

Master Thesis

# How does imprinting affect the innovativeness of a CVC-backed start-up?



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## 1. Research introduction

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A central question in organizational research is how the past of a company casts a shadow over the present (Marquis & Tilcsik, 2013). This is especially the case for young firms who are sensitive to external influences, for example during the early stages of a start-ups' life. The concept of imprinting refers to "... how organizations take on elements of their founding environment and how these elements persist well beyond the founding phase" (Marquis & Tilcsik, 2013 page 196). Researchers have identified several factors that are important sources of imprinting, such as factors relating to the founder(s) of the start-up (Beckman, 2006; Geroski, Mata, & Portugal, 2010; Kim & Park, 2017), their network position (McEvily, Jaffee, & Tortoriello, 2012) and external conditions at the time of the start-ups' founding (Dobrev & Gotsopoulos, 2010; Swaminathan, 1996). Due to these factors the survival chances and growth rate of the imprinted start-ups can be influenced, both positively and negatively, and is therefore decisive for the future of the start-up. In prior literature, there has been relatively little consideration of a start-up's early relationship with external investors as a potential source of imprinting, while external investors have been playing an increasingly important role in recent decades in speeding up the growth of those start-ups (Kim & Park, 2017; Kortum & Lerner, 2000). Because imprinting can potentially have a major effect on a start-up's future, it is worthwhile to investigate what the imprinting effect caused by external investors will be.

The literature on organizational research increasingly emphasizes the potential role that imprinting has on the future of a new firm (Dobrev & Gotsopoulos, 2010; Kim & Park, 2017; Marquis & Tilcsik, 2013). Imprinting theory posits that organizations are particularly sensitive to environmental forces during their founding and that characteristics developed during early life will persist (Marquis & Tilcsik, 2013; Stinchcombe & March, 1965). Although prior research examined the effect of Corporate Venture Capital funding on a start-up's innovativeness, the empirical findings are rather mixed. At the one hand, scholars found a positive effect of CVC-funding on a start-ups innovativeness (Alvares-Garrido & Dushnitsky, 2016; Chemmanur, Loutschina, & Tian, 2014; Park & Steensma, 2013), while others found no significant effect (Phanke, McDonald, Wang, & Hallen, 2015). Moreover, literature has shown that unfavorable conditions at founding may result in consistently lower survival chances for new firms (Dobrev & Gotsopoulos, 2010).

That those start-ups are sensitive to imprinting is not without reasons. Because, in the existing literature, start-ups are described as resource-poor and most of them lack access to complementary resources and to financial capital (Ahuja, 2000; Katila, Rosenberger, & Kathleen, 2008). By contrast, corporates are powerful, resource-rich (Katila et al., 2008) and have the scale and the routines needed to run a proven business model efficiently (Weiblen & Chesbrough, 2015). While start-ups are motivated to collaborate with corporates because they can provide access to financial capital and to complementary resources, corporates often work together with start-ups for strategic reasons (Katila et al., 2008; Wadhwa & Kotha, 2006). From a strategic point of view, corporates are interested in obtaining access to promising innovations, to provide information on possible acquisitions and even block new products that might compete with their own (Katila et al., 2008). This shows that CVC-backed start-ups and CVC-funding corporates are not always having the same interest in collaborating with each other. The nature of corporates and start-ups and their motivation to collaborate are thus decidedly different, as a result, collaboration with a certain type of corporate can have a substantial impact on the start-up's future.

The collaboration between a start-up and a corporate can occur in multiple forms. The focus of this study is on the new-firm-investing arms of corporations, which type of collaboration is known as CVC-funding (Phanke et al., 2015). CVC-funding is defined as external equity investments made by established firms in privately held entrepreneurial start-ups (Gompers & Lerner, 1998). This form of collaborating is getting an increasingly common arrangement between start-ups and corporates and has been playing an increasingly important role in recent decades in speeding up the growth of start-ups (Kim & Park, 2017). Prior research documents that CVC-funding can be beneficial for both the corporate and the start-up. By attracting CVC-funding, the start-up can access financial capital and valuable complementary assets from the corporate (Katila et al., 2008), particularly when they need relationship-specific assets (Park & Steensma, 2012). Moreover, Alvarez-Garrido and Dushnitsky (2016) argue that the innovation output and performance of a start-up is sensitive to the investor type and reported that CVC-backed ventures are associated with a higher innovation rate (Alvarez-Garrido & Dushnitsky, 2016; Kim & Park, 2017).

