2021). Collaboration with large companies, which can act as catalysts to speed up access to investment and the end-user market, is one of the things that might help start-ups in Europe overcome growth barriers. However, a strategy for success must be established, as well as an interaction model that works for both parties, can be applied broadly, and is long-lasting. According to a recent study by Stryber (2021), it is possible to analyze different trends that are affecting CVC investments in Europe (Onetti, 2021):

1. **Few but large operations**

Companies are investing more money, but fewer deals are being done. Less deals were closed this year than they were in the first and second quarters. Therefore, growth is not evenly distributed but is instead driven by a few outliers (primarily the $800 million raised by Messagebird and the $650 million raised by Wefox).

2. **Lower growth than industry**

Although CVC investments are increasing, their growth is slower than that of venture capital investments in Europe. In fact, CVC investments decreased from 23% in Q1 2021 to 17% in 2021. (19 percent in the same period a year ago). This represents only about 5% of the total amount invested. Important methodological caveat: The statistics on investments do not accurately reflect the capital invested by CVCs and VCs, respectively; rather, they reflect the investments in which CVC funds participated, as opposed to those made solely by VCs. As a result, companies' actual capital investments are much lower than reported (probably less than one third of the reported amounts).

3. **Considering the world market, the bulk of investments come from American companies**

The stars and stripes continue to make their mark. In the second quarter of 2021, GV, Second Century Venture, and Salesforce were involved in 18 deals, which was more than the top ten European companies combined. Most start-up acquisitions are made by US companies, which is also true on the M&A front. As a result, it can be said that corporate venture capital is undoubtedly growing in Europe, albeit at a slower rate than it is in the US market.

1.2.9. Corporate Venture Capital in USA

Over time, there has been an internationalization trend in the venture capital industry. The number of international transactions is steadily increasing, and by the early 2000s, about half of the investments involved foreign parties (Aizenman & Kendall, 2012). It is becoming more and more clear that Europe is a desirable ecosystem for foreign investment funds, particularly US-based ones that seek out high returns and overseas investment opportunities.

Corporate venturing establishes roots in the American market with both financial and strategic goals of external innovation. Large, well-established American businesses began engaging in CVC activities in the middle of the 1960s. They mainly competed with VC firms that had been around in the US since 1948. The majority of the new CVCs were established during periods of favourable capital market developments (Fast, 1978; Gompers and Lerner, 1998). The majority of corporate venturing initiatives in the US were economically unsuccessful because they were unable to meet their financial and strategic goals. Many US CVCs were shut down only a few years after they were established because they failed to produce a significant enough business flow or foster technology transfer to the parent company (Rind, 1981; Hardymon et al., 1983).

1.2.10. Corporate Venture Capital and Technological Discontinuities

Top managers need to properly address the significant and practical challenges posed by technological discontinuities. These discontinuities, which frequently occur at an industry's periphery, are typically caused by creative, frequently venture capital-backed start-ups that reshape existing markets and produce novel goods in ways that are challenging for veteran managers to comprehend considering their pre-existing cognitive schemas. The very survival of incumbents, however, may be threatened by a failure to recognize and embrace successful technological discontinuities. Top executives typically concentrate on information coming from well-known sources, such as current alliance partners or rival companies (Peteraf and Shanley 1997; Porac et al. 1995). Managers frequently interpret data using pre-existing heuristics, cognitive frames, and knowledge categories based on prior experience due to time constraints (Barr 1998, Barr and Huff 1997, Barr et al. 1992, Leonard-Barton 1992, Levinthal and March 1993).

When it comes to specifics, a sector may encounter radical innovation or incremental innovation (Ettlie, Bridges, & O'Keefe, 1984). If incremental innovation is taken into account, it only entails minor upgrades or modifications to the state of technology (Dewar & Dutton, 1986). A radical innovation, on the other hand, signifies a revolution in modern technology and a significant shift from accepted practices (Duchesneau, Cohn, & Dutton, 1980). To this extent, technological evolution can be viewed as an incremental process with brief periods of discontinuity caused by revolution (Tushman & Anderson, 1986).

In this sense, CVC investments have been used as a technology radar (Dushnitsky and Lenox 2006, Keil et al. 2008a, Siegel et al. 1988) that helps to capture emerging technologies and related business models that will play a key role in the market. CVC can be helpful as well because it can provide crucial details about the direction of the sector (Maula, Keil, & Zahra, 2013).

CVC plays a special role in drawing top managers' attention to technological discontinuities and the business opportunities they present by establishing co-investments between them and high-level venture capitalists.

1.2.11. Corporate Venture Capital: Connections between Performances

The interrelationship between these performance outcomes across domains, in addition to how well CVC investments perform in various industries, is a crucial issue (Huang, 2021). In my quest to comprehend CVC performance, evaluating these relationships is the last step. I still don't fully understand how corporate strategic returns relate to other performance outcomes in CVC investments, despite the fact that corporate strategic outcomes are widely acknowledged as the main focus for initiating CVC investment (Drover et al., 2017).

To theorize the transmission path of performance outcomes in CVC investments, we combine three mechanisms, including learning, complementary assets, and investment, according to a temporal logic. Each of these mechanisms hypothesizes a slightly different (but not necessarily exclusive) path leading to performance domain outcomes (Huang, 2021).

1. **Learning Mechanism**

Learning benefits in the strategic domain may be salient enough to motivate CVC involvement, even though achieving superior strategic outcomes might motivate corporations to invest despite financial risk (Hill and Birkinshaw, 2008) (Huang, 2021). First, an investor's financial return on CVC investments is influenced by their ability to learn from invested ventures, or their corporate investors' absorptive capacity (Benson and Ziedonis, 2009). A high level of absorptive capacity is indicated by the strength of externally generated knowledge and the capacity to access priceless information, which enhances a company's capacity to promote growth and value (Zahra et al., 2009).

Second (Huang, 2021), learning from CVC investments offers a competitive advantage that may increase longer-term financial value. Businesses can take advantage of existing assets, seize investment opportunities, and gain exclusive access to certain deal flow thanks to their improved performance outcomes in the strategic domain's market or technology aspects (Hill and Birkinshaw, 2008; Park and Kim, 1997). Corporate investors' valuation skills can be improved by the experience gained through the "learning by doing" process, which results in more accurate equity evaluation (Yang et al., 2009).

2. **Complementary Asset Mechanism**

We concentrate on the provision of complementary assets from investing corporations in terms of value manifestation from corporate strategic outcomes to venture outcomes (Huang, 2021). Early research has demonstrated that corporate information can be used to their investment venture. More recently, it has been discovered that providing specific complementary assets by corporations to new ventures is especially advantageous (Park and Steensma, 2012). These particular complementary assets include companies' superior market and technological knowledge, reputational advantages, and better use of hazy startup data (Alvarez-Garrido and Dushnitsky, 2016).

The commercialization process could be accelerated and performance in the venture domain ultimately improved once investing corporations have gained a better understanding of the invested technologies and market. The specific complementary assets offer ventures advantages that cannot be accessed otherwise thanks to investing corporations' inherent industrial insights and pertinent technology. Therefore, when corporate investors are better able to utilize the available information and technology in CVC investments, the venture domain will perform better.

3. Investment Mechanism

Although the strategic domain initially provides the incentives for CVC investment, CVC ultimately results in financial domain performance outcomes (Huang, 2021). Venture performance further determines corporate financial returns while being influenced by corporate strategic performance. Through exit strategies like initial public offerings and sales to third parties, corporate investors can earn financial returns (Gompers et al., 2009). However, the current literature is unclear about the returns that corporate firms get from successful entrepreneurial ventures. According to logic, the outcome of the promoted venture performance should

improve corporate financial performance. However, when the ventures have higher overall performance, demonstrating high strategic value, the central role of strategic incentives could imply a lower financial expectation for corporate investors. First, as corporate investors compete for better performing ventures, there frequently is a price premium. CVC programs have long faced criticism for overcharging investors compared to IVCs for their investments (e.g., Gompers et al., 2009). Corporate investors may be willing to give up some financial revenue because the strategic outcome is their main objective in attracting those ventures. Second, it lessens the interest of other prospective buyers when the venture greatly benefits from its partnership with CVC parent. In order to support acquisitions of their portfolio companies, CVC investors typically have strong incentives (Masulis and Nahata, 2011). As a result, they might be willing to accept a lower offered price even if it is not financially advantageous. The frequent interactions among CVC investments have a negative impact on bidding competition and lead to potential buyers of portfolio ventures offering a discounted price. Third, high-performing businesses might establish a new market that could unsettle corporate investors. Intense 35 competition emerges as businesses race to take advantage of new technologies at the technological frontier, where corporate firms try to foster entrepreneurial endeavours (Chen et al., 2017). When considered as a whole, the justification for CVC investment suggests that corporate investors may suffer financial losses if the venture performs better.

1.2.12. Organizational Structure of Corporate Venture Capital

In the current literature, many papers discuss the organizational structure of CVC programs. While some authors emphasize autonomy (Hill et al., 2009; Teppo &

Wüstenhagen, 2009) and cultural aspects (Teppo & Wüstenhagen, 2009), a largely neglected topic relates to the view of CVC within organizational boundaries.

One of such was the initial analysis of various organizational arrangements of CVC units by Hill and Birkinshaw (2008). In addition, Hill and Birkinshaw (2014) connected the general orientation of CV units to their survival rates by drawing on the well-established interaction of exploration (developing new capabilities) and exploitation (using current capabilities).

According to the findings, CVC units that take an ambidextrous approach by using CVC as a tool to simultaneously investigate and exploit capabilities have a greater survival rate than those that have a definite emphasis. These units are frequently distinguished by a high degree of communication with all stakeholders, including top executives, business units, and investors. Furthermore, Souitaris et al. (2012) study how brand-new organizational units, like CVCs, balance conflicting influences from two distinct institutional settings. Organizational structures for CVC units may be centred on the IVC sector or on their corporate parents. Staffing choices and the legitimacy the CVC units seek have an impact on the path the unit prefers. CVC units that are endomorphic to their parents' norms (command-like communication, focused decision-making, established and documented processes, and a clear division of work into distinct jobs) are more likely to acquire mechanistic structures. A consultative communication style, flexible and unwritten processes, widely dispersed decision-making, and overlapping roles are often characteristics of CVC units that match with IVC (i.e., Independent Venture Capital) industry standards. Souitaris et al. (2012) were unable to connect the idea of isomorphism to performance because of the sample size of just six examples, which is comparatively small. The organizational structure also establishes how the performance of the

CVC is evaluated. How businesses gauge CVC performance and respond to failures is a concern noted by Teppo and Wüstenhagen (2009).

