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DOES THE MARKET REWARD CORPORATE VENTURE CAPITAL ACTIVITY?

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Abstract

This paper aims to empirically research if there are higher stock returns when a large company has an active corporate venture capital arm compared to its competitor without an active corporate venture capital arm. The regression outcome shows that there is no significance and that there are no higher stock returns for the time period of 2012-2016 years for a corporation which has an active corporate venture capital arm compared to a set of comparable companies that do not have an active corporate venture capital unit. The dataset consists of 30 corporations with an active corporate venture capital arm and 30 companies with a non-active corporate venture capital arm, in total 60 companies. The mirror portfolio replicates the companies with respect to the sector, market capitalization and risk using the beta of the stocks. The data is handpicked, however, the papers novelty is the empirical approach that hasn't been done in this way before.

Keywords: Corporate Investment, Corporate Governance, Venture Capital, Innovation

JEL classification codes: G34, G32, O31

Abstract in Portuguese

O objectivo deste artigo é pesquisar empiricamente se uma grande empresa com um braço activo de corporate venture capital apresenta rendimentos bolsistas superiores aos de um concorrente sem actividade de corporate venture capital, uma questão que não foi previamente tratada na literatura. A amostra, recolhida a dedo para o período 2012-16, inclui 30 empresas com participadas dedicadas ao corporate venture capital e 30 empresas sem tal actividade, num total de 60 empresas. A carteira de controle foi construída a partir de critérios sectoriais, de capitalização bolsista e de risco, este aferido através do beta das acções. Os resultados estatísticos obtidos não evidenciam rendimentos bolsistas superiores em empresas com um braço de corporate venture capital activo relativamente a um grupo de empresas comparáveis sem actividade de corporate venture capital.

1. Introduction

The market does not reward corporate venture capital (CVC) activity. That is what the results of this paper suggest.

But let's take a step back. This paper analyses the stock returns over the past 5 years from 2012 to 2016 of 60 companies. The regression model, which I developed for this paper, shows that the returns of large companies are not affected by whether a corporation has a CVC arm or not. The model uses a matching portfolio technique which mirrors the size and the risk of 30 large companies that use an active CVC arm. The matching portfolio is a way of "*generating a reasonable benchmark for determining the relative performance of a specific equity portfolio"* (Kane & Enos, 2010).

The finding is that the coefficient of the dummy variable (referred to as "dummy" in the results tables), that tells if the corporation in the sample has a corporate venture capital unit, has a value of -0.033027116 (Table 4). This means that there is a negative correlation between the independent dummy variable that distinguishes CVCs and non-CVCs and the dependent variable which is stock returns. So, based on the regression outcome, the market does not reward corporate venture capital activity. But, the outcome is not significant. This will be explained in detail in the last chapter.

First an understanding about the topic is needed, this will also help to understand what the results mean. I will give a quick historical overview and then describe and distinguish corporate venture capital from venture capital (VC).

It is hard to figure out which was the first venture capital company. In a paper from Gompers and Lerner, the authors state that "*American Research and Development (ARD)"* was the first venture capital firm. It was formed by the MIT President at that time, Karl Compton, Harvard Business School Professor Georges F. Doriot and local business leaders in 1946. Draper, Gaither and Anderson formed the first venture capital firm with a limited partnership in 1958. Soon most venture capital firms used the limited partnerships in the 1960s and 1970s. (Gompers & Lerner, 1998)

DuPont and other companies like 3M and Alcoa were the pioneers in corporate venture investing. The first corporate venture capital companies developed in the late fifties and early sixties until the stagflation crises in the seventies. The motivation of the first CVC investors was that they wanted to find new markets, in particular large American companies had large

cash positions which they wanted to put into productive use. Venture capital companies became really successful within the tech industry boom, that provided a successful model for the large corporations. As the first personal computer was released at the end of the 1970s the corporate venture capital sector had its second wave.[1] Two companies in the sample of this paper founded their corporate venture capital units in the late 1970s, the rest were founded later.

After that brief historical overview, let's distinguish corporate venture capital from venture capital by describing what venture capital is:

As Gompers & Lerner (1998) explain, venture capitalists are more active investors. They really go to the company and look at their processes and monitor the performance, they also often have members in the boards of directors and set milestones for further investments. To have more control, they implement certain rules in the contract that gives them the right to intervene in the company's operations. Venture capitalists also provide a network of consultants, investments bankers and lawyers.

Chemmanur et al. (2013) explains that independent venture capital (IVC) funds often structure their funds as limited partnerships. This is consistent with what I wrote in the short history introduction discussed earlier. The duration of the fund is usually ten years, with an option to extend for another two years. The "*IVCs' fund-draws are limited by the amount of capital initially committed by their limited partners"* (Chemmanur et al., 2013).

IVCs are the traditional venture capital funds that most people know. However, there is another type of venture capital set up, which is corporate venture capital.

Vermeulen & Fenwick (2016) describes corporate venture capital as the following: "*corporate venturing is usually understood as a corporation making an investment in external start-ups either directly (off the balance sheet through a corporate venturing unit) or indirectly (through an independent and separately managed venture capital fund) for strategic and/or financial gain. The strategic benefits usually imply the further stimulation of the innovative capacity and potential of large corporations*". However, the alternative description is the one that describes the corporate venture capital arms in this paper.

[1] CBS Insights website: https://www.cbinsights.com/research/report/corporate-venture-capital-history/. Access 12.10.2017

Back to Chemmanur et al. (2013), they explain that corporate venture capitalists are usually "*stand-alone subsidiaries of non-financial corporations and they invest in new ventures on behalf of their corporate parents*".

Another distinction between the two types of venture capital funds is the nature of the fund management. The "*traditional venture capital firm (..) seldom intervenes in the day-to-day running or decision-making process of the firm it finances, CVC goes much further than simple leveraging"* (Lantz & Sahut, 2011).

"There are prominent people that do not like the idea of a corporate venture capital fund. One of them is Fred Wilson, who is a venture capitalist a New York City based company Union Square Ventures for many years. He says in a discussion at a Future of Fintech Conference: "*I hate corporate investing ... it's stupid. Corporations should buy companies*."[2]

What are the reasons behind such statements? There are indeed disadvantages that come with a corporate venture capital funding. Large corporations have a dilemma; they want to serve their existing customers with the current product. They might improve this product and launch a new version, but the core stays the same. On the other hand, they want to innovate themselves so as not to lose market share or miss trends. But a corporation only has so many resources. As Vermeulen & Fenwick (2016) describe, Intel is one of the examples where their corporate venture capital unit is very active, the company is also in my sample, but they were unable to anticipate the next disruptive trends in the technology sector.

Furthermore, "*CVC firms make a large number of investments in some cases for financial benefits and in other cases for strategic benefits"* (McCahery & Vermeulen, 2016). They explain their statement with the argument that those mixed strategies create problems and confusion within the parent company. Another problem that they identified is the lack of experience and information asymmetry of the fund manager within the CVC arm. They observed that large corporations often syndicate with traditional venture capital funds. Syndicate means in this case that they both invest alongside each other to gain the advantage of the other and create synergy. They *"show that CVCs have less efficient compensation structures than traditional venture capitalists*". The incentive structure of corporate venture capital fund manager drives them to more risk-averse behaviour. The problem is that the

[2] CBInsigths website: https://www.cbinsights.com/research/corporate-venture-capital-investment-disadvantages-fred-wilson-usv/. Access 12.10.2017

venture capital industry is highly network based. Staff that work for a corporate venture capital arm are often foreign to that environment. Another problem is also that many start-ups fear accepting investment funding from corporations because they feel restricted in their exit options and are aware of the issue of what happens if the corporation with the venture capital arm decides to not support the venture anymore. Finally, *"intra-corporate reporting lines often make it difficult to defend the continuation of a CVC program when most investments do not prove to be sustainable and successful"* (McCahery & Vermeulen, 2016). These problems are important to consider when analysing and discussing the topic of corporate venture capital.

In the next chapter, I will discuss what is written about this topic in the literature. I compare this paper to the papers that are the closest to show the novelty of my paper. The next part will provide a more detailed guideline that helps to put my paper in the context of the topic of corporate venture capital. In the third chapter I will discuss the hypothesis in detail. The fourth chapter explains the data and the methodology of the paper and the fifth chapter will present the results of the empirical analysis.

What should you expect from this paper? The reader will gain additional knowledge about corporate venture capital, which is backed by an empirical analysis. He will see empirical results, that explain the impact of corporate venture capital engagement on large corporations. The reader should not expect a black and white answer. Your own thinking and judgement is required. Instead, this paper will give an argument that expands the current level of knowledge for further discussion on the topic of corporate venture capital.

2. Literature Review

The novelty of this paper is the empirical analysis which aims to find out if the market rewards corporations that have an active venture capital arm.

Venture capital is exciting, it creates, it innovates and it disrupts industries, but it is also a buzz word that has been in the mainstream media for a long time. This literature review will explain why it is such an exciting topic by reviewing the papers that are closest to the topic of this paper and the hypothesis raised in the next chapter.