CVC-funding, however, can come with drawbacks as well. Because of the different nature of the start-up and the corporate, their motivation of the CVC-funding could differ. Moreover, as a part owner of a CVC-backed start-up, the CVC-funding corporate can influence the strategic direction of especially young start-ups for their subsequent development, due to the

imprinting effect (Kim & Park, 2017). Start-ups are, particular, during the first years of life sensitive for these imprinting effects (Dobrev & Gotsopoulos, 2010), for two reasons. First, during this early stage of life start-ups are growing up and are still in the process of establishing organizational routines, processes, and structures that tend to have long-term consequences (Dobrev & Gotsopoulos, 2010). Second, they lack resources of their own, which means that start-ups can better respond to the demands of external investors during this period (Kim & Park, 2017). Moreover, literature has shown that unfavorable conditions at founding may result in consistently lower survival chances for new firms (Dobrev & Gotsopoulos, 2010). Thus, with what type of CVC-funding corporate the CVC-backed start-up is collaborating is expected to have a significant impact on the future of these start-ups.

Overall, prior research and theory address the impact that imprinting has on the survival change and growth rate of start-ups (e.g. Alvares-Garrido & Dushnitsky, 2016; Dobrev & Gotsopoulos, 2010; Marquis & Tilcsik, 2013). At the same time, literature confirms that there is a need for start-ups to collaborate with corporates, due to their lack of complementary assets and financial resources (Ahuja, 2000; Katila et al., 2008; Weiblen & Chesbrough, 2015). Moreover, during recent decades external investors have been playing an increasingly important role in speeding up the growth of start-ups (Kortum & Lerner, 2000). However, there has been relatively little consideration of a start-up's early relationship with external investors – among others CVC-funding corporates – as potential sources of imprinting (Kim & Park, 2017). In order to fill this void, this study focuses on the CVC-funding relationship between start-ups and corporates and how this relationship impacts the innovativeness of the CVC-backed start-up.

The research question is: *How does imprinting affect the innovativeness of a CVC-backed start-up?*

This study contributes thus to the existing literature by investigating how CVC-funding during the early life of the start-up - originating from different types of corporates - will affect the innovativeness of the CVC-backed start-up.

This report is divided into four sections and the remainder of the report is structured as follows. In section two, the theoretical review and hypotheses will be presented by discussing the latest insights about the imprinting effect, corporate venture capital funding, innovation, and geographical distance, and how it is expected that the innovativeness of the CVC-backed start-up will be influenced based on what we already know about these different theories.

Section three describes the collected data and how the variables are measured. In section four, the results of the data analyses will be presented. Finally, section five concludes and discusses the limitations and implications of this study and issues for further research.

## 2. Literature review and hypotheses

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### Innovation

Innovation is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth (Drucker, 1985). Due to the dynamic nature of most markets, almost all industries are engaged in continuous or periodic innovation (Hurley & Hult, 1998). Therefore, companies need continuous innovation to survive in this turbulent and potentially disruptive environment (Weiblen & Chesbrough, 2015). Organizations innovate to be competitive, but in many cases, they do not possess the knowledge that is required to produce those innovations (Wadhwa & Kotha, 2006). When a company is not able to create the needed innovation by itself, it must look out for external sources of innovation in order to survive in that market.

Novel ideas that potentially lead to innovations can arise from different originators. Historically, innovation was mainly carried out in the research and development departments (R&D) of the corporations themselves (Powell, Koput, & Smith-doerr, 1996). Although this is still a contributing source, start-ups are becoming increasingly important originators of innovations and thus foster economic prosperity (Kim & Park, 2017; Winborg & Landström, 2000). Consequently, as the innovations by start-ups disrupt markets, the need arises for corporates to move faster so that they are not left behind in the changing landscape (Weiblen & Chesbrough, 2015).