Corporate Venture Capital Staff and Emoluments

Only a few of the publications that have been published touch on the significance of factors that are connected to people, including staffing the CVC unit and paying investment managers, in the CVC arrangement. For instance, the duration and effectiveness of such CVC projects depend greatly on personnel decisions, as well as on the career experiences of CVC managers. Gaba and Dokko (2016) discovered that placing a staff manager in charge of a CVC unit who has extensive firm-specific experience with the corporate mother can be harmful because internal hires find it difficult to develop the depth of knowledge required to comprehend the value of CVC practices for the firm.

Additionally, internal employees frequently overlook financial goals since they see CVC investments as the main means of delivering strategic advantages to the corporate mother. On the other side, adding managers with IVC experience to a CVC unit may lengthen the life of the CVC investment.

Dokko and Gaba (2012) also looked at how much practice variance was influenced by people's work experiences. The realization that people who implement and manage chosen practices from the IVC industry also play a crucial role in the interpretation and translation of such practices in the corporate setting served as the impetus for this study.

According to the findings, CVC units with managers with IVC expertise tended to follow the standard procedures from that environment to leverage financially focused aims through investments in early-stage businesses. Additionally, CVC units that are staffed with managers that have prior engineering and firm-specific

experience prioritize strategic benefits above financial ones and are more likely to participate in later-stage enterprises.

Beyond the personnel issues, a developing area of study in the governance-related research stream is the remuneration of CVC managers. While Dushnitsky and Shapira (2010) discovered data suggesting that the compensation plans utilized by CVC vehicles may have an impact on a CVC unit's overall performance, other writers demonstrated that the deployment of an IVC incentive plan may also have unfavourable effects. For instance, Hill (2009) point out that using high-powered equity-based remuneration to reward and incentive managers has a favourable impact on the financial success of the CV unit, but surprisingly does not encourage strategic performance.

1.2.13. Corporate Venture Capital: Operational Models

Based on the literature on the topic of CVC, three main models can be identified in which Corporate Venture Capital activity can be structured: "*Balance Sheet*", "*GP Model*" and "*LP Model*" (Askew, 2021) (Cipolletta, 2018).

- ***Balance Sheet Model*** (i.e., *Corporate/Direct Investment*): the model envisages a direct investment in the start-up by the company, without setting up an ad hoc vehicle; this activity is managed by a team of internal corporate resources. Hence, in this type, Corporate Venture Capital investments are made directly by the investing company, using internal budget, structure, and capital allocation processes (Cipolletta, 2018).
- ***GP Model*** (i.e., *Internal Dedicated Fund*): the model benefits from a greater degree of decision-making and strategic autonomy despite being a vehicle totally of captive origin. In this case, the activity is carried out by a team

composed of a combination of resources from the company and from venture capital funds. Therefore, the investor is a general partner of a captive venture capital fund that makes the deal, in which the company retains strong, if not complete, control over strategic decisions (Cipolletta, 2018).

- ***LP Model*** (i.e., *External Fund*): the company in this case is configured as one of the investors (Limited Partner); the management, in this context, is entrusted experienced venture capital investors, possibly supported by corporate resources for a temporary period. So, the company is a limited partner of an external venture capital fund, i.e., it invests but does not influence strategic choices. This last model, although it does not perfectly meet some definitions in the literature, may represent a company's first step towards CVC, functional to lay the foundations to be able to carry out this activity in the best possible way. This allows, in fact, to develop venture capital skills and competences internally, while market dynamics and the 'rules of the game' are understood, as well as allowing the share the deal flow of the invested fund (Cipolletta, 2018).

Delving into details, it is possible to summarize the main Purpose, Structure, Talent, Success measures, as well as some practical examples, of the three above-mentioned Operating Models.

Table 1: Operating Models (Source: BVCA - Guide to CVC)

	Balance Sheet Model	***GP Model***	***LP Model***
Purpose	Gain direct business and technology experience in emerging areas	Emerging business and technology with more autonomy for step out options	Develop internal VC capabilities whilst gaining market awareness and understanding
Structure	Direct investment, funding each deal, closely related to business divisions and future business opportunities	Corporate acts as LP in a 100% captive fund and has a greater fund autonomy	Decision on investment GP is evaluated in fund parameters
Talent	Internal corporate talent	Mixture of external VC hired and internal corporate talent	Experienced VCs and potential secondees from corporate
Success measures	Measurement of direct strategic inputs	Primarily financial with a level of strategic exposure	Predominantly ROI (i.e., Return On Investment)
Examples	BP, Bosch, Panasonic	Unilever Ventures, Reed Elsevier Ventures, Bloomberg Beta	Siemens Venture Capital (SVC), Physic (Unilever)

1.3. Corporate Venture Capital in the Energy Sector

Teppo and Wüstenhagen (2009) discussed the key aspects of Corporate Venture Capital in the energy sector.

The most significant changes to energy systems occurred during a few decades, primarily around the year 1900 (Victor, 2018) (Dudley, 2017). Prior to spreading and shaking up contemporary economies, the internal combustion engine and electricity found specialized niches in wealthy industrialized cities.

New sources of energy led to new designs in urban planning and architecture (air conditioning and elevators made high-density living and working possible, even in hot areas), transportation (buses and vehicles were considerably cleaner than horses), and practically every major industry's production method. The global energy systems are susceptible to being swept away by an innovation tsunami. It has the potential to cause as much economic disruption and change as the shocks of electricity and oil did a century ago.

Although the magnitude and complexity of today's energy systems produce significant inertia, tsunami-like pressures have the potential to quickly upend enterprises and significantly alter the outlook for how energy systems will affect emissions and sustainable development.

Some companies predict that these strong waves will carry them into new markets. The predictability of the energy system has shrunk, while investor risks and opportunities have increased.

1.3.1. Design of Energy Industry in the Future

Nowadays, several patterns are starting to emerge. First, the century-long electrification process is probably going to continue and pick up speed (Victor, 2018). When flexibility and cleanliness are highly valued, as they are in cities, moving electricity by wire is extremely advantageous. Since it gradually becomes competitive to produce power with little or no carbon, pressure for decarbonization will probably speed electrification.

Second (Victor, 2018), as economies change in structure, efficiency rises, and economic development slows, the growth in overall energy demand is anticipated to slow. The majority of countries have made transitions to lower demand growth at rates that are surprisingly quick when you consider how infrastructure-intensive the energy system is. While there are some nations and regions where primary energy demand will continue to increase significantly, this is not what is most striking. Third, there are major issues with coal all over the world. Although there are some potential development areas, the industry is on the verge of contracting due to flattening demand in general. Oil still plays crucial roles in transportation and petroleum-based chemicals, which feasibly plateaus global liquid demand at levels not substantially greater than current levels. The major "wildcard" is gas, especially when used to generate electricity. The entire demand for gas might significantly increase with the correct technologies and regulations. Without them, markets aiming for significant carbon reductions will put pressure on traditional natural gas. Whether or not gas will be a transition fuel depends on technology. Although these patterns contain a lot of positive information, they may not always be consistent with the objectives that communities have set for their energy infrastructure. The ability of business and government to discuss these facts must significantly improve. Technological innovation could have a seismic impact on

how humanity consumes energy. However, it's still likely that advancements will fall far short of what society expects.

1.3.2. Less Predictability of the System

It is far more challenging to predict a system that is about to undergo a profound transition (Victor, 2018). These unpredictable circumstances present many causes. The energy value chain is first becoming decentralized, flat, and open in major portions. This transfers power and influence from established businesses and infrastructure to new competitors and even to consumers. Since many of those competitors are by definition hypothetical, it is challenging to predict how they will affect the system.

Moreover (Victor, 2018), system interactions are what have the biggest impacts on large-scale innovation. For instance, several power markets are experiencing significantly higher penetrations of wind and solar energy without much of an influence on overall cost, a result that reflects a number of reasons. Changes in business models that open up new sources of capital are among them, as are innovations in the materials and techniques used in solar and wind generators, in the management of complex stochastic power supplies, in the availability of more pervasive information to customers and grid managers, and in the creation of more responsive demand and storage. Each aspect is difficult to predict separately, but when combined, the interactions in these systems of systems cover the entire gamut. This helps to explain why current energy forecasts are so inaccurate about the uptake of new technologies.

The inertia of a large (size and capital intensity) system has also been emphasized by the energy sector as a source of stability and hence predictability (Victor, 2018).

That system, though, needs ongoing funding. Firms are reluctant to invest capital due to pervasive uncertainty. Similar hesitation to invest in expensive renovations has been witnessed in the power sector due to the grid's financing dilemma. The business models and legitimacy of the policies required for long-term investment have also been rocked by new companies and regulations intended to promote change. Chronic underinvestment may lead to more extreme price and behavioural cycles, deteriorating infrastructure, and more crisis-driven policymaking.

For the most part (Victor, 2018), these sources of deep innovation lie outside the energy industry's sphere of knowledge and forecasting expertise. They typically respond less quickly to the supply and demand variables that govern markets generally. The rapid development of information and communications technology, which is at the heart of the extensive changes currently underway, did not develop in response to fluctuations in the price of oil or electricity.

The fact that the most disruptive discoveries come from short-lived start-ups, whose survival in the race for money and market dominance depends, in part, on exaggeration that drives valuation, only makes the issue worse. It is challenging to predict which ideas will last in the disruptive innovation ecosystem, where everything and anybody claims to disrupt exponentially. The business model for this democratic, decentralized style of invention tends to produce a lot of idea churn and a few "blockbuster" success stories, just like it did for much of the Fourth Industrial Revolution. Success is frequently equated with foresight, although luck frequently has a bigger impact. The difficulty of separating the signal from the noise is made worse by some media outlets, which frequently and uncritically publish the claims of the new class of billionaires as fact.

2 Hypothesis Development

In addition to other business decisions, the company's investment decision is critical to validate the continuity of business operations. Corporate Venture Capital represents a new investment strategy that has found wide application in the past two decades. CVC is an investment strategy that involves the acquisition of minority shares in an entrepreneurial company by a corporate venture capital firm. As seen in previous chapters, it is an investment that mostly pursues strategic rather than financial objectives. Like all types of investments, in the case of CVC, the acquiring and target companies conduct assessments to understand the strategic and financial benefits they can gain from a given transaction. Therefore, several variables must be considered in this assessment context, from industry characteristics to individual company characteristics, from macroeconomic aspects to more operational ones. Without going into the details of the evaluation process, the following analysis aims to understand whether and how corporate venture capital investments are affected by certain macroeconomic variables.