The papers by Gompers & Lerner are classics and are among the most cited papers, very helpful to dive into the topic. They wrote multiple papers on the topic of venture capital but in their paper Gompers & Lerner (1998) the two Harvard Professors give an introductory overview about the history of venture capital and what drives venture capital fundraising from a

macroeconomic, firm-specific and regulatory point of view. They discuss venture capital in general but not corporate venture capital in particular. Their paper is relevant because it explains in which ecosystems the venture capital industry developed the best in the past. The factors discussed in said paper, considered to impact venture capital fundraising, also apply to some extent to corporate venture capital investments.

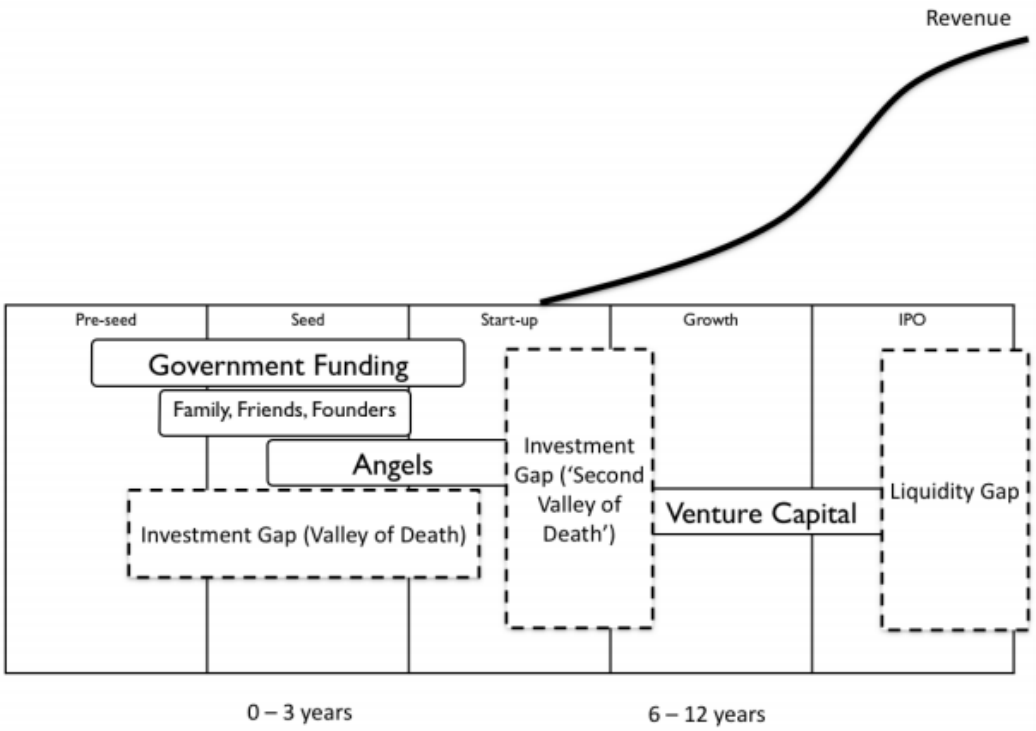
Rudy Aernoudt a Belgian professor is another influential character on the topic of venture capital. In his paper Aernoudt (2008) explains different ways to stimulate business angel investment (a wealthy individual investing in start-ups). The author discusses "*corporate orientation*" as one way to stimulate business angel investment. He also says that "*management skills and financing are abundant in most large companies. This is exactly what start-ups and SMEs are most missing.*" The author clearly outlines how large corporations can help start-ups and small and medium-sized enterprises (SMEs). Business Angels differ from normal VCs but the argument still holds true.

Another much more recent paper is Vermeulen & Fenwick (2016). Erik Vermeulen a professor from the Tilburg University in the Netherlands is influential on the topic of venture capital. In Vermeulen & Fenwick (2016) they ask "*What should companies do to accelerate innovation and remain relevant? Or, stated differently: What should companies do to avoid being disrupted by more agile and innovative startups?*" This paper takes the view from the perspective of the large corporation. That is interesting because a lot of papers focus on the performance of the companies who receive the funding. The paper answered many of the questions regarding how corporate venture capital activity can help large corporations. Also, as explained by the author, financial gain is one of the reasons why corporations should venture. My paper takes the same perspective as this paper.

Benson & Ziedonis (2009) explain that *"(...) firms consistently engaged in venture financing earn greater returns when acquiring start-ups than do firms with more sporadic patterns of investing"*. They find *"(...) the effect of CVC investing on acquisition performance hinges critically on the strength of the acquirer's internal knowledge base: as CVC investments increase relative to an acquirer's total R&D expenditures, acquisition performance improves at a diminishing rate*." This paper focuses on the performance of each CVC investment. One of the main findings of their paper is that corporations which are more active in acquiring start-ups show higher performance in their investments, due to an increase in internal knowledge.

Venture capital funding is crucial for a well-functioning start-up ecosystem and a constant process of innovation. Graph 1 shows a version of the venture capital cycle by McCahery & Vermeulen (2016). The authors describe that corporate venture capital helps the venture capital cycle in the critical phases of a start-up life cycle. The benefit for the large corporation investing through its corporate venture capital unit is to gain information of new technology and products. This is achieved by equity investments and a partnership with the start-up. The authors state that "*listed companies with strong balance sheets and cash positions are particularly active venture capital investors*." They also explain that firms with strong technology and marketing departments are most likely to invest significant resources in start-ups through a corporate venture capital arm. This bias is relevant and true for my sample.

Graph 1 shows the 5 stages of a start-up. The x-axis describes years and the y-axis describes revenue. Throughout the different stages, and the number of years the companies exist, the revenue increases. In the different stages, the start-up usually receives funding from different parties. In the beginning the start-up received funding from government funding schemes and family, friends and founders. After the pre-seed stage Angel investors who are usually wealthy individuals come into play and often help as advisors as well. Between the start-up and the growth stage the start-up struggles because the funding from the angel and similar investors is not enough, so it seeks more funds which usually come from venture capital companies. If the start-up is able to pitch its idea successfully and raise more funds from a venture capital company, the start-up will usually seek an initial public offering (IPO) because this is one of the major ways to exit for the investor and founders. Corporate venture capitalists are especially important in the 'Second Valley of Death', because CVCs tend to invest in start-ups early, while traditional venture capital companies tend to enter at a later stage to minimize their risk.



Graph 1: The venture capital cycle (McCahery & Vermeulen, 2016)

Ivanov & Masulis (2008) analyse two different groups, first newly public firms that are backed by CVCs, and second, newly public firms that are backed by IVCs. Their findings are focussed on the number of directors and board members, not so much on the financial performance. For example, one of their main findings is "*(…) strategic CVC backed IPOs have weaker CEOs and a larger proportion of independent directors on their boards and compensation committees compared to a matched sample of TVC backed IPO firms. CVC backed IPO firms also have a higher frequencies of staggered boards and forced CEO turnovers.*"

In a well written paper on intrapreneurship by Ibrahim (2016) the author discusses CVCs and its advantages over IVCs. The paper is written from the legal perspective and, as the author points out, there is much written on the innovation in start-ups but the innovation in corporation, which the author calls it intrapreneurship, is understudied. "*The Article explores a hybrid approach—corporate venture capital—that combines entrepreneurial and intrapreneurial advantages. In corporate venture capital, a large corporation's venture arm can invest in promising start-ups, and thus share in disruptive gains, without having to overcome obstacles to developing those projects internally*" (Ibrahim, 2016). This distinction

and thought process makes the paper relevant, because here the author tries to combine the best from both worlds.

Lantz & Sahut (2011) has been like an encyclopaedia for my corporate venture capital research. The authors explain very well what corporate venture capital is and how it distinguishes its self. One part that was very helpful was the list of benefits from a CVC investment. A few of these are: "*help for short-term problems, access to expertise in company management and giving credibility to the start-up*". In their conclusion they write, "*corporations benefit from the chance to invest in a diversified portfolio which enables them to reduce the risk of innovation whilst keeping some control over the target firm or a purchase option on the innovation once it has passed the early stage."* That is a good argument to be fair, but there is little empirical proof. Another interesting finding in their paper is also that "*CVC activity continues to develop more in high-tech sectors such as biotechnology*" (Lantz & Sahut, 2011). That is an indicator of why it was hard for me to find any competitors for the pharmaceutical sector companies in my sample. There seems to be a high number of very active CVCs among the largest corporations in that sector. This consistency makes my sample more elegant.

In the next chapter there will be a more detailed explanation about how these papers helped me step by step to develop the hypothesis that finally evolved after reading and processing the information.

3. Hypotheses

The Hypothesis that developed in this paper is, the market rewards corporate venture capital activity. And I want to find out if that is true or not. After reading the many significant papers on the topic I concluded that from the perspective of the CVC there has not been a large amount of empirical research done. Many papers write about the advantages and disadvantages of corporate venture capital investment activity, but few, if any, take the step and try to empirically prove the success of corporate venture capital investments and how that may result in benefits for a corporation that engages in these activities. In the following text I will refer to the literature review in the previous chapter and how the papers helped to develop the research question. As I started working on this paper, there was no clear hypothesis, I only knew it would be on the topic of venture capital.