Due to the different natures of start-ups and corporates, they need to engage with each other in order to further develop and commercialize their innovations. In general, corporates are powerful, resource-rich (Katila et al., 2008) and have the scale and the routines necessary to run a proven business model efficiently (Weiblen & Chesbrough, 2015). But by only relying on internal R&D activities, corporates often do not possess the knowledge required for producing innovations (Hagedoorn, 1993). Accordingly, many corporates turn to external activities such as alliances, joint ventures, mergers and acquisitions, and corporate venture capital funding, to obtain the necessary novel knowledge to innovate (Schildt, Maula, & Keil, 2005). Start-ups, on the other hand, are more successful in innovating, amongst others, because of their flexibility and promising ideas, their agility, their entrepreneurial and willingness to take risks (Weiblen & Chesbrough, 2015). Although start-ups are important originators of innovations, they are also described as resource-poor and most of them lack access to complementary resources and to financial capital (Ahuja, 2000; Katila et al., 2008).

Therefore, start-ups need to collaborate – amongst others with CVC-funding corporates – to obtain the resources they need for developing and commercializing their novel ideas.

### Corporate Venture Capital funding

To be competitive and to realize continuous innovation, start-ups and corporates need to collaborate. This collaboration could have various forms. Related to the access to financial capital, the literature describes five sources of entrepreneurial equity investments that can fuel a start-up's innovation: venture capital, corporate venture capital (CVC), angel investment, crowdfunding and accelerators (Drover et al., 2017). The focus of this study is on CVC-funding, the new-firm-investing arms of corporations (Phanke et al., 2015). In 2016 established firms invested approximately 24.9 billion dollars in start-ups, which is roughly 20% of all venture capital during that year (Kim & Park, 2017).

Both the start-up and the corporate have reasons to collaborate with each other. From the start-up perspective, they not only benefit from CVC-funding by attracting financial capital as well as attracting complementary resources provided by the CVC-funding corporate, which facilitates the innovative activities of start-ups (Alvares-Garrido & Dushnitsky, 2016; Chemmanur et al., 2014). Particularly, these complementary resources include expertise and infrastructure for product development, manufacturing, legal, distribution, marketing, sales, and customer service activities (Park & Steensma, 2012). However, the benefits of accepting CVC-funding can come with trade-offs, due to incentives of the CVC-funding corporate conflicting with that of the CVC-backed start-up. For example, the CVC-funding corporate eagerness in maximizing the overall value can be at odds with the new venture's ability to source complementary assets from the open market (Park & Steensma, 2012). The extent that this trade-off is worthwhile might differ depending on what specific complementary assets are required and on environmental uncertainties (Williamson, 1991).

The literature points out that corporates have different reasons to invest in a start-up. Although superior financial returns for the corporate are an important consideration (Hallen, Katila, & Rosenberger, 2014), corporate investors generally consider strategic objectives more important than financial ones (Dushnitsky, 2006). CVC-funding seeks strategic advantages for their parent corporations through investing in new firms that provide a window on novel technologies, products, and potential acquisitions (Katila et al., 2008), through developing new businesses and through promoting the demand for complementary products (Chesbrough, 2002; Winters & Murfin, 1988). Additionally, CVC-funding can be

beneficial for corporates because it can increase their innovation rates (Dushnitsky & Lenox, 2005; Wadhwa & Kotha, 2006), financial performance (Dushnitsky & Lenox, 2006) and will give corporates the ability to recognize technological discontinuity (Kim & Park, 2017). Even when uncertainty levels are high, CVC-funding can offer a solution for corporations as a real option to acquire the start-up later (Benson & Ziedonis, 2009).

### *Imprinting effect*

Due to the different motivation of the CVC-backed start-up and the CVC-funding corporate, CVC-funding is not only about the corporate investing in the CVC-backed start-up but also about how the start-up gets influenced by the CVC-funding corporate. The manner the CVC-funding is set-up is a significant determinant for the future of the CVC-backed start-up. The concept of “imprinting” relates to how organizations take on elements of their founding environment and how these elements persist well beyond the founding phase (Beckman & Burton, 2008; Marquis & Tilcsik, 2013). Imprinting theory posits that organizations are particularly sensitive to environmental forces during the founding and that characteristics developed during early life will persist even if environmental forces that influenced these characteristics have changed (Marquis & Tilcsik, 2013).