As mentioned above, strategic goals take precedence over financial goals. According to A. Sahaym et al. (2010), one of the goals of corporate venture capital firms is the pursuit of innovation. Indeed, one of the reasons why CVC has become popular in the recent years is that it provides a means to spread investment for pursuing innovations across multiple new ventures. Now, innovation underpins the competitiveness of many companies in many industries. However, to innovate there needs to be the conditions that put companies in a favourable situation. Innovation requires certain investments from companies; it is an expensive process. Under unfavourable conditions, it is cheaper for companies to follow innovation than to innovate. Several factors undermine companies' ability to innovate. Usually,

innovation comes from small businesses, but in certain contexts they may find it very difficult to pursue innovative ideas, precisely because of unfavourable conditions. Think, for example, of a context in which the entrepreneur with an innovative idea is not protected and risks that his innovative idea will be used without rights by someone else. Obviously, this leads to entrepreneurs having little incentive to innovate, strongly reducing the level of innovation in that context. Without going into details, it is obvious that there are several innovation enablers and several obstacles. M. Johnsson (2017) identifies seven innovation enablers among which we find culture, education, and knowledge. Starting from the concept of innovation and enabling factors and obstacles, the goal of our research is to understand if there are factors that related to the concept of innovation can go into impacting CVC investments.

Country Development Level

The concept of CVC is strongly related to that of open innovation, and thus the use of external ideas to innovate. The level of innovation in a given country, however, depends on various factors, cultural and otherwise. Previous studies show a strong association between innovation and the country's level of economic development and growth. Entrepreneurs and companies move their capital to where it is easier to do business (Tukuoka, 2013), and thus to those emerging or fast-growing countries that can provide more opportunities. Along these lines, we need to think about the role of Corporate Venture Capitalists and how they seek innovation. Corporate Venture Capitalists do not always look for ready-made, ready-to-use innovations, but often invest with the goal of providing the resources necessary for entrepreneurs to develop highly innovative ideas that nevertheless require capital to be ready for market. Moreover, very often in emerging countries, innovation

comes from companies overcoming major technological and organizational gaps, and this often happens as more capital moves into a particular country. As a result, we expect that in a country with a higher rate of development and growth there will be more capital movement by Corporate Venture Capitalists because of the greater opportunities, in terms of innovation and beyond, that these countries present.

Hypothesis 1

The level of a country development and economic growth will be positively associated with the amount of capital invested by Corporate Venture Capitalist.

Country Educational Level

Again, starting with the concept of innovation, one can consider another country-level concept that could have impacts on CVC investments because of its strong correlation with innovation: a country's level of education. The concept of innovation and education are strongly correlated with each other. Education is the basis of innovation. Often, inventors are made, not born. Suzanne Scotchmer (1991) defined innovation as a cumulative process in which knowledge is an input to innovation. Therefore, one of the prerequisites to produce high-quality innovative content is the ability to achieve a high level of knowledge and education. Just like innovation, education is also a cumulative process, and access to higher-level knowledge is based on access to education and basic skills in the early years of life. As a result, a higher level of education in each country would result in a higher level of innovation and consequently a higher investment appeal. In line with the above, Corporate Venture Capitalist seeking for innovation should look at those countries where the educational and knowledge condition, and consequently the level of

skills of the human capital, ensure higher opportunities in terms of progress and innovation.

Hypothesis 2

The educational level of a country human capital will be positively associated with the amount of capital invested by Corporate Venture Capitalist.

3 Methodology

In this section we will describe step by step the methodology we followed to conduct our analysis. After a careful review of the literature on Corporate Venture Capital, we developed the hypotheses outlined in the previous chapter. To evaluate our hypotheses, we built a database on CVC investments and collected some variables that we found useful for our purposes. This chapter will be structured as follows. We will begin by providing an overview of the research context, examining the main challenges faced by Corporate Venture Capitalists and the energy industry over the time frame we analyzed. This overview will be helpful in clearly defining our research question, understanding what our **exploratory** analysis intends to highlight. Then, we will provide a brief description of the process of data collection, highlighting the data sources, the time frame considered and other aspects of our final database. Following to this, all the variables categorized by dependent, independent and control variables, are presented with a brief description of each one. Finally, we will explain the model used for our **explorative** analysis.

3.1. Research Context

3.1.1. Macro Determinants of CVC and Research Question

Prior to deepen the factors and variables that influence corporate venture capital intensity across nations, it is crucial to review why it is challenging for CVC-backed companies to obtain traditional financing. Uncertainty, asymmetric information, the intangibility of firm assets, and the circumstances in the pertinent financial and product markets are the four main factors that restrict a young company's ability to

obtain financing (Gompers and Lerner 2001). The uncertainty will be high if investors find it difficult to predict whether the company will succeed in the future. It will be challenging to convince risk-averse investors to fund projects with high levels of uncertainty, which affects both the capital contribution and the timing of investments. When an entrepreneur has more knowledge of the company than investors, asymmetric information develops.

Entrepreneurs may act in ways that investors cannot see, which could have an adverse effect on investors. Asymmetric information may also result in an adverse selection problem, where investors find it challenging to distinguish between entrepreneurs and projects that are efficient and those that are not. The third factor is the intangibility of company's assets. If a company does not rely on physical assets and its assets are mainly intangible, it may be more challenging to find financing for company's projects. Lastly, market conditions play important roles in the rigidity of financing companies. At this point, CVC firms emerge as financial intermediaries to bring lenders and borrowers together where adverse selection, asymmetric information, uncertainty costs exist.

On the macro-level factors that determine CVC, very few articles have so far centred on them. The first author to theorize the changes in supply and demand for venture capital investment was Poterba (1989). He contends that numerous financial changes could result from shifts in the supply or demand for venture capital. Similar to this, Poterba has given special consideration to the effects of changes in the capital gains tax rate (Poterba 1989). According to Poterba, since venture capital funds come from tax-exempt investors, they are impacted by changes in capital gains tax rates. Poterba also discusses this effect, noting that it doesn't affect the funders but rather encourages employees to start their own businesses, increasing the demand for venture capital.

Gompers and Lerner found, using the Poterba (1989) model, that lower capital gains tax rates have a significant impact on the volume of venture capital investments made. On the other hand, institutional investors are prone to over or underinvest in markets like venture capital, according to Jensen (1991) and Sahlman and Stevenson (1986). They discuss how the variations in fundraising can be explained by this irrational pattern of investing. Additionally, they argue that these differences may cause the American economy's entrepreneurship to lag.

After this introduction and after a thorough analysis of the literature review, several interesting aspects emerged. In particular, it emerged that there are few studies concerning CVC that analyze in detail the impact of macroeconomic variables on CVC.

Hence, the scope of the present dissertation is to examine, investigate and draw conclusions regarding the correlation between the macro-economic factors and Corporate Venture Capital deals.

3.1.2. CVC Emerging Challenges Linked to CVC Macro Determinants

In order to properly deepen the linkages between CVC investments and Macro-Economic factors, it is pivotal to understand which are the emerging challenges for CVC.

Investments in corporate venture capital (CVC) are typically beneficial to both parties: the venture receives funding and has access to the corporate investor's production facilities, knowledge, sales networks, and reputation. In addition to receiving a financial return on its investment, the corporate investor has access to the venture's innovations, employees, and distribution channels. CVC units are

under pressure to adapt due to the difficulties of cost cutting, increasing competition from private equity investors, and now the Covid-19 pandemic.

In these hard times, CVC units are up against fresh obstacles that come from both inside and outside of their own organizations. They frequently have to defend their "right to exist" internally. This can be challenging because the effects of CVC investments are frequently strategic rather than purely financial and frequently only become apparent in the medium to long term. The interests of the various stakeholders within the organization can present challenges for CVC units. Additionally, it may be challenging to keep up with changes in the company's priorities and strategic agenda as the average tenure of C-suite employees is decreasing.

External elements also pose difficulties. Private equity investors are moving toward smaller ticket sizes and earlier-stage deals while corporate investors are increasing the size of their investments and shifting their focus to later-stage deals. Their areas of interest become overlapping, and there may even be direct competition for the same start-ups as a result. At the same time, the Covid-19 pandemic has put companies under increased cost pressure and reduced their appetite for risk. Companies that manage investments have had to learn how to identify potential investment targets, conduct due diligence, and communicate virtually rather than in person with new ventures. In some instances, this has forced businesses to revaluate their entire approach to innovation.

3.2. Data Collection and Sample

In the previous chapter, we saw the main challenges faced by Corporate Venture Capitalists and the energy sector. We then highlighted the objective of our research, which is to conduct an exploratory analysis to understand whether there is a clear

link between macroeconomic variables and CVC investments, with a focus on the energy sector. The choice of the energy sector is mainly related to the fact that in the energy sector, the CVC phenomenon has found wide application over the years and has often been used to manage challenges, such as market instability, which is affected by disruptive forces such as increasing sustainability and local content requirements. Therefore, we needed data on CVC operations in the energy sector over a specific time frame. We chose the years 2018 to 2020 as the time frame. The choice of this time frame is due to the very purpose of the analysis. In fact, many events occurred during this period. For example, the U.S.-China trade war, Brexit, and the Covid-19 pandemic. Therefore, this period is significantly influenced by macroeconomic and political issues. Therefore, it is an ideal period for our research because it is strongly influenced by significant events in macroeconomic terms that may have affected Corporate Venture Capitalists' investments. Therefore, to collect data on CVC transactions from 2018 to 2020 in the energy sector, we searched Crunchbase for minority equity investments in the energy sector over the specified time frame.

CrunchBase was founded in 2007 by Michael Arrington and is now a platform for learning about corporate data from private and public companies. It offers intelligent prospecting software based on current corporate data. Materials include information on investment and financing, founding partners and people in leadership roles, mergers and acquisitions, news and market trends. The Crunchbase website, originally created to monitor start-ups, provides data on public and private companies around the world.

CrunchBase is one of the best software for collecting data on CVC deals because, as mentioned above, it provides a wealth of information on investments and funding rounds related in particular to start-ups. Crunchbase provides numerous details

about a particular deal. However, we have selected only the information that we found significant for our analysis and will examine in the next section.

Totally, we collected 156 deals among 23 different countries.

Therefore, the information collected with Crunchbase was transaction-based. However, for the purpose of our analysis, we needed to collect some macroeconomic variables. These variables were collected by consulting: the OECD and the IMF.

The **OECD** (Organization for Economic Cooperation and Development) is an international economic studies organization for its member countries, developed countries that share a market economy. The organization mainly plays the role of a consultative assembly that provides an opportunity to compare policy experiences, solve common problems, identify business practices and coordinate local and international policies of member countries.

The **IMF** (International Monetary Fund) was established in 1944 following the Great Depression of the 1930s. The 44 founding member countries sought to build a framework for international economic cooperation. Today it has 190 members and staff from 150 countries. The IMF is governed by and accountable to these 190 member countries on a near-global level. By accessing the IMF website, various macroeconomic data on a wide range of countries can be collected.

After having collected all the data we considered useful for our analysis, we arranged all the data on an Excel file to build our own database to be used as input for SPSS Statistics by IBM (i.e., the statistical software powered by IBM we used to run our analysis).