Vermeulen & Fenwick (2016) says that in a direct investment "*large and established corporations establish an "internal" - but independent - corporate venturing capital (CVC) unit that invests directly from the companies own balance sheet (i.e., it is usually a direct*

subsidiary of the parent company)". In this part of their paper they included a chart of the most active corporate venture capitalists, from a source which would later be the same as my source, the databank from Global Corporate Venturing Analytics. Furthermore, in the same part they point out that they have difficulty to measure their success. But despite the strategic measurement, the authors state that these corporate venture capital units focus on financial returns as much as on strategic success. Their paper however is mainly discussed on a qualitative level. I knew that I found something where more research was needed, but I was still puzzled on how this could lead to a research topic for my paper.

Ivanov & Masulis (2008) distinguish very well the difference between independent venture capital and corporate venture capital. Similar to my study the authors want to find out the impact of CVCs, but here compared to IVCs on a group of companies. The observed corporations here are not the invested companies but the companies that receive the funding. The distinction and the thought process gave me a better idea about how to structure my thesis.

McChaery & Vermeulen (2016) describe the importance of venture capital and the challenges of the corporate venture capital sector. The authors describe that there is a bias towards corporation with a strong technology and marketing department. This bias was important to consider to have a sample that reflects reality as much as possible. The problems they describe helped me to understand that when looking at the global performance of the corporations that provide the investment, there will be many factors that can confuse the result. Thinking about a mechanism that tries to reflect all information possible there is one system that tries to do that for many years, the market, one can discuss this method of measurement. It is not the only way to look at the performance, but it is the measurement that I chose, because the market has always been an efficient way to reflect a large amount of information in very few figures. The stock performance is easily accessible data for each of the companies in the sample size.

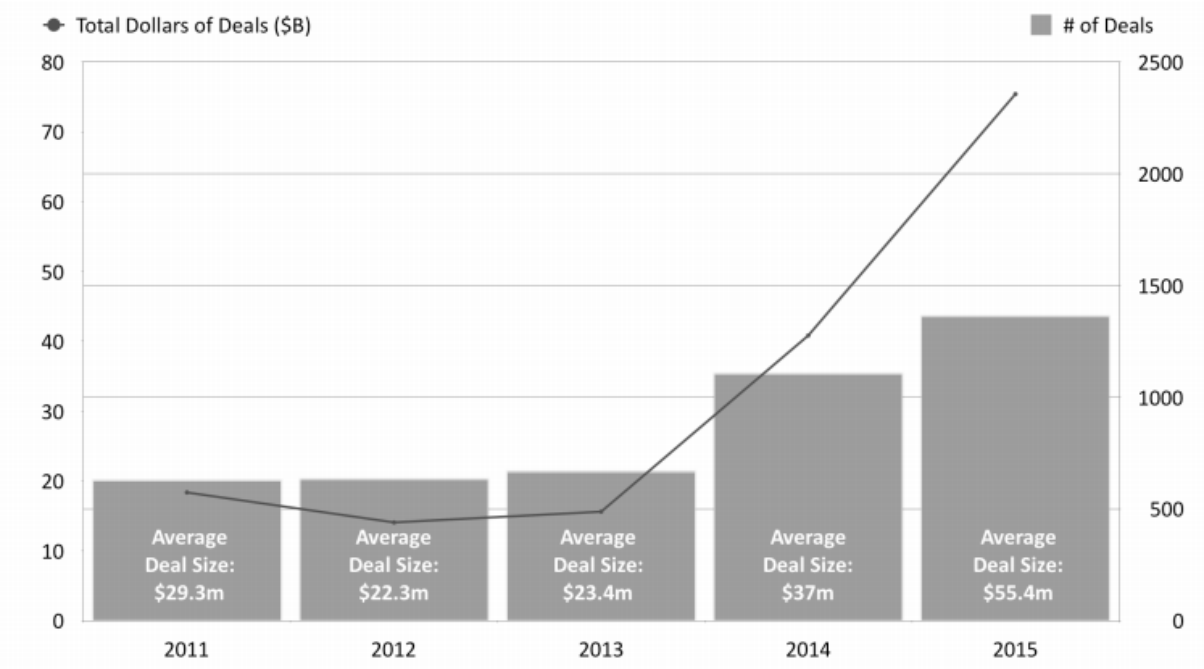
Benson & Ziedonis (2009) discuss performance of corporations that invest in start-ups. They found out that when investments relative to their R&D increases then their acquisition performance increases as well. They also state that the experience of the corporation engaging in venture capital has a positive impact on the performance of the start-up. That is why I implemented an experience dummy variable (referred to as "experience" in the results tables) to measure whether the experience of the corporate venture capital company has any impact on the stock returns. This empirical approach regarding the investment performance of corporations raised further questions regarding my research question. Does this improvement

in investment performance then continue to show positive evidence in the overall success of the company? Does the market reward have any relevance here? Interesting here is that the authors use a sample size of 34 companies. I find many of the corporations in their sample in my sample as well. That being said, I did not look at their samples until after I had my sample already stabilized, that gives greater confidence in the sample in my paper a more confident note.

The idea for the paper then developed to look for a difference in the stock returns of the companies that engage in CVC investments compared to companies that don't. Therefore, I chose yearly stock returns over the past 5 years as the dependent variable. The independent variable is active CVC yes or no, which is a dummy variable. The pattern or result that I expected was that there is a bias toward active CVC. Also I knew there was a possibility that too many factors would dilute the result.

Start-ups, venture capital and corporate venture capital are some of the most interesting fields to study for a young finance student and after all the buzz and hype around these topics one can get suspicious about the value it really creates for those who invest.

The graph above shows that the average deal size in CVC investment increased from $29.3m in 2011 to $55.4m in 2015, an increase of 89%, highlighting the relevance of the topic.



Graph 2: Global Corporate Venture Capital Investments 2011-2015 (Vermeulen & Fenwick 2016)

Vermeulen & Fenwick (2016) asks: "*What is interesting, however, is that the most active corporate venture capital units are often affiliated with relatively young listed corporations which are usually still run and managed by executives who have the "startup life" embedded in their DNA. Does this mean that older corporations do not or should not engage in corporate venture capital initiatives?"*

There is no doubt that every product that we see and use, was at one point an idea in the head of a curious person. However, it is easier to have an idea than trying to realize that idea, some ideas need a significant amount of resources to make them become real. Silicon Valley in California is a prominent example; companies like Paypal, Facebook, Amazon and Tesla would be less likely to occur without external funding from risk seeking investors. Banks aren't interested in high risk investments, the average investor does not high risk investment either, but a small amount of visionaries and high risk takers such as Peter Thiel, Marc Andressen, Fred Wilson and Sam Altman seeking those kinds of investments.

Large companies struggle with disruptive innovation because they need to serve their existing customers and don't have abundant resources left to innovate, their shareholders are more important. Small companies try to break into the market, and they usually cannot do that by size and scale but by novelty of the product. "McCahery & Vermeulen (2016) describe the reason why large companies often have problems dealing which start-ups. Both organisations operate in almost exactly the opposite way, and have different expectations about their partnership. If the start-up does not feel the full support and motivation from the CVC manager, then their willingness to share details may decrease. Again, one important reason why corporations engage in corporate venture capital activity is because of their need for information about the newest technology and products. If the start-up does not want to share all information, this benefit is not there. One of the reasons why corporate venture capital manager's performance is sometimes not at the same level as the expectation by the start-up is because they get paid in salary and bonus."

There is a way of synergy where both start-ups and large corporations can profit and that is venture capital activity as part of a large company. McCahery & Vermeulen (2016) say that "*even though CVCs perform less well compared to traditional VCs, CVC-backed firms are more innovative despite their age and high level of risk. They also find that these CVCs have a greater tolerance for failure.*"

From the discussion so far it seems that large corporations have a difficult time finding capacity to innovate. A solution is an independent venture capital arm as a part of a large corporation. I It is hard for the management of a large corporation to set up a venture capital fund., especially with little amount of data to rely on evidencing how that will impact the overall performance of their companies. I believe the question raised in this paper will contribute to a more transparent way of analysing CVC activity.

4. Sample, Data and Methodology

I constructed a hand-collected set of corporate venture capital companies, which means that I researched every number of the dataset by myself. The reason I did it that way was that there is no dataset so far with the information needed. All data had to be collected via my own research.

My data is a list of the most active CVCs, this is measured by the number of investments in start-ups a CVC makes. I prefer the number of CVC investments over the magnitude of each investment because one large investment can bias the whole list, and it does not give a precise information about the activity.

The main source for my sample comes from *CB Insights*. A platform that analyses millions of data points on venture capital, start-ups, patents and partnerships. They publish every year a list of the most active CVCs. However, their list of the companies does not equal my list, because for some companies it is difficult to collect data. Therefore, my sample of companies focusses on public companies, it is much easier to ask the market and collect the data.

It is crucial to find a match that reflects as well as possible the CVC sample. This is where I invested most of my research time, because I know that this is the strength and at the same time the weakness of the paper. I mainly used www.google.co.uk/finance, because their data is free and considered to be a reliable source. The data from their platform is also easy to use and easy to manipulate with Microsoft Excel. I also used the website www.hoovers.com to find the competitor of each CVC. That website is very good, because it analyses the 3 companies that are the biggest competitors and explains why. Furthermore, I used www.crunchbase.com as a starting point to gather information about the number of investments made and if the non-CVCs are really not active. This is an important point. Some companies that are in the non-CVC mirror portfolio might have a CVC arm but the arm is not very active based on the list of investments that they made. The total dataset contains 60 companies.