The first three years of a start-up’s life is regarded as the most sensitive and important period for two reasons. First, during the early stages of life start-ups are growing up and are still in the process of establishing organizational routines, processes, and structures, of which many tend to have long-term consequences (Dobrev & Gotsopoulos, 2010). Second, they lack resources of their own, which means that start-ups will want to respond to the call of external investors during this period (Kim & Park, 2017). Moreover, literature has shown that unfavorable conditions at founding may result in consistently lower survival chances for new firms (Dobrev & Gotsopoulos, 2010).

Because of the collaboration and thus the interaction between CVC-backed start-up and CVC-funding corporate, the start-up can be influenced due to various sources. Prior literature has identified three categories of factors that contribute to the imprinting effect. First, scholars discussed several internal factors related to the founders of the start-up, such as the background of the founders, their education and the composition of the founding team (Beckman, 2006; Geroski et al., 2010; Kim & Park, 2017). Second, studies have examined the importance of the external factor network position of the founders on the survival chances and growth rate of start-ups (McEvily et al., 2012). Finally, the external conditions at the time



of the start-up's founding including the aforementioned effect that external investors such as CVC-funding corporates can have on the CVC-backed start-ups (Dobrev & Gotsopoulos, 2010; Swaminathan, 1996).

A start-up's relationship with its CVC-funding corporate during the first three years of life is particularly important because it can influence the start-up's strategic orientation and organization structures, which in turn has a profound effect on its innovativeness and growth rates (Dobrev & Gotsopoulos, 2010; Kim & Park, 2017). Moreover, scholars argue that the influence of external investors is likely to be strongest during the early period of a start-up's lifetime (Stinchcombe & March, 1965). Additionally, the annual number of patents for start-ups receiving early CVC-funding is much higher than those receiving late CVC-funding (Kim & Park, 2017). Literature thus indicates that the age of the start-up on which the CVC-funding investment takes place matters and that this timing effect needs to be considered when it comes to CVC-funding by both the start-up and the corporate. Although prior research examines the effect of CVC-funding on a start-up's innovativeness, the empirical findings are mixed. Scholars found positive effects of CVC-funding on the innovativeness of start-ups (Alvares-Garrido & Dushnitsky, 2016; Chemmanur et al., 2014; Park & Steensma, 2013), while others found no significant effect (Phanke et al., 2015).

Because of the imprinting effect though, it is important for start-ups to consider with what kind of CVC-funding corporate they want to collaborate during their early life and consider whether it is desirable to work together with a certain corporate at a certain age. On the one hand, this consideration depends on what kind of resources the start-up requires and on the other, on the motivation that the CVC-funding corporate has with its funding. Particularly, CVC-fund corporates pursue strategic objectives ultimately to the benefit of their parent firms and may for that reason direct the activities of the CVC-backed start-ups in ways advantageous to the CVC-funding corporate but not necessarily the start-up (Kim & Park, 2017). Thus, particularly when the start-up is highly sensitive to the imprinting effect, they must be aware of what effect the CVC funding could have on their future.

### *Geographical distance*

One of the aspects that determine how closely the start-up and the corporate can work together is the spatial distance between these two firms, which is expected to impact the extent to which the imprinting effect takes place as well. In addition, literature has shown that the collaboration between firms is influenced by the geographical distance between the

collaborating firms. To influence each other, more interaction is needed than just the CVC-investment between the start-up and the corporate, in order to learn from each other. In addition, literature on absorptive capacity examined that a firm's ability to learn from another firm depends on the similarity of both firms' in relation to their (1) knowledge bases, (2) organizational structures and compensation policies, (3) dominant logics (Lane & Lubatkin, 1998; Lane, Salk, & Lyles, 2001) and (4) transparency and receptivity (Hamel, 1991). Absorptive capacity may be defined as "the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990). Furthermore, scholars have argued that the concepts of localized knowledge spillovers and absorptive capacity are closely linked to each other (Audretsch & Feldman, 2004).

The literature on the economics of innovation states that spatial relationships between collaborating firms matter, especially when it comes to innovation activities for which knowledge spillovers are crucial (Audretsch & Feldman, 1996). Moreover, it is argued that when the CVC-funding corporate involvement in the CVC-backed start-up is high, the innovativeness of the start-up will be boosted (Wadhwa & Kotha, 2006). Furthermore, firms are increasingly utilizing interorganizational relationships – among others CVC-funding – to learn from knowledge sources beyond the boundaries of the firm. This helps them to become more innovative and grow faster (Powell et al., 1996; Stuart, 2000).