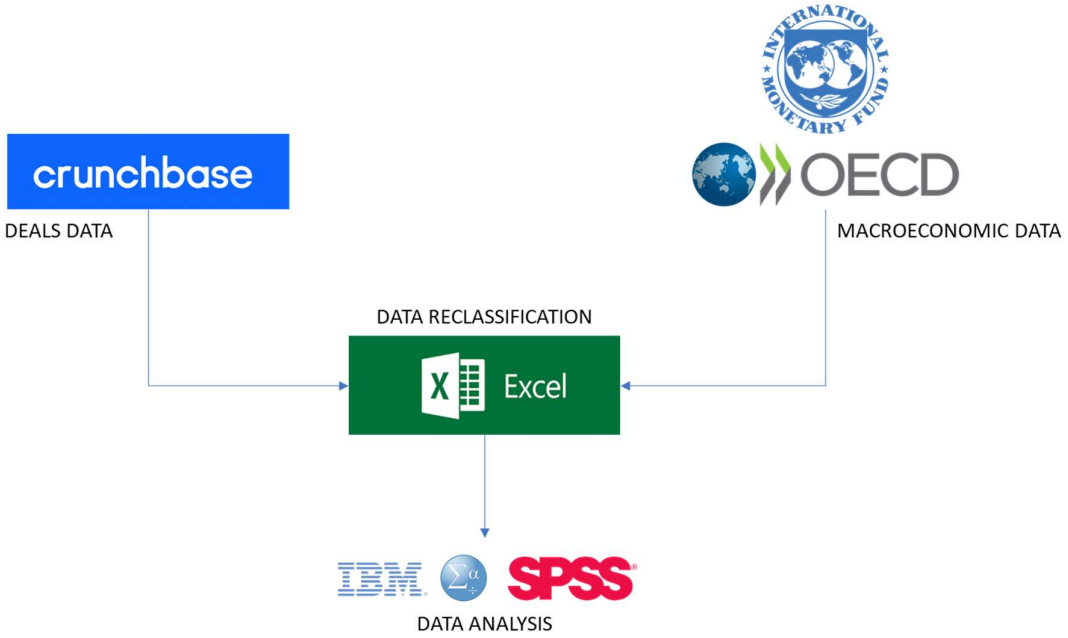

Figure 9: Software/Tool used

3.3. Variables

In this section, we present the variables we selected per each deal, and the macroeconomic variables we considered useful. This section will be divided according to the role of each variable, distinguish in between dependent, independent and control variable. After presenting such a classification, we introduce other variables that were used just to build our final database on Excel.

3.3.1. Dependent Variable

Given the motivation for our research question and our theoretical framing, our dependent variable is the **Deal Size**, such as the amount of funds raised by the target company in each deal. The data related to the Deal Size are in million US Dollars and all the other variables have been gathered keeping million USD consistent.

3.3.2. Independent Variable

The independent variable we used to test our hypotheses are two macroeconomic variables, such as:

- **GDP** (i.e., Gross Domestic Product), and
- **EAR** (i.e., Educational Attainment).

The former has been defined by the International Monetary Fund as follow:

"GDP measures the monetary value of final goods and services—that is, those that are bought by the final user—produced in a country in a given period of time (say a quarter or a year). It counts all of the output generated within the borders of a country. GDP is composed of goods and services produced for sale in the market and also includes some nonmarket production, such as defense or education services provided by the government."

Therefore, we used the GDP as measure of the **Country Development Level.** Indeed, the developed countries are the one with higher GDP.

Regarding the EAR, it has been defined by OECD as an indicator that examines adult education level, which is determined by the highest level of education the population aged 25 to 64 has attained. There are three levels: upper secondary, tertiary education, and education above upper secondary. Lower secondary education is typically followed by upper secondary education. Basic education is completed by lower secondary education, typically in a more subject-focused manner with more specialized instructors. The indicator is expressed as a percentage of people who are the same age, and data for tertiary and upper secondary education are also gender specific.

The EAR has been used as measure of the **Country Educational Level**.

Both the independent variables are country-based and as reported in the next chapters, they will be used to test our hypotheses looking at the impact they may have on the Deal Size of CVC transaction.

3.3.3. Control Variables

A **control variable** is anything that is held constant or limited in a research study. It's a variable that is not of interest to the study's aims but is controlled because it could influence the outcomes (Bhandari, 2022). Below, we report our control variables:

- **Type of fund**, refers to the different operational model of the CVC investor. As seen in the previous chapters, there are three different operational models, such as Balance Sheet, General Partners and Limited Partners.
- **Strategy**, refers to the four different strategies outlined by Chesbrough's framework that are Driving, Enabling, Emergent and Passive.
- **Syndication**, refers to the kind of partner a CVC investor invest with. As concern our dataset, the CVC investor can pursue either a stand-alone investment or with other corporate or financial entities.
- **Number of Investors**, refers to the number of investors that participate in a certain deal.
- **Funding Round**, refers to the different round of funding that start-ups go through to raise capital.

3.3.4. Other Variables

In this section we present some basic variables that have been used just for the purpose of building our final database.

Table 2: Other Variables

Variable Name	Definition/Use
Announced Date	Such a variable has been useful to identify the year in which a certain deal occurred. This is core in our analysis since the Macroeconomic variable may be affected by substantial variation.
Target Name	Such a variable refers to the name of the company that is raising funds.
Target Country	This variable refers to the country in which the target company is based. This variable proved useful in assigning the respective macroeconomic variables to each transaction.

3.4. Econometric Model and Test

In this section we present the econometric model we used to run our analyses and test our hypotheses along with some test performed on the variables. It is important to stress again the goal of our exploratory analysis is to explore whether some macroeconomic variable (i.e., our Independent Variables) may have an impact on the Deal Size of a given CVC transaction. To perform our analysis and test our variables, we used **SPSS Statistics by IBM**.

"IBM SPSS Statistics is a powerful statistical software platform. It offers a user-friendly interface and a robust set of features that lets your organization quickly extract actionable insights from your data. Advanced statistical procedures help ensure high accuracy and quality decision making. All facets of the analytics lifecycle are included, from data preparation and management to analysis and reporting." (https://www.ibm.com/products/spss-statistics)

3.4.1. OLS Model

To test our hypotheses and thus test for a possible link between our dependent and independent variables, we considered **OLS Regression** to be the most appropriate model.

Ordinary Least Squares regression (**OLS**) is a common technique for estimating coefficients of linear regression equations which describe the relationship between one or more independent quantitative variables and a dependent variable (simple or multiple linear regression). **Least squares** stand for the minimum **squares error (SSE)**.

In the case of a model with *p* explanatory variables, the OLS regression model writes:

$$Y = \beta_0 + \sum_{j=1,\dots,p} \beta_j X_j + \varepsilon$$

where Y is the dependent variable, β0, is the intercept of the model, X j corresponds to the jth explanatory variable of the model (j= 1 to p), and ε is the random error with expectation 0 and variance σ^2.

3.4.2. Assumption of OLS Model

For the OLS Model to properly work, it is important to consider verify certain assumptions. Below we report the main five assumption we tested (Addagatla, 2021):

- **Linearity,** linear relation between the dependent and independent variables.
- **No endogeneity,** it refers to the prohibition of a link between the independent variables and the errors.
- **Normality and homoscedasticity,** the error terms are normally distributed with an equal variance.
- **No autocorrelation,** errors are assumed to be uncorrelated.

- **No multicollinearity,** refers to the possible collinearity between two or more variables

3.4.3. Linearity and Scatter Plot

In this section we present the scatter plot used to test the linearity assumption.

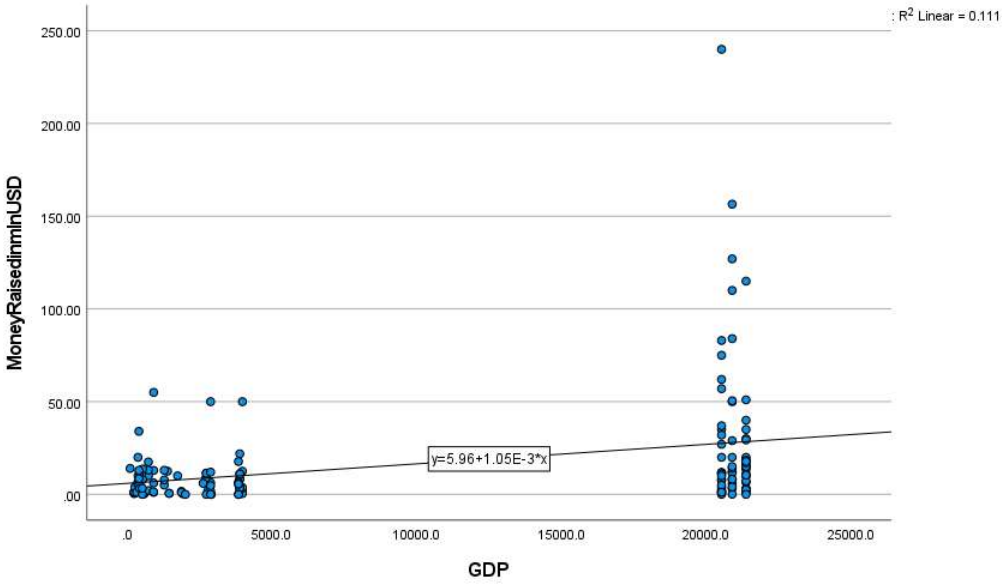

Figure 10: Scatter Plot Deal Size/GDP

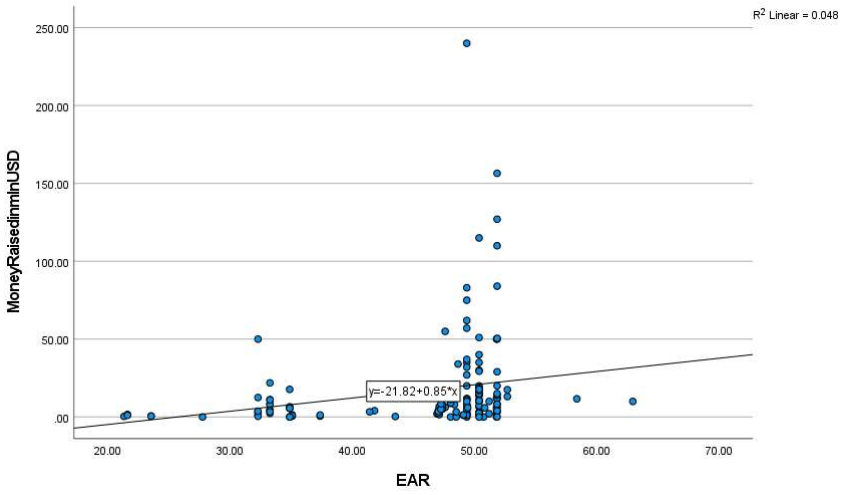

Figure 11: Scatter Plot Deal Size/EAR

3.4.4. Durbin-Watson

The **Durbin Watson (DW)** statistic is a test for autocorrelation in the residuals from a statistical model or regression analysis. The Durbin-Watson statistic will always have a value ranging between 0 and 4. A value of 2.0 indicates there is no autocorrelation detected in the sample. Values from 0 to less than 2 points to positive autocorrelation and values from 2 to 4 means negative autocorrelation.