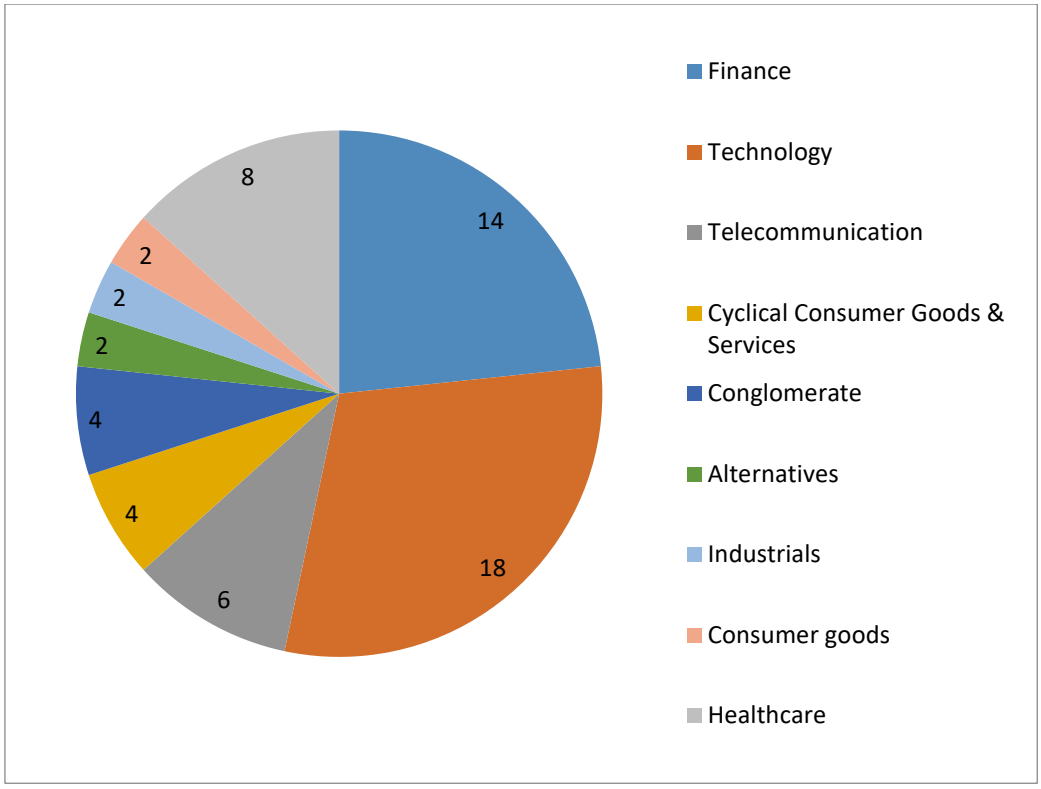
After considering these factors, to find the matching portfolio I controlled for the size using the market capitalization and for the risk using the beta of the stock. I decided if the market capitalization variation of the sectors in my sample is over +-50% and if the beta variation is over +-25% then I will reject the company and look for a better fit. For the sector healthcare, it was not possible to get a match for 2 of the total 4 companies so I exchanged them with companies that have the same size and the same risk; these companies are Johnson & Johnson and Merck. I used Exxon Mobile as the mirror company for Johnson & Johnson and BP as the mirror company for Merck. The reason I chose them was, that I want to have mirror portfolio that reflects the size and the risk of the original.

Sector	Amount	Market cap CVC (avg.)	Beta (avg.)	Market cap non-CVC (avg.)	Beta (avg.)	Market cap variation	Beta variation
Non-Cyclical Consumer Goods & Services	1	$ 167,073,840,000.00	0.90	$ 226,274,970,000.00	$ 0.65	35.43%	-27.78%
Cyclical Consumer Goods & Services	3	$ 123,873,506,666.67	1.18	$ 110,221,663,333.33	$ 1.24	-11.02%	4.51%
finance	7	$ 78,731,518,394.14	1.35	$ 114,845,565,714.29	$ 1.15	45.87%	-15.04%
Healthcare	3	$ 209,951,062,952.00	0.92	$ 97,444,046,666.67	$ 1.20	-53.59%	30.55%
cross section	2	$ 260,251,590,000.00	0.81	$ 237,599,175,000.00	$ 0.92	-8.70%	13.58%
Technology	10	$ 208,567,826,727.27	1.29	$ 188,165,060,000.00	$ 1.06	-9.78%	-18.34%
Telecommunication	3	$ 111,366,286,666.67	0.68	$ 167,255,823,333.33	$ 0.60	50.19%	-12.68%
Industrials	1	$ 262,181,190,000.00	1.19	$ 139,359,700,000.00	$ 1.16	-46.85%	-2.52%
Total	**30**						

Table 1: Sector Analysis for mirror portfolio

For the market capitalization it was important to convert the data into standardized USD currency. To compare the market capitalization and the beta I calculated the average of each sector of the dataset for CVCs and the same for the mirror portfolio, I then used the return formula to see the variation. Most of the mirror companies fit very well, with minor exceptions.

Graph 3 shows the allocation of the companies in the sample.



Graph 3: Number of companies in sample & its allocation by sector

As mentioned before, the sample size is 60 companies in total, which means 30 companies in each group, CVC and non-CVC. There is a significant number of technology and finance companies in the sample, which is not surprising due to the nature of their business, other papers also suggested that bias. The third largest sector is the healthcare sector with 8 companies, also not surprising as there are companies in the healthcare sector that engage a lot in corporate venture capital activities. The fourth largest sector is telecommunication with 6 companies. One sector that is also mentioned in the graph is the sector alternatives. These are the companies that are a mirror of a company with a corporate venture capital arm but from a different sector. The details regarding the decisions about the mirror companies will be explained in the following pages.

Alstom is a direct competitor of General Electric, however, the market capitalization of Alstom is about 7bn USD and the market capitalization of General electric is 260bn USD. Because of this mismatch I had to choose another company. Unfortunately, there are no direct competitors with the same market capitalization that don't have an active venture capital arm. Therefore, I looked at companies in alternative sectors and found Boeing Co. as the best fit. The market

capitalization is significantly smaller but within the limit set earlier in this chapter and the Boeing Co. operates in similar markets. There is one thing to be aware of, Boeing Co. does have an active venture capital arm called HorizonX[3]. However, the venture capital arm, cannot be considered active because it started its activity in 2017. Challenges like that describe very well the nature of the sample so tried to be as objective as possible in my evaluation of the mirror portfolio. I received most of the data from Google Finance, Yahoo Finance and Reuters, which helped me to analyse the fundamentals of the companies in the sample.

Another company that I wanted to have in my sample but could not include was Yahoo. Because of the acquisition of Yahoo by Verizon this year the access to the data became too difficult.[4] Yahoo was supposed to be the mirror company for Rakuten. "*The Japanese retail giant Rakuten purchased the U.S. ecommerce site Buy.com, and then rebranded it as the online marketplace Rakuten.com Shopping. Rakuten is similar to Amazon in that it has one product catalog, and retailers compete against other sellers by selling their own SKUs. Most of the customers are still from Japan (37.65 million monthly unique visitors in Japan).*"[5] Instead of Yahoo I used eBay as in the mirror company to Rakuten as their business model is much more similar to that of Rakuten. *"The largest C2C (consumer to consumer) marketplace on the internet, eBay provides a possibility to sell nearly anything you want by setting up an auction as well as by a fixed price.*"[6] The market capitalization is only about 50% lower than that of Rakuten, and the beta is fairly similar. After intense research, there is no evidence that eBay has a venture capital arm.

Due to lack of data for the mirror company of Verizon, (the mirror company in the original sample was the Sprint Group) I had to use another company; China Mobile. China Mobile is a good fit, as it operates in a similar industry; "*China Mobile Communications Corporation is a Chinese state-owned telecommunication company that provides mobile voice and multimedia services through its nationwide mobile telecommunications network.*"[7] "*Verizon (VZ) and China Mobile (CHL) remain the largest wireless players in the United States and China respectively, with both companies viewed as benchmarks of sorts for investors seeking*

[3] Crunchbase website: https://www.crunchbase.com/organization/horizonx-ventures#/entity. Access 01.10.2017
[4] Market Realist website: http://marketrealist.com/2017/07/how-the-yahoo-acquisition-is-starting-to-affect-verizon/. Access 12.10.2017
[5] Solid commerce website: http://www.solidcommerce.com/pros-cons-selling-top-marketplaces. Access 12.10.2017
[6] Solid commerce website: http://www.solidcommerce.com/pros-cons-selling-top-marketplaces. Access 12.10.2017
[7] Wikipedia website: https://en.wikipedia.org/wiki/China_Mobile. Access 12.10.2017

exposure to the telecom space in the world's two largest economies."[8] As the article explains, both companies cover different markets, but share the same model of revenue generation, that is why they fit very well.