The geographic distance between the CVC-backed start-up and CVC-funding corporate matters because of regional disparities. Existing literature has examined several factors that cause regional differences, such as cultural differences, differences in underlying structures and networks (Audretsch & Feldman, 2004). Additionally, Sorenson and Stuart (2001) show that location matters in obtaining venture capital. By analyzing the determinants of venture capital investment in the United States between 1986 and 1998, they find that the likelihood of a venture capitalist investing in a given target declines with geographical distance between the venture capitalist and the target company (Sorenson & Stuart, 2001). Based on the existing literature, it is expected that CVC-backed start-ups and CVC-funding corporates that are closer to each other will also have closer collaborations and therefore will be influenced by each other more strongly.

### Hypotheses

Based on the literature discussed in the section above, six hypotheses are developed. Though the CVC-backed start-ups and the CVC-funding corporates may have different reasons for

collaborating, their mutual interest is to boost innovation to survive in a dynamic, turbulent and potentially disruptive environment (Weiblen & Chesbrough, 2015). Consequently, it is expected that the CVC-backed start-up is being helped by the CVC-funding corporate to increase their innovativeness, which in the end also benefits the CVC-funding corporate. Based on the theory of the imprinting effect, it is predicted that corporates who are more innovative are better in making the necessary resources and skills available to CVC-backed start-up, which ultimately benefits the innovativeness of the CVC-backed start-up. Thus, because of this mutual motivation to boost innovation, one may expect that the innovativeness of the CVC-funding corporate is positively related to the innovativeness of the CVC-backed start-up. Therefore, hypothesis one is formulated as follows.

***Hypothesis 1:*** A higher innovativeness rate of the CVC-funding corporate has a positive effect on the innovativeness rate of the start-up.

On the other hand, literature proposes that the variance in CVC performance can be explained, in part, by the orientation of the CVC-fund. In particular, some corporates aim with their CVC-funding to generate a maximum financial return, while others pursue a strategic goal with their investment (Dushnitsky & Lenox, 2006; Hallen et al., 2014). In addition, developing an innovation requires investments upfront and potential results regarding the added value in the long term, which is a contradiction with the aim of an on financial return orientated CVC-funding corporate. Due to this difference in motivation to collaborate, it is predicted that corporates who are strongly focused on financial returns are guiding the CVC-backed start-up to better financial results instead of helping them to be more innovative. This because the CVC-funding corporates will mainly provide resources and skills which helps the CVC-backed start-up to generate a better financial result and consequently the start-up keeps on lacking the needed resources and skills to become more innovative. Therefore, it is expected that CVC-funding corporates who are mainly focussed on maximizing the financial return, will have a negative impact on the innovativeness of the CVC-backed start-up.

***Hypothesis 2:*** A higher financial performance of the CVC-funding corporate has a negative effect on the innovativeness rate of the start-up.

Due to the imprinting effect, it matters for a start-up from what kind of CVC-funding corporate the external capital is attracted and at what age the CVC-funding is attracted. Consequently, I expect that the age of the start-up at which the CVC-funding takes place, will

influence the strength of the relationship between the independent variable and dependent variable and thus is the imprinting effect included in this study as a moderator. Based on the imprinting theory, one may expect that the investment stage negatively relates to the effect that financial performance of the CVC-funding corporate has on the innovativeness of the CVC-backed start-up. In other words, the negative effect of the CVC-funding corporate that is focused on maximizing financial performance will become stronger if investments are made during early investment stages. This is because one may expect from the imprinting theory that start-ups are more sensitive to imprinting at a younger age and accordingly during an early investment stage. Therefore, hypotheses three is formulated as follows.

***Hypothesis 3:*** the start-up investment stage negatively moderates the impact of the financial performance of the CVC-funding corporate on the innovativeness of the start-up.