Therefore, this test has been used to test the second assumption of the OLS Model, such as no endogeneity. In our test we obtained a value equal to 2 that as stated above indicates no autocorrelation detected in the sample.

3.4.5. P-P-Plot and Breusch-Pagan

To test the assumption three regarding the normality and homoscedasticity. The normal distribution of the error has been tested through the P-P-Plots while the homoscedasticity has been tested through the Breusch-Pagan test. Here we present the P-P-Plots on GDP and EAR.

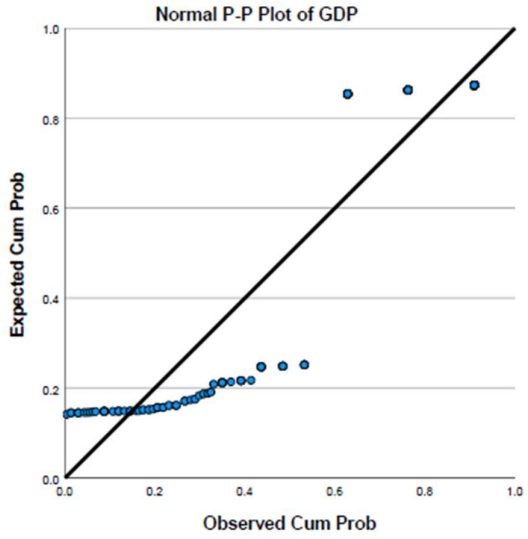

Figure 12: P-P-Plot GDP

As we can see from *Figure 13* the points are not aligned with the black line. Therefore, a Log transformation on the GDP has been performed.

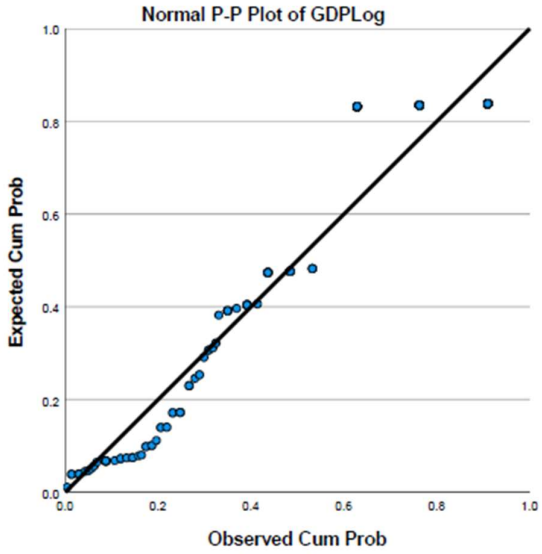

Figure 13: P-P-Plot GDPLog

Figure 14 shows the P-P-Plot on GDP after the Log transformation.

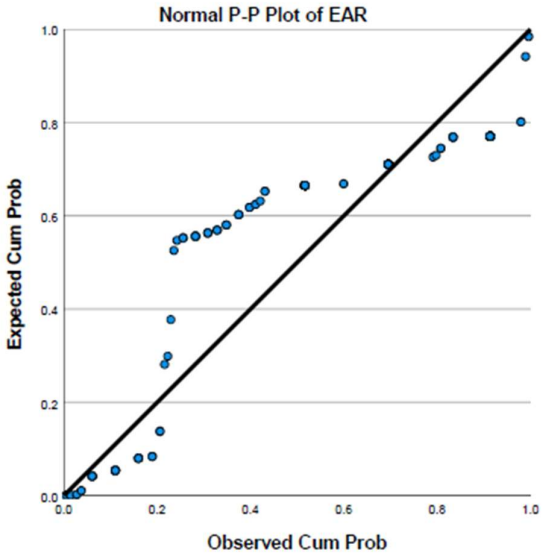

Figure 14: P-P-Plot EAR

Differently from the GDP, regarding the EAR the dots seems more aligned to the black line. Therefore, any Log transformation was necessary.

3.4.6. Variance Inflation Factor

To test the Multicollinearity, we looked at the Variance Inflation Factor. An indicator of the degree of multicollinearity in regression analysis is the variance inflation factor (VIF). In a multivariate regression model, multicollinearity occurs when there is a correlation between several independent variables (Investopedia, 2022). Here we report the results of this test.

Table 3: Variance Inflation Factor

	Collinearity Tolerance	*Statistics VIF*
Type of Fund	*.979*	*1.021*
Strategy	*.995*	*1.005*
Number of Investors	*.868*	*1.151*
Funding Round	*.955*	*1.047*
Syndication	*.925*	*1.081*
GDP Log		
EAR	*.893*	*1.120*

The value of the VIF is close to 1 for all the variables, indicating no multicollinearity between multiple independent variables.

3.5. Descriptive Analysis of the Sample

In this section, we are going to show and discuss the results of the descriptive analysis performed on our data set. Four main dimensions of analysis are identified for each transaction:

- **Strategy;**
- **Target Market;**
- **Year;**
- **Funding Stage**

3.5.1. Strategy

The first dimension of analysis we are going to discuss is the Strategy. To this end, we refer to Chesbrough's framework shown in *Chapter 1 (Literature Review)*. Therefore, in the following graph, we report the total number of deals in the period 2018-2020 divided by end-strategy. For each strategy, we report the total number of deals and the total amount of money raised in that period as well as the average amount of money raised per each deal.

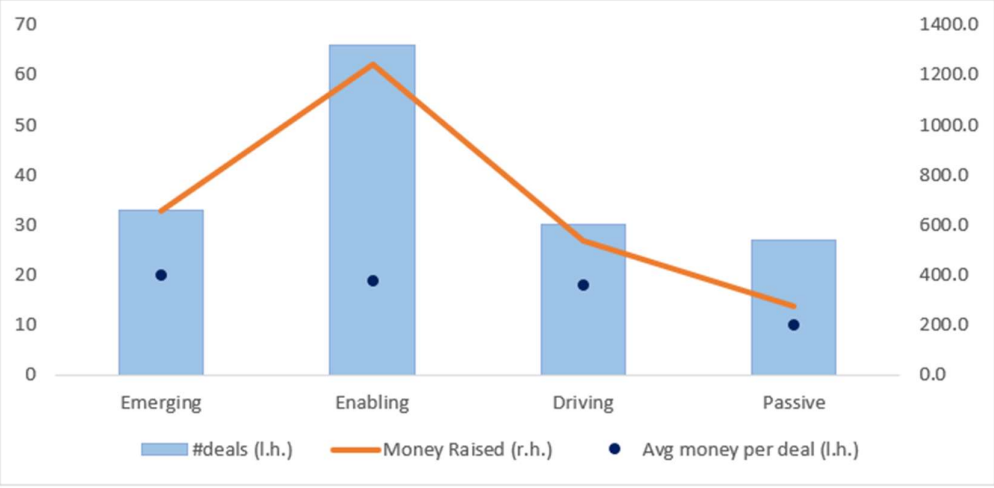

Figure 15: Deal and Money Raised per Strategy

From the graph above, it can be seen that the Enabling Strategy (i.e., the one that has a loose link to operational capacity and a strategic corporate investment objective) is the one that dominates among the other strategies in terms of number of transactions without differing strongly in terms of the average amount of funds raised.

According to Chesbrough, a CVC investor can use this investment strategy to stimulate the development of the ecosystem in which it operates (Chesbrough, 2002). It thus seems to be an investment strategy that is strongly linked to CVC's goal of pursuing innovation. It is therefore interesting to observe the data showing that in the energy sector this strategy has been widely applied, being significantly superior to the others in terms of transactions. This ties in with the fact that players in the energy sector see innovation as a strong competitive advantage, not least because of the profound change and challenges the sector is facing.

Analyzing the graph, the average amount of funds raised per strategy remains similar between the Emerging, Enabling and Driving strategies, while the Passive strategy shows the lowest average amount of funds raised. This behavior is probably due to the characteristics of the Passive strategy, where the investment may be perceived as riskier than the other strategies. Indeed, for a CVC company pursuing a passive strategy, having a limited strategic focus and little connection to the operational capabilities of the target company, it is difficult to obtain capital gains from companies that have a different business, knowledge and technological footprint.

3.5.2. Target Market

In this section the dimension of analysis is the "target market". In our data set we distinguish between B2B and B2C. However, some target companies operate both as B2B companies and B2C. Also in this case, we are going to highlight the total number of deals and of money raised divided by target market and the average fundraising per deal.

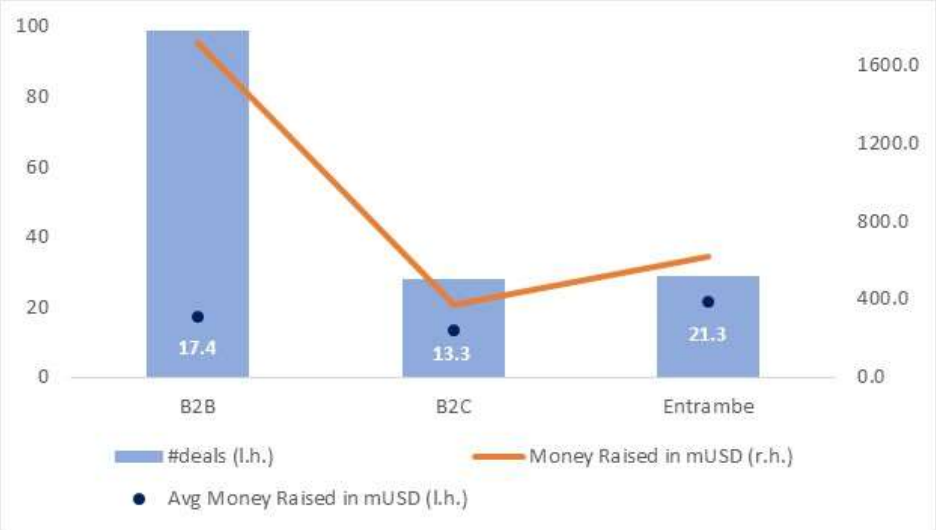

Figure 16: Deal and Money Raised per Target Market

Before analyzing the above graph, let's quickly define the difference between B2B and B2C. B2B is a very common and widespread type of business within companies. Companies sell products and offer services that specifically meet the needs of specific customers, who are other companies and not individuals. B2C, on the other hand, concerns companies that sell their products/services directly to the end consumer.

Looking at the graph, we note that target companies operating in B2B are those involved in the largest number of transactions and therefore with the largest number of total funds raised. This turns out to be quite in line with our sectors of

analysis, which inherently turn out to be more B2B-focused than B2C-focused. It is also interesting to note that the average value of funds raised is higher in B2B cases (or B2B and B2C together), a sign that perhaps there is greater confidence in investing in companies with that target market. In fact, because of the characteristics of the industries under analysis, one might think that CVC investors, particularly those with strategic objectives, tend to leverage their network to support the target company in growth and thus see B2B as a more familiar market.