The next in the list is the Siemens AG. The German company has a venture capital arm called Siemens Venture Capital or next47. Based on the website www.financials.morningstar.com[9] I found Honeywell International Inc. as a suitable match. Honeywell started its venture capital fund only very recently. Both companies have similar market capitalization and beta.

Comcast Venture from Comcast Corporation is the next corporation with a venture capital arm in the sample. The company has a market capitalisation of approximately 175,000 million USD and a beta close to 1. Initially I thought that Chartered Communications would be a good fit because of the similar business model. Unfortunately, Chartered Communications is a private company, thus no has no stock performance. I found Home Depot Inc. to be an even better fit, because both companies are in the cyclical consumer goods & services business and have a very similar market capitalization and beta.

Time Warner Investments from Time Warner Inc. and CBS Corporation which are both in the Cyclical Consumer Goods & Services Sector is the next pair. "*Time Warner Inc. is a media and entertainment company*."[10] And "*CBS Corporation is a mass media company*."[11] Both companies operate in very similar markets and their market capitalization is not too much different even though CBS Corporation is much smaller by size.

Ping An Insurance (Grp) Co of China Ltd and China life Insurance Co Ltd. are both companies that cover the Chinese market and operate in the insurance sector. Their market capitalization is very similar as too is their beta. They are a very good fit.

BNP Paribas SA and Citigroup Inc. are both companies which operate in banking and the financial market. Citigroup operates on a much wider field than BNP Paribas SA, they also operate in different geographic areas. But they are still a good fit, because of the relative similar sectors which they operate in.

[8] NASDAQ website: http://www.nasdaq.com/article/china-mobile-verizon-how-two-of-the-worlds-largest-wireless-carriers-compare-cm731260. Access 12.10.2017
[9] Morningstar Website: http://financials.morningstar.com/competitors/industry-peer.action?t=SMAWF&region=usa&culture=en-CA. Access 13.10.2017
[10] Google finance website: https://www.google.co.uk/finance?q=NYSE%3ATWX&ei=DT2cWdCDBNGUswHUvqW4Cg. Access 12.10.2017
[11] Google finance website: https://www.google.co.uk/finance?q=NYSE%3ACBS&ei=mD2cWdEPw-2wAcLflzA. Access 12.10.2017

We go now through all of the remaining companies in the finance sector of the sample. Allianz und AXA is the next pair. *Allianz SE segments include Property-Casualty, Life/Health, Asset Management, and Corporate and Other*[12], and AXA SA *is a company that includes Life & Savings, Property & Casualty, Asset Management , Banking and Holding companies*.[13] Both fit very well by market and by market capitalization.

An easy fit for American Express Ventures and their mother company was Visa Inc. Both companies operate in similar markets, but their market capitalization is different. Here again that is covered by the 14 companies in the finance sector in the sample.

For Caixa Capital from its mother company CaixaBank SA it was difficult to find a matching company. I found Erste Group Bank AG to be the best fit because both operate in similar industries but mainly because of their similar size. It is also difficult to find companies in the financial industry who do not have an active venture capital arm.

Santander InnoVentures from Banco Santander, S.A. and the matching company Banco Bilbao Vizcaya Argentaria S.A. (BBVA) are both large retail banks. They don't have quite the same size but their similar business model makes them a good fit, this is also the most sensible option when considering the other companies in the finance sector of the sample.

Capital One Growth Ventures from Capital One Financial Corp. which "*is a diversified financial services holding company*".[14] Bank of America Corp "*is a bank holding company and a financial holding company*"[15] and therefore fit very well. As the reader realizes there are no perfect matches but for the finance sector that is not too much of a problem because I am comparing the averages of the market capitalization and beta.

Let's continue with Novartis Venture Funds from the Novartis AG. I found Bayer AG as the matching company. As explained before, companies in the pharmaceutical industry are more heavily involved in the venture capital than other industries. Both companies operate in a similar sector with a similar size and risk measure.

[12] Google finance website: https://www.google.co.uk/finance?q=OTCMKTS%3AAZSEY&ei=uEacWbn5Cc6OUOr7oMAC. Access 12.10.2017
[13] Google finance website: https://www.google.co.uk/finance?q=OTCMKTS%3AAXAHY&ei=wkacWfGBD4PKUaTctqAO. Access 12.10.2017
[14] Google finance website: https://www.google.co.uk/finance?q=NYSE%3ACOF&ei=klucWYGLJoLAU7zFl0g. Access 12.10.2017
[15] Google finance website: https://www.google.co.uk/finance?q=NYSE%3ABAC&ei=b1ycWfjyIJONUteBtfgC. Access 12.10.2017

Pfizer Venture Investments from Pfizer Inc. is another large company in the pharmaceuticals sector. Bristol-Myers Squibb Co is the matching company here. Same industry, the market capitalization is different but the beta is fairly similar.

Roche Venture Fund from Roche Holding Ltd. "*is a research-based healthcare company*."[16] The matching company here is Gilead Sciences, Inc. which "*is a research-based biopharmaceutical company that discovers, develops and commercializes medicines in areas of unmet medical need*"[17]. Both companies have different values in terms of market capitalization and beta. This is an issue and might skew the result. However, both are companies within the same sector which also have a very similar stock performance.

Now let's get to the interesting bit of the sample, the tech companies. I start with Samsung Ventures from Samsung Electronics Co Ltd. "*Samsung Electronics Co., Ltd. is a Korea-based company principally engaged in the manufacture and distribution of electronic products*."[18] Samsung is not a typical tech company, the company could also be in the cyclical consumer goods sector. That's why is use Sony Corp as the matching company. "*Sony Corporation (Sony) is engaged in the development, design, manufacture and sale of various kinds of electronic equipment, instruments and devices for consumer, professional and industrial markets, as well as game consoles and software*."[19] They are the best fit that I could find. Sony's venture capital fund Sony Innovation Fund is a not very active venture capital arm. Please consult both sources below[20][21].

Mother company of Google Ventures, Alphabet Inc., actually has two venture capital arms, the second is Google Capital, but for the research of this topic this is not important. The company that I use to compare with Alphabet Inc is Facebook Inc. Both companies have similar market capitalization and a similar risk, they have different business models, but are both big players

[16] Google finance website: https://www.google.co.uk/finance?q=OTCMKTS%3ARHHBY&ei=kWCcWZCdOsOMUL2MkIgH. Access 12.10.2017
[17] Google finance website: https://www.google.co.uk/finance?q=NASDAQ%3AGILD&ei=nWGcWdmAEsnOU-LgvMAM. Access 12.10.2017
[18] Google finance website: https://www.google.co.uk/finance?q=KRX%3A005930&ei=nWGcWdmAEsnOU-LgvMAM. Access 12.10.2017
[19] Google finance website: https://www.google.co.uk/finance?q=NYSE%3ASNE&ei=N2OcWYn9DZONUteBtfgC. Access 12.10.2017
[20] Google finance website: https://www.crunchbase.com/organization/sony-innovation-fund#/entity. Access 12.10.2017
[21] Google finance website: http://www.sonyinnovationfund.com/portfolio/. Access 12.10.2017

within the technology sector. Facebook invests in start-ups, but not through a separate entity like a venture capital arm, most investments come from their principles.

Intel Capital from Intel Corporation is another large player in the technology world. Texas Instruments Incorporated as the matching company is a much smaller company but is a designing and manufacturing company like Intel Corporation. I believe they are a good fit, despite the difference in market capitalization, because that is covered by the total number of 10 technology companies in the sample.

Salesforce Ventures from salesforce.com, Inc. "*is a provider of enterprise software, delivered through the cloud, with a focus on customer relationship management (CRM).*"[22] I chose the much bigger Oracle Corporation to offset the size difference from other matching companies. "*Oracle Corporation provides products and services that address all aspects of corporate information technology (IT) environments, including application, platform and infrastructure.*"[23] They are both leading technology companies in their market and thus are a good pair.

Cisco Investments from Cisco Systems, Inc. is the next technology company in the list and I chose International Business Machines Corp. as the matching company. The two fit very well by market capitalization and by risk.

This one is a difficult one; Qualcomm Ventures from QUALCOMM, Inc. is the next corporate venture capital arm that needs a comparable and the website www.hoovers.com again was very helpful in figuring that out. I found Cirrus Logic, Inc. a good fit, because they have similar business models and also a similar size and risk. Thus, this is the closest fit among other options.

Microsoft Ventures from Microsoft Corporation is the next in the line. The matching company is Apple Inc. They are both big technology corporations which have a similar market capitalization and beta. An article[24] from marketwatch.com explains that Apple does not have a venture capital arm. This is an interesting thing to have in mind, when reading the results

[22] Google finance website: https://www.google.co.uk/finance?q=NYSE%3ACRM&ei=4mmcWen4BMyDUILMiegD. Access 12.10.2017
[23] Google finance website: https://www.google.co.uk/finance?q=NYSE%3AORCL&ei=6WmcWaCKB8K_UfLyocgK. Access 12.10.2017
[24] Google finance website: http://www.marketwatch.com/story/why-apple-doesnt-have-a-venture-capital-arm-2016-06-15. Access 12.10.2017

discussion of the paper. Apple Inc. is a very successful company even without having a corporate venture capital arm.