Additionally, a negative moderating imprinting effect is expected for the relationship between the innovativeness of the CVC-funding corporate and the innovativeness of the CVC-backed start-up. Based on the arguments of the imprinting theory, I expect that the influence of the CVC-funding corporate will be the strongest during the early investment stages instead of the later. Especially because the younger the start-ups are, the more sensitive they are for imprinting effects. In other words, the expected positive effect that the innovativeness of the CVC-funding corporate has on the innovativeness of the CVC-backed start-up will become stronger if the CVC-investment is made during the earlier investment stages. This is because, as explained in this section, that start-ups are more sensitive to imprinting at a younger age and accordingly during an early investment stage. Therefore, I hypothesize the following.

***Hypothesis 4:*** investment stage negatively moderates the impact of the innovativeness of the CVC-funding corporate on the innovativeness of the start-up.

Moreover, based on the theory on spatial distance, I expect that a greater distance between the CVC-backed start-up and the CVC-funding corporate will decrease the expected negative effect that the financial performance of the CVC-funding corporate has on the innovativeness of the start-up. This is because, it is less easy for CVC-funding firms with a greater distance from each other to create knowledge spillovers, besides the physical distance also due to cultural differences and differences in underlying structures and networks. Consequently, it is expected that the imprinting effect is less present when the distance between the start-up and the corporate increases. Therefore, hypothesis five is formulated as follows.

**Hypothesis 5:** the geographical distance negatively moderates the impact of the financial performance of the CVC-funding corporate on the innovativeness of the start-up.

Building on the above-mentioned literature, I expect that a greater physical distance between the CVC-backed start-up and the CVC-funding corporate will decrease the effect that the innovativeness of the CVC-funding corporate has on the innovativeness of the start-up. As mentioned above, it is expected that the innovativeness of the CVC-funding corporate has a positive effect on the innovativeness of the CVC-backed start-up, although I also expect that this positive effect will become less strong when the distance increases. This is because the imprinting effect is expected to be weaker when it is harder to realize knowledge spillovers between the start-up and the corporate due to an increasing distance. For that reason, I hypothesize the following.

**Hypothesis 6:** the geographical distance negatively moderates the impact of the innovativeness of the CVC-funding corporate on the innovativeness of the start-up.

The hypotheses stated above lead to the following conceptual model.