3.5.3. Year

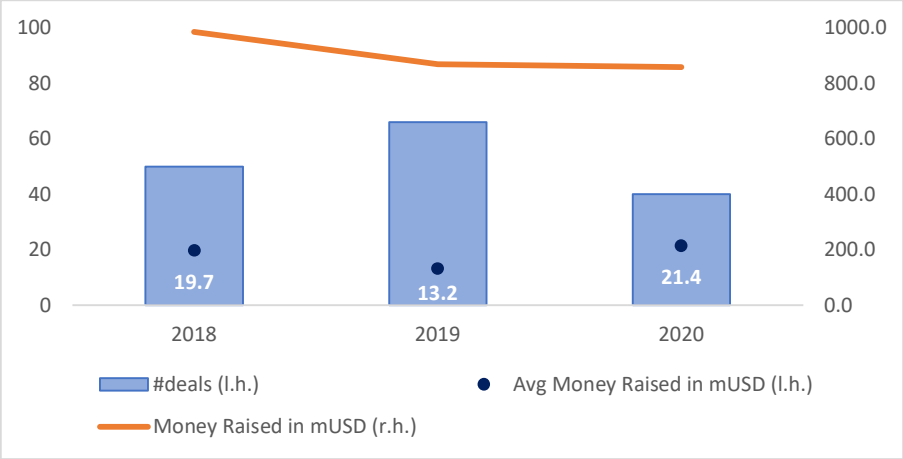

Figure 17: Deal and Money Raised per Year

It can be seen from the graph above that in the period 2018-2020 in the energy sector there was a decline in total funding. However, this decline should be contextualized of the historical macroeconomic moment experienced in 2020. In fact, 2020 was a special year, from a global perspective, due to the pandemic that inevitably affected and limited investments by companies, including those in corporate venture capital. Many companies, in fact, faced several challenges. Indeed, in addition to a global drop in demand, companies had to adjust to various restrictive measures put in place by the governments of their respective nations. Therefore, companies have

had to review their business models and investment plans, often finding themselves having to prioritize certain investments. In fact, it is interesting to note that although the total number of CVC deals from 2019 to 2020 dropped, the average value of funds raised per deal increased. This would seem to confirm that in 2020 companies focused on fewer investments by investing more capital.

3.5.4. Funding Stage

In this section, we will see the differences in terms of number of deals and money raised between the different funding stages. Briefly resuming the theory, the different funding stages differentiate each other accordingly to the life stage of the target company. Usually, in the early stages, the company has recently born, and the business idea is developing. There is already a basic level of organizational structure but still there is a need of professional assistance from the financial and managerial sides. In later stages the company is almost at full regime, ready to run the business independently. Therefore, at early stages, the investment might be perceived riskier, and this is somehow reflected in the graph below.

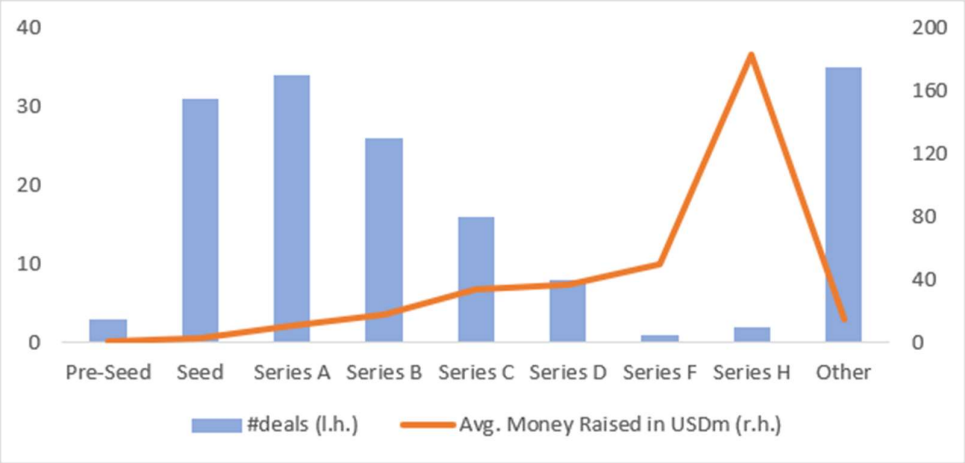

Figure 18: Deal and Average Money Raised per Funding Round

As it can be seen from the above graph, the largest number of deals occur in the early stages of the target company's life, thus in the Seed, Series A and B stages, while there is less contribution in the later stages. However, it is interesting to note that in average deal value instead has a completely opposite trend due to the risk. In fact, in the early stages the target companies have developed the business idea or some product/service but do not actually have a concrete business that can be carried on without external strategic and financial help. For this reason, investments at these stages are small in size as they are associated with higher risk. On the other hand, in the later stages, deals have a purely higher size because of the lower risk associated with the deal. This aspect may significantly impact the regression analysis we performed. Indeed, the stage of investment may result as a relevant variable in influencing the deal size.

4 Discussion of Results

In this section we are going to highlight the results we obtained during our analyses. In the Methodology section we explained the model used to run our analyses and the different test we performed on our variables. Now, the first step towards our analysis has been to identify which of the control variables we selected may have an impact on our dependent variable.

Table 4: Correlation Matrix

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
1 Deal size	1							
2 Type of Fund	-.088	1						
3 Strategy	-.142	.038	1					
4 Syndication	.035	-.055	-.051	1				
5 Number of Investors	.594	.007	-.077	-.188	1			
6 Funding Round	.619	-.126	.016	.039	.443	1		
7 GDP Log	.309	.036	-.038	-.064	.455	.368	1	
8 EAR	.009	.072	-.094	-.087	-.031	-.038	.010	1

The correlation matrix already gives us an idea of the result of the OLS model if we consider all these variables. It is interesting to note the positive and significant correlation between the number of investors and Deal Size, with a Pearson correlation coefficient of 0.594 and a p-value of less than 0.1%. This result was fully expected. A larger number of investors can pool more funds, which results in a larger amount of money raised by the target company and thus a larger Deal Size.

This is nothing more than the idea of investment syndication, which consists of pooling the resources of different investors to expand the investment amount while minimizing the risk for each investor.

Another interesting point is the positive correlation between the number of investors and GDP (with logarithmic transformation). Although this correlation does not clearly indicate a relationship between GDP and Deal Size, it is still significant for our analysis. In fact, this correlation somehow implies that investors are more likely to move their capital to those countries that are developed (i.e., with higher GDP), as they are perhaps perceived as less risky.

The matrix also gives us insight into the correlation between GDP and Deal Size, with a Pearson correlation coefficient of 0.309 significant at a level of 0.01 (two-tailed). Thus, there is somewhat of a positive link between GDP and deal size, but it is not sufficient to draw conclusions.

Another result provided by the matrix, and one that was quite expected, is the positive correlation between Funding Round and Deal Size. This finding is quite in line with what we saw in the descriptive analysis of our sample, with a higher average Deal Size when moving to later stages. Indeed, in the later stages, the target company is a more solid entity in terms of business model, strategically and operationally. We can say that investment in the later stages is perceived as less risky, and therefore investors are more likely to increase their investment, since the risk of losing their money should be lower. This aspect is also confirmed by the positive correlation between the funding round and the number of investors. This correlation can be explained by the fact that in later stages more investors are willing to participate in a given investment. Indeed, let us think of a risk-averse investor. If we are dealing with a risk-averse investor, he or she is likely to avoid investing in

the start-up or early stages of the target company, where the risk of failure of the company is high.

An additional point we can make about the above matrix concerns the correlation between GDP and the funding round. This positive correlation is interesting. In fact, it somehow indicates that a target company reaches the later stages of financing in countries with higher GDP, thus more developed. This is quite logical. In fact, in developed countries it should be easier for a start-up to succeed and reach the later stages of life. In fact, in more developed countries there might be a system that supports companies and pushes them into development in order to support the whole economic system.

The last aspects we want to highlight from the above matrix are the absence of correlation between our control and dependent variables as well as for the EAR.

Moving forward, given the results of our analysis, we decided to remove as control variables the Strategy, the Type of Fund and the Syndication, that should no have impact on our dependent variable.

Let's now have a look at the results of the OLS model.

Table 5: Models Output

	Model 1	*Model 2*
Number of Investors	.414	.349
	.933	.873
	<.001	<.001
Funding Round	.452	.497
	1.621	1.548
	<.001	<.001
GDP Log	-.045	
	3.209	
	.543	
EAR		.039
		.248
		.555

Note: Dependent Variable is the Deal Size. For each variable, regression coefficient, standard errors and p-values appears respectively in the first, second and third row.

Before going into details with the results of the OLS Model, let's have a quick recap of what seen in the previous chapters. The dependent variable is represented by the Deal Size (in million USD), while the independent variables are in this case the Number of Investors, the Funding Round and the GDP in logarithm terms. The first two independent variables play the role of control variables.

We can now discuss the output, studying three different dimensions per each independent variable, such as:

- **Sign** of beta-coefficient
- **Magnitude** of beta-coefficient
- **Significance** of the result

Then, we give a possible explanation of the results obtained.

Number of Investors

The number of investors results in both the models in a positive beta-coefficient and similar magnitude (β-Model1=0.414, β-Model2=0.349). In both the cases the significance is elevated, with a p-values lower than 0.1%.

This result indicates a positive impact of the variable number of investors on the size of a Deal. This result was already anticipated by the correlation matrix. Picking up on what was said earlier, this result was quite expected. In fact, it is a result that confirms a theoretical aspect of investment such as syndication. In fact, that of syndication, is a mode of investment also known as "pool financing," which involves two or more investors pooling their resources for a joint investment. This form of investment allows the individual investor to minimize risk by approaching the investment in a more relaxed manner. In addition, this type of approach allows for higher investments. In fact, multiple investors by pooling their resources can access higher investments and thus provide the target company with more funding.

Funding Round

The Funding Round results in both the models in a positive beta-coefficient and similar magnitude (β-Model1=0.452, β-Model2=0.497). In both the cases the significance is elevated, with a p-values lower than 0.1%.

Even in this case the result was anticipated by the correlation matrix, and it was quite expected since there is a theoretical basis for this result. Indeed, the different Funding Round differentiate each other because of the amount the target company can raise, accordingly also to its life stage. Picking up on what was said earlier, this outcome relates somewhat to the investor's perception of risk. In the early stages of the target company's life, we are often talking about start-ups, one finds oneself in a rather challenging and delicate situation, not so much because of the amount of funds needed but because of the difficulties in pursuing a business idea that is still not quite concrete. In fact, there are not many start-ups that make it past the first year of life, and just as many fails after not long without achieving a certain solidity. Once more advanced stages are reached, with the right input of financial and non-financial resources, as well as professional support from a strategic and operational point of view, it is less likely that the company will fail and thus the investor will see his investment vanish.