Nokia Growth Partners from Nokia Corporation is an interesting one. Nokia does much more than building phones, it "*is a Finland-based company engaged in the network and Internet protocol (IP) infrastructure, software, and related services market*"[25]. Telefonaktiebolaget LM Ericsson is the matching company. "*Telefonaktiebolaget LM Ericsson (Ericsson) provides infrastructure, services and software to the telecommunication industry and other sectors. The Company's segments include Networks, IT & Cloud and Media*."[26] I chose them because of their closely related business model.

Hewlett-Packard Ventures from HP Inc is the next one, here I chose Accenture plc. "*Hewlett Packard Enterprise Company is a provider of technology solutions*"[27] and "*Accenture plc is a professional services company serving clients in various industries and in geographic regions, including North America, Europe and Growth Markets.*"[28] So both companies provide solutions for technological challenges.

Unilever Ventures from Unilever plc "*is a fast-moving consumer goods (FMCG) company*"[29]. One of their main competitors is Procter & Gamble Co, that's why I choose them as the matching company. Both companies are of similar size.

Orange Digital Ventures from Orange SA is the next one. "*Orange SA is a telecommunications operator*."[30] The matching company is AT&T which now was acquired by Time Warner but the past data still suits the purpose, acquisition effects will come later.

Deutsche Telekom Strategic Investments from Deutsche Telekom AG is the next one and the British equivalent, BT Group plc, is the matching company. Both companies have a similar market capitalization and are both communications services companies.

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[25] Google finance website: https://www.google.co.uk/finance?q=NYSE%3ANOK&ei=QW-cWficE4zDUdihuugC. Access 12.10.2017
[26] Google finance website: https://www.google.co.uk/finance?q=FRA%3AERCB&ei=QW-cWficE4zDUdihuugC. Access 12.10.2017
[27] Google finance website: https://www.google.co.uk/finance?q=NYSE%3AHPE&ei=GnGcWaGANMaSUrWon9AC. Access 12.10.2017
[28] Google finance website: https://www.google.co.uk/finance?q=NYSE%3AACN&ei=6HCcWeHXAor2U8HaiOAE. Access 12.10.2017
[29] Google finance website: http://www.google.co.uk/finance?q=LON%3AULVR&ei=RIydWeH3IYGcUITAkqgJ. Access 12.10.2017
[30] Google finance website: https://www.google.co.uk/finance?q=NYSE%3AORAN&ei=GnGcWaGANMaSUrWon9AC. Access 12.10.2017

CVC companies	non-CVC companies
Robert Bosch GMBH	Honeywell International Inc.
Comcast Corporation	Home Depot Inc.
Time Warner, Inc.	CBS Corporation
Ping An Insurance (Group) Company of China, Ltd.	China Life Insurance Company Limited
Citicorp Banking Corporation	BNP Paribas
AXA Strategic Ventures Holding	Allianz SE
American Express Company	Visa Inc.
Caixa Geral de Depósitos, SA	Erste Group Bank AG
Banco Santander, S.A.	Banco Bilbao Vizcaya Argentaria, S.A.
Capital One Financial Corporation	Bank of America Corporation
Pfizer Inc.	Bristol-Myers Squibb Co
Johnson & Johnson	Exxon Mobil Corporation
Merck & Co. Inc.	BP P.L.C.
Novartis International AG	Bayer AG
Roche Holding AG	Gilead Sciences, Inc.
General Electric Company	The Boeing Company
Samsung Group	Sony Corporation
Rakuten, Inc.	eBay Inc.
Alphabet Inc.	Facebook
Intel Corporation	Texas Instruments Incorporated
salesforce.com, inc.	Oracle Corporation
Cisco Systems, Inc.	International Business Machines Corp.
QUALCOMM Incorporated	Cirrus Logic Inc
Microsoft Corporation	Apple
Nokia Corporation	Telefonaktiebolaget LM Ericsson
Hewlett Packard Enterprise Company	Accenture Plc
Unilever plc.	Procter & Gamble Co.
Orange S.A.	AT&T Inc.
Deutsche Telekom AG	BT Group plc
Verizon Communications Inc.	Sprint corporation

Table 2: List of all corporations in sample

There is one company that is very prominent in the corporate venture capital industry and that is SoftBank. Softbank is "*neither soft nor, technically, a bank. It's a sprawling Japanese mobile carrier, internet service provider and holding company for other businesses ranging from cloud services and self-driving cars to energy trading. And its investment arm has bankrolled some of the world's largest and most successful upstart technology companies, including many with serious name recognition here in the U.S.*"[31] The reason why SoftBank is not in my sample is that the company does not have a typical CVC setup. While the company makes many CVC investments themself, they also raised external funding for their venture investments. This

[31] Techcrunch website: https://techcrunch.com/2017/08/09/how-softbanks-100b-fund-is-in-a-league-all-its-own/. Access 12.10.2017

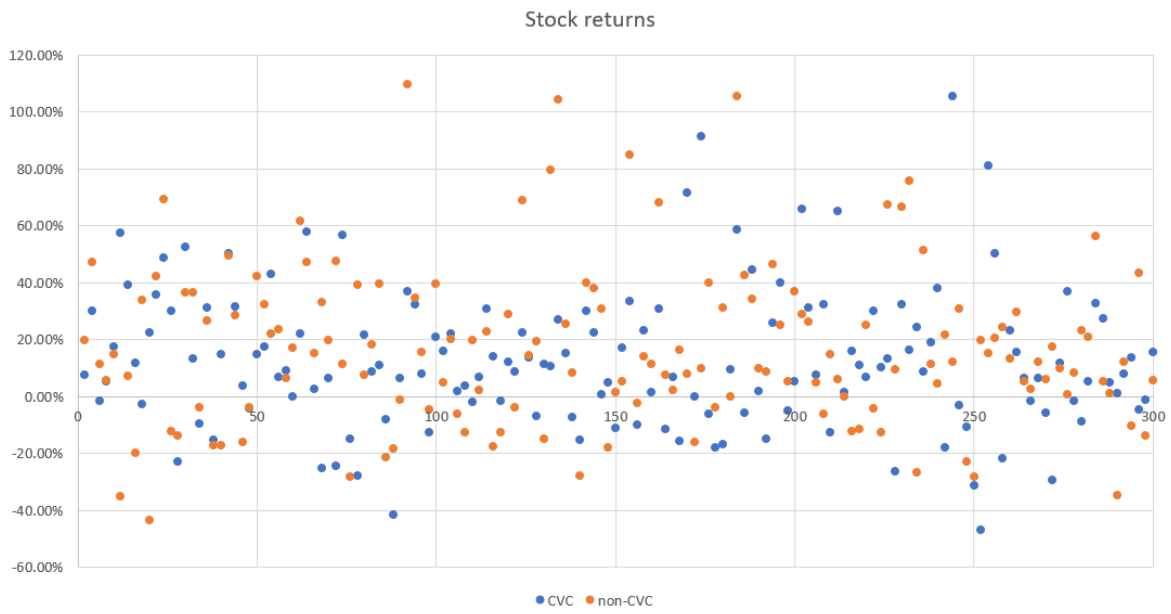
novel approach is a mix between the traditional venture capital and corporate venture capital, because of this I exclude it from my sample.

The data for the independent variables come from a website called www.gurufocus.com. The website was founded in 2004 by Charlie Tian, Ph.D[32], I was able to find annual data for most of the companies on that website. After running the regression for the first time I discovered that a company with a very high market return, +-300%, can skew the regression outcome, I decided to take these out. One example that I took out of the dataset is Netflix with a market return of around 800% over 5 years.

After I had a good mirror portfolio I started researching for the stock returns of each company, I used Yahoo Finance to download the historical prices and I used the adjusted close prices of each of the corresponding months and years. In the next step I calculated the returns, then I created a separate Excel spreadsheet were I implemented the data for all of the 60 companies stock returns in one column; stock returns are my dependent variable. After gathering the information for the stock returns I focussed on the independent variables.

Graph 4 shows the distribution of the stock return of the sample. One can see that there are no outliers that could bias the results. As mentioned before, there were a number of stock returns in the first draft of the sample that included outliers which would bias the results dramatically, especially when considering such a small sample size.

[32] Gurufocus website: https://www.gurufocus.com/about.php. Access 12.10.2017



Graph 4: Scatter diagram of stock returns of all 60 corporations

I tried different independent variables, not only the ones that you can find in the final regression model. I first used the market capitalization as the size measure variable, but I realized that total assets would be a better measure and fit, because the market capitalization is a value given by the market. Total assets states how much assets the company has. For the papers purpose this gives a good indicator about the size of a company in the sample.

For the experience variable, it is important to know when the corporate venture capital arm was founded. See table 3 for these details.