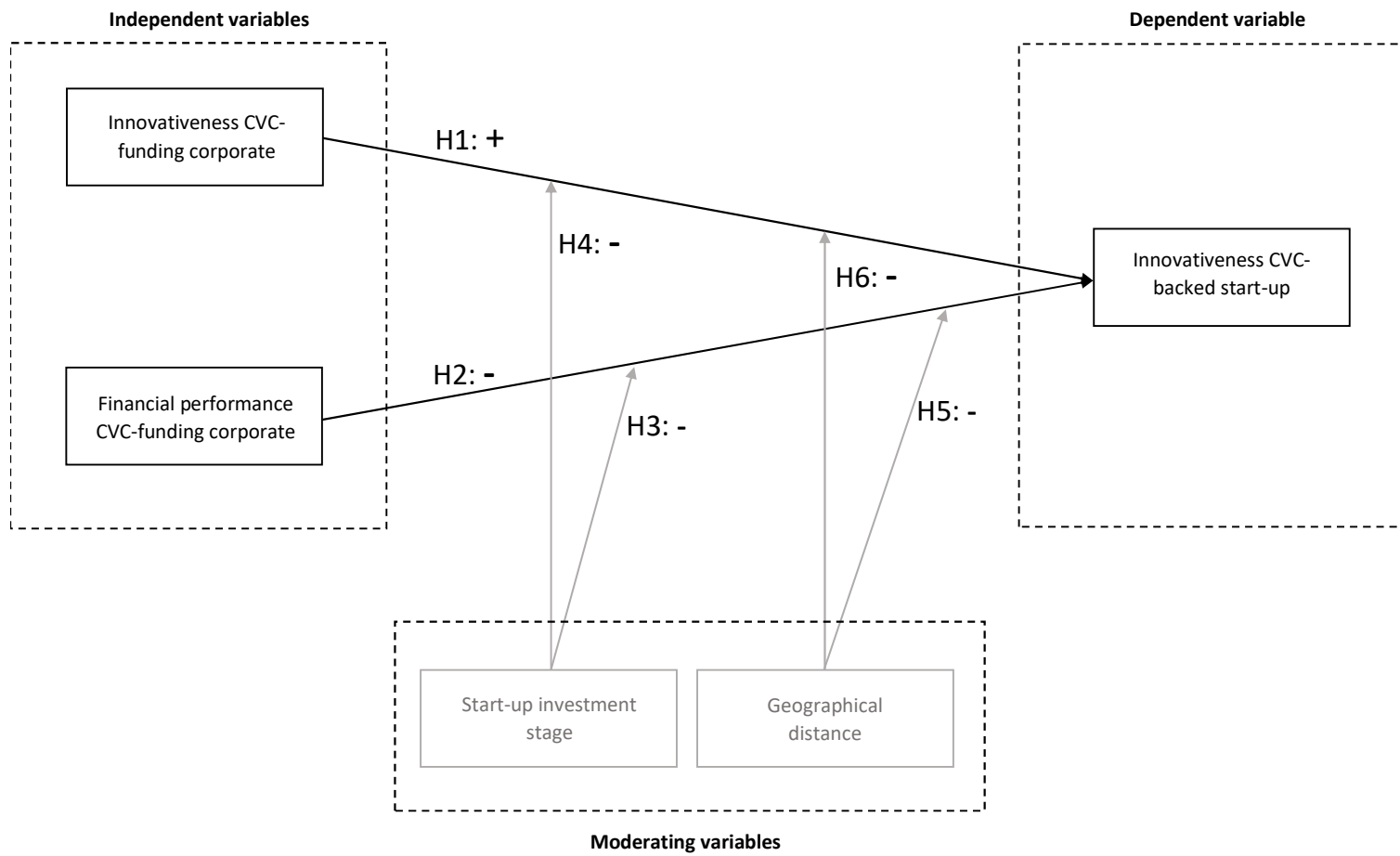


Figure 1: conceptual model

### 3. Method

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For this study, I followed a deductive research strategy. Therefore, based on the existing literature a theoretical model, which contains a research question and hypotheses, I developed. The aim of this study is to test the developed theoretical model empirically by executing a quantitative research method by using data which could be achieved via existing databases. In this section, I describe how the variables included in the conceptual model are operationalized.

#### Data collection

I gathered a sample of 236 start-ups founded in North America (both the United States of America and Canada) between 1991 and 2010. To be included in the sample, the start-ups had to have been founded between 1991 and 2010, received their first funding by one single corporate during at least the first six years of the start-up's life and the CVC-funding corporate must be in North America as well. This study is limited to the first investment of a single corporate because the effect of the CVC-funding could otherwise not be traced back to one specific corporate.

Focusing on North America has several advantages. First, the selected start-ups of this continent provide an appropriate setting for this study because there were significant CVC-investment activities during the sample period. Second, these start-ups and corporates show a strong propensity for filing patents during the sample period, which data is used to measure the innovativeness of the start-ups and the corporates. In addition, financial data of the corporates part of the sample was available, by which the financial performance of each corporate is measured.

It is preferred to use one patent system instead of various patent systems because a sole patent system maintains consistency, reliability, and comparability, as patenting systems across nations differ in the application of standards, system of granting patents and value of protection granted (Ahuja, 2000). In addition, prior research has shown that patents provide a fairly reliable measure of innovative activity (Acs & Audretsch, 1989).

The data for this study was collected by following three stages. During the first stage, I made a selection of start-ups and corporates that met the requirements as mentioned above. To do so, I used VentureXpert from Thomson One, which provided detailed information about the CVC-backed start-ups and their CVC-funding corporates. More in detail, VentureXpert

provided among other things information about the investment year, founding year, the age of the start-up at the first investment, date of the first investment of the corporation, geographical location, SIC codes of the start-ups and the start-up stage at the investment date.

Scholars have argued that start-ups are, especially during the first three years of life, sensitive to the imprinting effect of the CVC-funding corporate (Dobrev & Gotsopoulos, 2010). For that reason, the start-ups were selected who got a first CVC-funding of a corporate during the first six years of life, by which the effect between an investment during the first three and the first six years could be demonstrated.

Throughout the second stage, I collected patent data from the U.S. Patent and Trademark Office (USPTO) for both the start-ups and the corporates. For the selected start-ups and corporates of stage one, I collected the patent data during the period between 1985 and 2015. Out of this thirty-one years of patent data, for each start-up, I collected the total number of patents achieved in the first three and five years after the investment date. In addition, I collected for the CVC-investing corporates the total number of patents achieved during the five years before the investment date. For the corporates, the number of patents of the parent holding, the Global Ultimate Owner (GUO), is considered.