GDP

As for the GDP, the beta coefficient results negative and equal to -0.045 with a p-value of 0.543. This result does not confirm our hypothesis one, that state the positive relation between the GDP and the Deal Size, but at the same time we cannot claim that it is not verified. In fact, the model indicates that GDP with a coefficient of -0.045 has a negative impact on our dependent variable. However, this result is insignificant given the high p-value. Consequently, other studies will have to be developed to verify the veracity or otherwise of the model, even considering the positive correlation of the two variables.

EAR

As for the EAR, the beta coefficient is positive and equal to 0.039 with a p-value of 0.555. Thus, the EAR has a positive impact on the dependent variable. However, again we cannot confirm our second hypothesis regarding the positive impact of a country's level of education on the size of the operation. In fact, although the beta coefficient is positive, the p-value is high indicating that this result is not significant. Consequently, we cannot test the veracity of our hypothesis, but neither can we disprove it. Therefore, even in this case further and more in-depth studies will have to be conducted.

5 Conclusions

Our Master's Thesis began with an in-depth review of the academic literature on Corporate Venture Capital investments. The purpose of this literature review was to gain a deeper understanding of the various perspectives and elements that characterise the corporate venture capital phenomenon.

This literature review demonstrated how the CVC is becoming more and more important on the global stage today. Researchers claim that this phenomenon is particularly noticeable in the energy sector, which is why we chose that industry for our analyses.

A careful review of the literature revealed a partial absence of macroeconomic considerations in the literature. Therefore, in order to fill this gap, we decided to carry out an exploratory analysis aimed at opening up new lines of research on macroeconomic issues and their connection to Corporate Venture Capital activities.

Therefore, the first step in our analysis was to develop hypotheses on a potential correlation between certain macroeconomic variables and corporate venture capital activities. In particular, the two hypotheses on which our analysis was based are outlined below:

Hypothesis 1: The level of a country development and economic growth will be positively associated with the amount of capital invested by Corporate Venture Capitalist.

Hypothesis 2: The educational level of a country human capital will be positively associated with the amount of capital invested by Corporate Venture Capitalist.

To test and validate these hypotheses, we constructed a database, based on data extracted from CrunchBase and OECD. It allowed us to analyse a total of 156 Corporate Venture Capital deals held in 23 countries, first performing a **descriptive** analysis of the sample, and then proceeding with an **exploratory** analysis of the same, using an econometric model.

In addition, a descriptive analysis of the sample was conducted to get a more in-depth overview of four dimensions that characterize each CVC operation: strategy, target market, year, and funding stage.

Regarding strategy, it was found that the average amount of funds raised per strategy remains similar among the Emerging, Enabling, and Driving strategies, while the Passive strategy shows the lowest average amount of funds raised. Thus, it appears that the strategy has little influence on the value of a deal, except in the case of the Passive strategy. This could be related to the characteristics of the strategy, which has a limited strategic focus and thus more distant from the pure idea of Corporate Venture Capital.

From the analysis of the target market, it was found that companies operating in the B2B market tend to have a higher amount of total funds raised, compared to companies that are focused on B2C; this is likely due to the fact that an investment in B2B appears less risky in the eyes of a CVC investor.

The analysis regarding the time dimension showed that although CVC was a growing phenomenon before the Covid-19 pandemic, it too slowed down in 2020 in terms of volume, with companies, however, focusing on fewer deals but larger in size.

The last aspect highlighted by our descriptive analysis is that in terms of volume, corporate venture capital firms tend to invest more in start-ups that are in their early

stages. However, the value of deals is purportedly lower than in later stages. This is related to the fact that, in the advanced stages, start-ups have a certain maturity and the associated risk decreases.

The exploratory analysis provided us with some interesting insights into the interaction between some macroeconomic variables and firms' venture capital activities.

First, it should be specified that the regression model used neither confirmed nor disproved the hypotheses made. In fact, the analyses showed that the impact of GDP and EAR on deal size was not significant.

On the other hand, the correlation analysis revealed some interesting aspects, related to the links between some variables, which can be further investigated by future studies. One interesting aspect that emerged from our analysis is the positive correlation present between the number of investors and GDP. This correlation is not particularly high, but still positive. This aspect is particularly interesting, as one might think that CVC investors prefer to invest capital in countries with a high level of development, probably because of a higher probability of investment success. Another interesting aspect that emerged from our analysis is the positive correlation between GDP and funding rounds. In particular, it was found that business ideas have a greater chance of success in countries with a higher level of development. In fact, it is precisely in countries with the highest GDP that start-ups reach the later stages of investment.

In addition, the regression analysis showed that the number of investors, and thus the concept of syndication, and the stage of funding, have a quite significant impact on the value of a CVC deal, as they are key characteristics of a deal itself.

6 Implications and Limitations

6.1. Practical and Theoretical Implications

The current thesis adds to the current foundation of the literature on Corporate Venture Capital and serves as a starting point for future research. It draws attention to the various aspects of investment deals and how they relate to other topics covered in CVC literature.

In particular, from the analyses undertaken it has emerged that our first hypothesis (i.e., "The level of a country development and economic growth will be positively associated with the amount of capital invested by Corporate Venture Capitalist") is not confirmed. Although the regression did not test this hypothesis, as can be seen from the analyzed coefficients, the analysis showed a positive correlation between GDP and deal size. This aspect may be the starting point for subsequent, more in-depth analyses. In fact, should the starting database be expanded, which would lead to more CVC deals being considered, and should the time horizon be extended, this hypothesis is likely to be verified. Therefore, at present, only a positive correlation mentioned, between deal size and GDP, is noted, but it is not excluded that further conclusions may be drawn, with a more complete database; future and more in-depth studies can further analyze this correlation.

Regarding the second hypothesis (i.e., "The educational level of a country human capital will be positively associated with the amount of capital invested by Corporate Venture Capitalist"), that our model decided to test, neither has it been verified by our econometric model. Indeed, despite the positive beta coefficient, the high p-value indicates that this result is not significant. Hence, as pointed out, we are unable to verify our hypothesis, but we are also unable to refute it.

So, again, if the source database were to be expanded, perhaps by referring to more platforms, more deals would be considered, and this could verify this hypothesis. Alternatively, one could consider additional variables, within our macroeconomic model, that would show other correlations, enriching our analysis.

In conclusion, there is still a lot of work to be done to fully comprehend the function of CVC in a larger corporate context. Our analysis is in fact preliminary and needs to be further investigated using different techniques and additional data.

6.1.1. Implications for Investors

The current dissertation also has implications for investors and corporate managers, who are crucial in bringing innovation and strategic growth paths for businesses.

It first draws attention to the importance of corporate venture capital investments as a particular tool for implementing Open Innovation within corporations and the major benefits it can offer. It helps to clarify how CVC activity can support corporate strategy objectives and aid businesses in adapting to volatile markets. Furthermore, this analysis provides a comprehensive picture of the Operational Models of Corporate Venture Capital deals, with a particular focus on the energy sector, as well as an overview of their performances. Additionally, every particular and relevant aspect of CVC is taken into account, giving a comprehensive overview of the energy industry in particular.

Also, the present paper provides an analysis of some countries in which CVC deals are worthwhile, such as Europe and the USA, also showing the most recent trends. This is particularly significant for potential investors, as the strategic choice of the country in which to make the deal will have a significant impact on the success of the deal.

Our paper also provides an overview of the main variables that should be considered when analyzing a CVC deal and the impact they might have on future deals. In fact, most investors tend to prioritize later-stage investments, treating CVC more like conventional M&A. They seek out companies that they can immediately integrate into their core operations and feel more at ease conducting due diligence on those that have a proven product or market fit.

This work can also provide support to investors who want to investigate further aspects, such as assessing the strategy and purpose of a CVC deal. Hence, the present dissertation could be a solid starting point for investors and managers who decide to undertake this type of investment.

6.1.2. Implications for Practitioners

It is worth mentioning how, in our studies, there are several implications for practitioners. In fact, our Master Thesis fits into the landscape of academic literature, adding some aspects to be further taken into consideration, when undertaking a CVC deal. In particular, the macroeconomic issues of the countries involved in CVC deals should be taken into account for practitioners. Indeed, it is not enough to look only at traditional issues, which are generically referred to when analyzing a deal in general, e.g., financial return, but further aspects should be kept in mind. In fact, it is necessary for the entities involved in the CVC deal to keep in mind the trend of different macroeconomic variables of the countries involved, as there might be a link to the deal and probably to its success. In addition, there may be additional macroeconomic variables, beyond those analyzed in our analysis, that could have an impact on the successful outcome of a CVC deal. In this regard, it is advisable for practitioners to have a comprehensive view of the macroeconomic overview of the countries involved. That being said, practitioners must still perform the necessary

due diligence and checks to ensure the success of the deal. Our Master Thesis, however, provides other elements to be analyzed with care.

Obviously, there are other issues that should be explored by practitioners, and it is likely that new areas of interest will be explored in academic literature in the future.

6.2. Limitations

The results obtained from the application of our econometric model, as well as the methodologies implemented, gave interesting insights in understanding the linkages between CVC investments and Macro-Economic factors. However, just like any other research paper, the present dissertation has its own limitations, which can broadly be categorized into limitations related to the data and methodology used as well as the industry (i.e., the sector) selected. i.e., the Energy sector. Now, we delve into details, considering the two main limitations mentioned, explaining how they affected our analysis.

6.2.1. Cyclical and Defensive Economic Sectors

Starting from the choice of the sector, generally speaking it is possible to divide sectors in two main typologies. On the one hand the **Cyclicals**, on the other hand the "counter-cyclicals", also called **Defensive**. The difference between these two categories is closely related to the nature of the business cycle, which explains precisely the cyclical-anticyclical (or defensive) antithesis (BPM, 2019).

The performance of an economy follows a precise cycle, very simply called the business cycle, structured in 4 different phases that repeat themselves over time:

1. **Growth**: this is the expansion phase the economy continues to grind along. The main economic factors - industrial production, employment, GDP, demand, and supply of retail products - are increasing.
2. **Recession**: demand gradually begins to fall, and an oversupply of goods is created. In this phase, economic factors begin to decline
3. **Depression**: this is the phase in which general economic activity reaches its lowest level. In other words, it can only 'recover'.
4. **Recovery**: once the two negative phases have passed, a turning point is reached. The various economic factors begin to register positive values that become gradually stronger

Therefore, a sector is said to be cyclical when it is strongly, distinctly, and clearly influenced by the phase of the business cycle, while it is a countercyclical or defensive sector if it holds up better in these phases.

Delving into details, it is possible to deepen such two typologies of sectors.