Companies	Date founded
Johnson & Johnson Innovation	1973
Citi Ventures	1974
Caixa Capital	1991
Intel Capital	1991
Cisco Investments	1993
Novartis Venture Funds	1996
Deutsche Telekom Strategic Investments	1997
Time Warner Investments	1998
Siemens Venture Capital	1999
Comcast Ventures	1999
Samsung Ventures	1999
Qualcomm Ventures	2000
Verizon Ventures	2000
Roche Venture Fund	2002
Unilever ventures	2002
Pfizer Venture Investments	2004
Nokia Growth Partners	2005
Google Ventures	2009
Salesforce Ventures	2009
Merck Global Health Innovation Fund	2010
American Express Ventures	2011
Ping An Ventures	2012
General Electric Ventures	2013
Rakuten Ventures	2013
Santander InnoVentures	2014
Capital One Growth Ventures	2014
Hewlett-Packard Ventures	2014
AXA Strategic Ventures	2015
Orange Digital Ventures	2015
Microsoft Ventures	2016

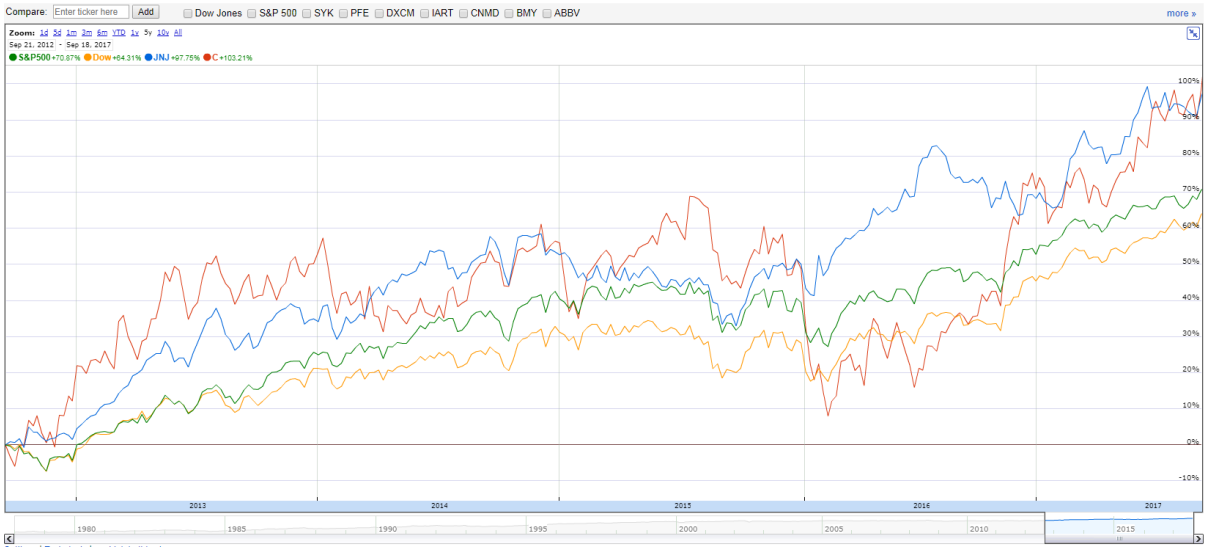
Table 3: List of corporate venture capital units and the year they were founded

I would like to mention that among the companies that have the longest history in corporate venture capital activity are Citicorp Banking Corporation, who started their corporate venture capital fund in 1974. "*Citi Ventures, Inc. is the venture capital arm of Citicorp Banking Corporation specializing in incubation and seed investments in the Fintech sector. It seeks to invest in startups. The firm seeks to invest in financial services industry and transformational technologies, including those that leverage the power of social media and information analytics with a focus on commerce and payments; security, cybersecurity, and enterprise IT; big data and analytics; machine learning, and financial technology*."[33]

[33] Bloomberg website: https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=209506094. Access 12.10.2017

Johnson & Johnson Innovation is an even older corporate venture capital arm. The arm was created in 1973. "*Johnson & Johnson Innovation - JJDC, Inc. operates as an investment arm of Johnson & Johnson. The firm specializes in investments from early stages of seed funding including start-up, early, mid, and late venture investments to the advanced stages of series venture management. It also provides bridge financing. The firm invests in emerging health care businesses and life science and technology businesses that focus on traditional health care sectors such as medical devices, diagnostics, consumer health, pharmaceuticals, and consumer products, as well as emerging areas of innovation, including biotechnology, and wellness and prevention.*"[34]

These two companies were way ahead of their peers at that time. The following chart (Graph 5) shows that both companies outperform the SP500 and the Dow Jones for the time period of the past 5 years.



Graph 5: Comparison of Johnson & Johnson & Citicorp Banking Corporation with S&P 500 & Dow Jones (www.google.finance.com)[35]

The red line shows the Citigroup stock performance of the last 5 years, and the blue line is the stock performance of Johnson & Johnson of the last 5 years. The other 2 lines in green and yellow show the performance over the same period of time of the S&P 500 and the Dow Jones.

[34] Bloomberg website: https://www.bloomberg.com/research/stocks/private/snapshot.asp?privcapId=21299. Access 12.10.2017
[35] Google finance website: https://finance.google.co.uk/finance?q=NYSE%3AJNJ&ei=bzbjWcjEC4fIswHAnIqABA. Access 15.10.2017

As visualised by this chart, both companies outperform the two major indices in their respective market. To take this into account it makes sense to implement an experience variable in the regression model.

I also tried using the profit-earnings-ratio (PE-ratio) as an additional independent variable for the regression model. The PE-ratio is used as a growth measure. "*A stock with a high P/E ratio suggests that investors are expecting higher earnings growth in the future compared to the overall market, as investors are paying more for today's earnings in anticipation of future earnings growth. Hence, as a generalization, stocks with this characteristic are considered to be growth stocks*."[36] The PE-ratio is calculated as the Share Price divided by Earnings per Share. Unfortunately, the PE-ratio was not really helpful to develop the regression model, due to a strong lack in significance.

Another option I tested was controlling for the sector by running the regression for only the companies in the finance sector and in the technology sector. This will become more clear in the next chapter.

5. Presentation and analysis of results

In this section I present and analyse the results of the paper. The model shows that there is no evidence that having a CVC arm increases the stock returns.

As explained in the section about the data, one of the variables is a dummy variable which is used to explain the relationship between the stock returns and having a corporate venture capital arm or having no active corporate venture capital arm.

The multi-linear regression model #1 is:

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_i \quad (1)$$

Where:

y_i= stock returns where i = 1, …, 261

x_1= dummy variable to determine if it is a corporation with or without a corporate venture capital unit

x_2= revenue of the companies in the sample

[36] Investopedia website: http://www.investopedia.com/university/ratios/investment-valuation/ratio4.asp. Access 12.10.2017

x_3= total assets of the companies in the sample

ε_i= error term where i = 1, …, 261

The coefficient of the dummy independent variable, calculated with Microsoft Excel is -0.033027116 (Table 4). The negative coefficient value means that there is a negative correlation between the dependent and the independent variables. Thus, we can observe by just looking at this number, that having a corporate venture capital arm actually results in a lower stock return performance over the past 5 years (2012-2016). If we look at the p-value of the dummy variable, we find that the value is 0.302902238. That means that we don't reject the null hypothesis and the dummy variable is not significant. The R-squared of the regression output in Table 4 is 0.020427148. When adjusting it for the numbers of variables in the regression model the adjusted R-squared becomes 0.008992446. The coefficient for the independent variable revenue is -4.60686E-07 and has a significant p-value of 0.048525666, this means the variable is significant. The last independent variable, total assets, has a coefficient of -1.57963E-08 and an insignificant p-value of 0.638670353. The standard error of the regression model is 0.257578784.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.142923575
R Square	0.020427148
Adjusted R Square	0.008992446
Standard Error	0.257578784
Observations	261

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.355569337	0.118523112	1.786417112	0.150169267
Residual	257	17.05113531	0.06634683		
Total	260	17.40670465			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.186521627	0.028521145	6.539766367	3.30542E-10	0.130356718	0.242686536	0.130356718	0.242686536
dummy	-0.033027116	0.031993731	-1.032299609	0.302902238	-0.096030371	0.029976139	-0.096030371	0.029976139
revenue in mio	-4.60686E-07	2.32415E-07	-1.982167034	0.048525666	-9.18368E-07	-3.00502E-09	-9.18368E-07	-3.00502E-09
total assets in mio	-1.57963E-08	3.36008E-08	-0.470116659	0.638670353	-8.19642E-08	5.03716E-08	-8.19642E-08	5.03716E-08

Table 4: Regression output (#1) without the experience variable

Overall, the results are disappointing. The coefficient of the dummy variable is negative and the p-value is very low, which makes it not significantly different from zero. During the analysis of this regression output I thought about implementing other variables in the regression

and I tried the PE-ratio, the ROIC (return on invested capital). When these options did not yield any interesting results I considered another variable; the experience of the corporate venture capital arm, this leads to a significant result.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.145044044
R Square	0.021037775
Adjusted R Square	0.00574149
Standard Error	0.258000926
Observations	261

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	4	0.366198331	0.091549583	1.375351925	0.242884334
Residual	256	17.04050631	0.066564478		
Total	260	17.40670465			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.187126068	0.028607905	6.541061494	3.30049E-10	0.130789267	0.24346287	0.130789267	0.24346287
dummy	-0.044854016	0.043622618	-1.028228433	0.304812909	-0.1307589	0.041050867	-0.1307589	0.041050867
revenue in mio	-4.61928E-07	2.32817E-07	-1.984079851	0.048314862	-9.20408E-07	-3.44708E-09	-9.20408E-07	-3.44708E-09
total assets in mio	-1.76676E-08	3.39801E-08	-0.519940266	0.603554515	-8.45837E-08	4.92485E-08	-8.45837E-08	4.92485E-08
experience	0.000853283	0.002135347	0.399599378	0.6897848	-0.003351799	0.005058366	-0.003351799	0.005058366

Table 5: Regression output (#2) with the experience variable

After researching the year of founding of the CVC arm I realized that this should have an impact in the regression model. I also had to take out some of the years in the sample from the CVC and the mirror non-CVC company. I made these adjustments because it makes sense to compare only the years after the CVC arm was created. However, there is another factor to consider and this is that some CVC were founded fairly recently, while others were founded much earlier. To take this factor into consideration, I create an experience variable.

The multi-linear regression model #2 is:

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \varepsilon_i \quad (2)$$

Where:

y_i= stock returns where i = 1, …, 261

x_1= dummy variable to determine if it is a corporation with or without a corporate venture capital unit

x_2= revenue of the companies in the sample

x_3= total assets of the companies in the sample

x_4= experience variable

ε_i= error term where i = 1, …, 261

The calculation of the variable is 2016 minus the year of founding. 2016 because I observe the years 2012 until 2016 which makes in total 5 years, if 2012 is included as the year as well. So let's say when a large company has a corporate venture capital arm founded in 2000, then I would give the observed year 2016 the value of 17, note that 2000 is counted as well. 2015 would get the value 16 and so on until 2012. This variable allowed me to control for the experience. If the coefficient is positive, then the experience would positively influence the stock returns.

Unfortunately, the reality is different. The coefficient of the newly implemented variable is positive, with a value of 0.000853283, which is good, but the variable has very little impact on the stock return the closer the coefficient value is to zero. Furthermore, the p-value, which measures the significance of the variable is far from 0.05 or 0.1. Instead the value is 0.6897848. That makes the variable insignificant. The variable R-squared and the other independent variables are more or less the same as in Table 1. The p-value of the dummy variable is not significant in this second regression (Table 5) with a value of 0.304812909. The important finding here is that there is a positive coefficient and with further research there might be even a significant p-value result, but within the scope of this paper the experience variable plays no significant role.

As mentioned in the previous chapter, it also makes sense to see whether there are significant results when looking at each sector in isolation. This was not possible for all sectors because the number of companies in each group was too small, to be a reliable sample. However, there are two sectors that are large enough to control for, these are finance and technology. In the Table 3 one can see the result for the analysis of the finance sector. The coefficient of the dummy variable is -0.130862876, which is slightly more negative than the coefficient for the regression in table 1. The p-value of the dummy variable is very low and almost 0.1 with a value of 0.112566815. The coefficient for the experience variable is positive and the p-value becomes lower but still not significant with a value of 0.342052843. The coefficient for the revenue is still negative as with the regression model before but not significant. Interesting here is that the coefficient for the experience variable becomes more positive and the p-value is

much lower. This might be a hint that the more experienced a corporation in the finance sector, in respect to corporate venture capital activity, the higher their returns become.

The multi-linear regression model #3 is:

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_i \quad (3)$$

Where:

y_i= stock returns where i = 1, …, 54

x_1= dummy variable to determine if it is a corporation with or without a corporate venture capital unit

x_2= experience variable

x_3= revenue of the companies in the sample

ε_i= error term where i = 1, …, 54

Table 6 shows the control for the finance sector.

SUMMARY OUTPUT FINANCE SECTOR

Regression Statistics	
Multiple R	0.226357566
R Square	0.051237748
Adjusted R Square	-0.005687988
Standard Error	0.254326805
Observations	54

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.174657366	0.058219122	0.90008056	0.447787833
Residual	50	3.234106185	0.064682124		
Total	53	3.408763552			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.167428978	0.068863168	2.431328423	0.018670078	0.029113234	0.305744722	0.029113234	0.305744722
dummy	-0.130862876	0.081020977	-1.615172764	0.112566815	-0.293598299	0.031872546	-0.293598299	0.031872546
experience	0.00321489	0.003351492	0.959241511	0.342052843	-0.003516779	0.009946559	-0.003516779	0.009946559
revenue in mio	-1.81668E-07	9.62079E-07	-0.188828765	0.850991407	-2.11406E-06	1.75073E-06	-2.11406E-06	1.75073E-06

Table 6: Regression output (#3) finance sector

The multi-linear regression model #4 is:

$$y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \varepsilon_i \quad (4)$$

Where:

y_i= stock returns where i = 1, …, 74

x_1= dummy variable to determine if it is a corporation with or without a corporate venture capital unit

x_2= experience variable

x_3= revenue of the companies in the sample

ε_i= error term where i = 1, …, 74

Table 7 shows the control for the technology sector.

SUMMARY OUTPUT TECHNOLOGY SECTOR

Regression Statistics	
Multiple R	0.172408999
R Square	0.029724863
Adjusted R Square	-0.011858357
Standard Error	0.293585334
Observations	74

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	0.184838192	0.061612731	0.714828309	0.546419046
Residual	70	6.033464398	0.086192349		
Total	73	6.21830259			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
stock returns	0.210944485	0.059736042	3.53127659	0.00073637	0.091804707	0.330084263	0.091804707	0.330084263
dummy	0.040057091	0.096493222	0.415128541	0.679317466	-0.152392573	0.232506754	-0.152392573	0.232506754
experience	-0.004110588	0.005960864	-0.689595929	0.492728105	-0.015999157	0.007777981	-0.015999157	0.007777981
revenue	-1.20512E-06	1.01586E-06	-1.18630217	0.239513889	-3.2312E-06	8.20955E-07	-3.2312E-06	8.20955E-07

Table 7: Regression output (#4) technology sector

After taking out all the other companies and just running the regression model with the technology companies, the results suggest that the market does not reward technology companies who engage in corporate venture capital activity.

The experience variable is negative with a value of -0.004110588 and the p-value is 0.492728105. The revenue variable has a coefficient value of -1.20512E-06 and a p-value of 0.239513889.

So when looking at the sectors individually we can observe that the results are consistent with the overall result of the regression in Table 1. Having a corporate venture capital arm is not rewarded by the market even when the company has experience in the field of corporate venture capital.

The stock return is a market measure, this means that there are a lot of variables that explain the stock return of a company, which have nothing to do with the corporate venture capital arm. Nevertheless, one would expect, especially with the hype of the venture capital industry, that there would be a significant positive result towards corporate venture capital activity.

There are many factors that could skew the results, but it is not easy and a lot of work to identify these factors. Irregular events in some of the companies in the portfolio could also skew the regression outcome. For example, a major acquisition by one of the companies in the sample could improve or worsen the stock performance of that company and distort the results.

6. Conclusions and outlook

The paper gives an introduction in the empirical analysis of the impact of corporate venture capital arms on their mother corporations' performance. However, the results are not as favourable as I expected when I started the research on this topic.

So is Fred Wilson really right? Are large corporations stupid to invest through a corporate venture capital arm? Should they buy companies instead? Well, large corporations certainly have a dilemma, as stated in the beginning of this paper. They need to serve their existing clients with their existing product and thus struggle with being flexible and pivot their product or even change the strategy. Additionally, large corporations focus heavily on financial benefits alongside with strategic benefits when investing through a corporate venture capital arm. This sounds like the old dilemma of maximising the shareholder value in the short term in exchange for long term growth and sustainable success. These financial benefits however seem not to result in an overall gain in stock performance compared to their respective competitors. Furthermore, large corporations have a different payment structure for their fund managers. They are not incentivised and tied enough to the overall success of the start-up, but rather receive an annual salary and a bonus for success on top, therefore more risk averse behaviour should be expected. This is a really important remark to remember when setting up or restructuring a corporate venture capital arm. Another, less easy to solve problem with corporate venture capital units are their networking skills. The venture capital and start-up environment is small and in many areas even family like, it needs time and trust to build relationships with this ecosystem to really benefit from it. Corporate venture capital managers need to be very aware of that.

But there is light, corporations with a high level of their capital allocated to R&D might have an advantage. The experience variable suggests that there is a positive correlation between

the maturity of a corporate venture capital fund and their stock performance. The p-value in this papers regression is not strong, however worth pursuing further. This means, that if a corporation is involved in investing in start-ups for many years, the possibility of a positive effect on their stock performance, in the long run, can be higher.

The research on the topic of corporate venture capital is new and exciting, therefore, there are numerous articles analysing the performance of and impact on start-ups that receive the investment. However, much less research is done on the impact on the CVCs of making these investments, but this is a subject of equal importance.

Many companies large and small try to keep up with the fast pace of innovation, in a world where almost everybody with a computer and internet connection can come up with a revolutionary idea. Having said that, this paper does not advocate a step away from corporate venture capital investments, rather it aims to make the topic of corporate venture capital more transparent and reflect reality better. The managers of the corporations need and want guidance about how to structure their R&D department, I hope that this paper provides a catalyst to conversations that contribute to this.

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