- **Cyclical Sectors**: Businesses with cyclical business models gain the most from economic expansions. Companies operating in defensive sectors, however, are more stable during a recession. Different companies and business models respond to economic trends in different ways. Profits for some businesses spike sharply during economic expansions but plummet precipitously during recessions. They are thought to be extremely reliant on the economic cycle. These businesses are referred to as "cyclical companies". Cyclical sectors of the economy include those areas of production, expenditure, and consumption that the government, businesses and households, the three main economic actors, cut back in times of 'lean cows'. For example, secondary consumption, i.e., consumption that is not primary needs, which includes cars for instance. Other examples of sectors that

belong to the category of Cyclical Sectors are the Airline Industry, the Banking Sector, Hotels, Restaurants, and Leisure Sectors and more others.

- **Defensive Sectors**: Businesses in defensive sectors produce profits that are comparatively consistent throughout the entire economic cycle, but they benefit less as the economy grows. Defensive sectors have little correlation with the economic cycle and are therefore less affected by slowdowns or recessions. It is no coincidence that they are called 'defensive'. Defensive sectors of the economy are those linked to primary needs, such as food and health care products, which of course people tend not to give up even in times of economic hardship. Besides foodstuffs and the health care and pharmaceutical sectors, two typical counter-cyclical sectors are utilities - the so-called utilities, related to the supply of water, gas and electricity - and the energy sector.

6.2.2. Cyclical and Defensive Sectors: Pros and Cons

By their nature, companies within cyclical sectors generally incorporate higher market risk and higher variability of earnings and dividends (Banco BPM, 2019). Defensive sectors, by comparison, entail lower risk and tend to have more regular results over time.

So, to summarize, when the economy accelerates and maintains a good cruising speed, companies belonging to the cyclical sector tend to do better than the market (and, of course, those in defensive sectors) and report robust financial results, whereas when the economy starts to slow down or enters recession, they tend to suffer more than the others. Conversely, precisely because they hold up better during a slowdown or recession, defensive sectors tend to be less attractive during economic recoveries and expansions.

6.2.3. Final Considerations

Starting from what just reported, it is possible to say that the choice of the Energy industry, which belongs to the Defensive Sector category, has some implications on our analysis and somehow could limit it. Indeed, given the aim of the present study, which refers to understanding the impacts of macro-economic variables on CVC deals, the choice of a Defensive Sector, which has little correlation with the economic cycle and is therefore less affected by both slowdowns or recessions and macroeconomic variables, may be controversial. In this sense, the fact of having considered a sector that is not significantly affected by the impact of macroeconomic factors is also evident in the analyses shown above, looking at the level of correlation that certain macroeconomic variables (such as GDP) have on the invested capital.

On the other side, regarding the limitations related to the variables used and the methodology implemented, it should be pointed out that our database does not capture all possible CVC deals that occurred in the three-year period 2018-2020. In fact, to collect all the CVC deals that occurred, it would have been appropriate to use several sources and refer to several databases. In contrast, our research mainly involved the use of CrunchBase to create the database.

In addition, the variables we considered and used for analysis were also chosen on the basis of the information available from the mentioned database. Certainly, with the use of other databases, additional variables could have been retrieved, which would have enriched the analyses performed. Also, regarding our Depend Variable, i.e., the Deal Size, such variable mainly considers the amount of money collected in the CVC Deal under consideration but does not consider further parameters. In fact, a more all-inclusive approach could have also considered other parameters, within the dependent variable (e.g., minority stake acquired).

The potential selection bias in the analysis's final dataset is another problem. The model is vulnerable to a potential selection bias that could be eliminated by using an improved initial dataset because we had to exclude many deals due to missing or impossible data. By doing this, selection bias would be eliminated, and a larger number of deals would be available for analysis, improving and strengthening the results.

The chosen time horizon, i.e., the three-year period 2018-2020, also has political and economic influences, which certainly had an impact on both the number and type of CVC deals. Additionally, some restrictions were imposed by the design of the websites' search engines. The key challenge should be to understand how the categories were defined in order to select all of those that contain CVCs, but we were unaware of how the sites were built, so we only chose the categories that we thought were most appropriate. In fact, one has the option to use some predefined categories to select and filter the data during the filtering phase. Since we are more likely to have overlooked some offers that might be pertinent to our search, this definitely reduces the robustness of our work.

Hence, to improve the present dissertation, further directions may include expanding the dataset to include other industries and evaluating the use of additional databases, thanks to which more variables could be taken into account.

6.3. Future Research Directions

In this final section, we discuss potential future research directions that scholars could pursue taking into consideration the various points of view.

In fact, our analysis has a purely exploratory purpose, aimed at opening up new lines of analysis regarding CVC. Starting precisely from our analysis, further investigations could be carried out, with the aim of improving our own analysis given the limitations set out in the previous chapter or extending it by considering other variables.

Indeed, the present work can be improved and refined in several ways.

First, with regard to the choice of the energy sector, one could consider extending the analysis to other sectors. In fact, as seen in the chapter on limitations, the sector we have considered, (i.e., the energy industry), is a defensive sector, hence not strongly influenced by economic cycles. Alternatively, one could consider cyclical sectors, which are instead strongly affected by economic cycles. By doing so, stronger correlations between the variables considered could be revealed, thus opening up new analyses.

Furthermore, as already mentioned, the number of databases used could be expanded, which would allow more CVC transactions to be explored. In fact, our analysis only considers 156 deals, which although they represent a significant sample may not be sufficient. A larger database, with more data available, would undoubtedly improve our model.

In addition, other improvements could concern different analysis techniques, which would further explore the links between the mentioned variables. One could, for example, use the panel data method as an econometric model. Indeed, panel data

methods are based on repeated observations of the same set of cross-sectional units over time and their use for our analysis offers the possibility of analyzing the joint movements of CVC program. Regarding panel data analysis, using the general statistical software Stata, for example, it would be possible to exploit various techniques, such as fixed effects and random effects, to observe or measure the behavior of our variables.

In addition, a more in-depth investigation could also consider the various types of companies that decide to undertake CVC operations. Indeed, in the absence of a formal CVC program, companies investing in start-ups or other target companies may behave differently, seeking to choose and acquire a particular technology from target companies, without worrying about the reputational consequences that might limit established CVC program.

Analyzing the effects of varying levels of CVC investment and comparing these variations with other macroeconomic variables could greatly extend the present analysis. Compared to simply measuring the start or end of a program, this would provide a more illuminating and accurate indicator of CVC activity. Furthermore, another approach that could be pursued is to develop and test new hypotheses from our variables and dataset. Indeed, the hypotheses we have proposed and analyzed do not include all the possible hypotheses that could be generated, given our starting database. Therefore, future research will allow us to further explore these issues and perhaps even discover new correlations.

After mentioning some elements that could improve and extend the content of our dissertation, we highlight some concrete research directions that academics and researchers could deepen in the future. From the analysis undertaken, it is now possible to point out the main possible future research directions in the following future lines of research:

1. Deepen a possible link between CVC deals and financial markets, with a particular regard on the IPOs. An IPO (Initial Public Offering) is a company's first sale of stock to the public. In other words, the IPO is an offering which allows non-listed companies to go public on the stock exchange. In this regard, it could be interesting to deep in a possible correlation between the IPOs market and the CVC deal. Several are the benefits related to IPOs, from a financial, operating, and organizational point of view. However, IPOs are associated with even different costs and risks that might be impactful on the company going through the IPO. Now, without going in detail with the characteristics of the IPOs and their process, what we do need to keep in mind about IPOs is that the **timing** is crucial. The IPOs market, as several other markets, is characterized by a cyclical pattern. The market of IPO is very volatile, it depends on the business trends but also on the market momentum (whether there is a "bullish" or "bearish" market). It is possible therefore to define the so called "hot issue periods", such as those periods during which going public is favorable for the non-listed companies. Usually, companies prefer to go public in those periods when it is easier to find investors and to get a favorable valuation. What is then the link with the Corporate Venture Capital? When speaking about Corporate Venture Capital, a common exit strategy is to go public through IPOs. Therefore, it could be interesting to see whether the IPOs market has impact on the intensity of Corporate Venture Capital activities. Indeed, one might think Corporate Venture Capital activities are expected to intensify in "hot issue periods", due to better exit opportunities.
2. Deepen the study on macroeconomic variables and their possible impact on CVC activities. In the present study, we focused on two macroeconomic variables such as the GDP and the EAR. These two variables pursue

respectively two different objectives; on one side with the GDP, we want to look at a possible impact of the country development level (with a financial point of view) on the CVC activities, while with the EAR, we aim at understanding whether the educational level of a country may be impactful. However, these are just two of the variables one might consider. Thus, it could be interesting to have a look at other macroeconomic variables to test other aspects within a country. As for example, it could be interesting to have a look at the impact of institutional factors on the CVC activities, so deepening the several studies on the role of institutional factors in investment decisions. Besides, it could be interesting to enlarge the set of macroeconomic variables including the level of interest rates and the inflation rate, to study their role in investment decisions. Of course, such two variables have been widely studied and their impact on investment decisions has been demonstrated. However, it might be interesting to see if there is a particular behavior in the case of the CVC. Indeed, it might be that the impact of those variables is softer, since the CVC pursues more strategic objectives than financial ones.

3. A potential new line of research could also consider the home country of the investing company and assess whether or not it tends to invest in countries with a similar culture. Indeed, it would be very interesting, in our opinion, to understand whether the choice of the country in which a CVC investor decides to invest also depends on some cultural factors of the country where the investment is made. Today, corporate culture runs through all structures and accompanies teams from their inception and throughout their development. It is decisive for the success or failure of the company, since it largely conveys the vision, attitude and way of acting of each employee. In the times of uncertainty and crisis we are experiencing around the world,

having a good corporate culture facilitates the transformation and adaptability needed to survive and learn to navigate in a new environment where change seems to be the only constant. In analyzing corporate culture, one can see that it is obviously highly correlated and aligned with the culture of the country in which the company in question operates. Therefore, one could precisely consider the culture of the country as a reference point. With this in mind, one could examine whether the choice of countries in which to invest actually depends on the cultural factors of that country. Cultural aspects could in turn be reflected in numerous variables, including of course the risk appetite and time orientation of the investment. Indeed, some countries may have very patient and confident investors in long-term investments, so they are willing to wait longer for high returns. These elements may therefore have an impact on the choice of country to invest in. In addition, one could also understand how the investor's cultural background influences investment behavior, when, for example, variables such as inflation rates and wealth are taken into consideration. In addition, if an investing company decides to choose a target nation that has a similar culture to its own country, one could consider whether such a choice could lead to possible synergies between the investing company and the target company. The different types of synergies that could be obtained and their magnitude could be evaluated. In this way, the link between the cultures of the two countries could be further explored. Therefore, future studies could relate the geographic location of the investing company and that of the target company, so that it could possibly be tested whether there is a correlation between the cultures of the two countries.

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