Finally, during the third stage, financial data of the CVC-funding corporates is collected by using the data provided by the Wharton Research Data Service (WRDS). The CUSIP code for the selected CVC-funding corporates has been obtained manually. Based on the attained list with CUSIP codes, for each CVC-funding corporate data about the total assets, total equity and net income for the investment year was collected. For a few of the CVC-funding corporates, the data was obtained via Orbis, in the case that the data was not available in WRDS. For the CVC-funding corporates for which there was no data available for the investment year, the data of the nearest available year was taken. As a result, the return on equity (ROE) and return on assets (ROA) are calculated out of the net income, total assets and total equity.

## Measures

### *Dependent variable*

I examined the outcome variable innovativeness of the CVC-backed start-up by measuring the number of patents achieved by the start-up during the first three and five years after the investment year. The five-year period is used because knowledge in high-tech industries is known to depreciate sharply within this period (Argote, 1999) and this was the maximum



period of which the patent data were available, for the start-ups with the most recent investment year (2010).

### *Independent variables*

I examined two independent variables; the financial performance of the CVC-funding corporate and the innovativeness CVC-funding corporate. The first independent variable, the financial performance of the CVC-funding corporate, is measured by using the measures ROA and the ROE. These two broad financial measures have been widely used in literature as measures of a company's profitability (Orlitzky, Schmidt, & Rynes, 2003). These measures indicate how profitable a company employs its assets and equity since it reflects how much profit a company is able to generate for each asset and/or equity invested (Bharadwaj, 2000). The independent variable Innovativeness of the CVC-funding corporate is measured by counting the patents that the corporate achieved during the five-year period before the investment year. This period was chosen because after five-year knowledge in high-tech industries is known to depreciate sharply within about 5 years (Argote, 1999).

### *Moderators*

The effect that the independent variables have on the dependent variable is expected to be influenced by the two moderators "start-up investment stage" and "geographical distance". I measure the moderator start-up investment stage by making a difference between six investment stages of the start-up, i.e. (1) Seed, (2) Early stage, (3) Expansion, (4) Later stage, (5) Buyout/acquisition and (6) Others/not defined. Because the later stage contains data that should have been part of stage 1 to 5, I decided to split this variable into two variables. One variable contains stages 1 to 5 and the other one of only of stage 6, by which it is predicted that not defined data will get a substantial impact on the analyses. In addition, the moderator geographical distance is measured by defining for both the CVC-funding corporate and the CVC-backed start-up in which state of North America they are established.

### *Control variables*

The model includes five main control variables based on a multitude of previous studies in this field, by which this study is controlled for possible alternative explanations (e.g. Alvares-Garrido & Dushnitsky, 2016; Audretsch & Feldman, 2004; Dobrev & Gotsopoulos, 2010; Dushnitsky & Lenox, 2005; Kim & Park, 2017). First of all, I control for the years of experience that the corporates have with CVC-funding. It is expected that CVC-funding corporates that have more experience are better in selecting innovative start-ups at an early

stage. The years of experience is calculated by determining the difference between the year in which the CVC-funding corporate did its first investment and the investment year. Second, I control for the location of the start-up, since prior research have shown that some areas are more innovative than others (Audretsch & Feldman, 1996). Third, I considered further adding the age of the start-up at the investment data as a control. Moreover, the analysis control for industry codes by creating individual sic-code dummies and for the time by including year dummies to account for the influence of macro environments during the study period.

#### Data analyses

The collected data will be examined by using a zero-inflated negative binomial regression analysis for the Control Model (1), Control Model and direct effect moderators (2), Main Effects Model (3), Interaction Effects Models (4 up to 7) and Full Model (8). Because the outcome data of this study are discrete counts, highly non-normal and overdispersed, both poisson regression and negative binomial regression could be used for estimating the relationships among the variables of this study. Analysis of the dataset shows that the dependent variable has an excess of zero counts, approximately 58 percent, which is shown in the histogram in figure 2 of appendix 1. Consequently, I could better perform a zero-inflated poisson regression or a zero-inflated negative binomial regression. I opted for the zero-inflated negative binomial regression since the variance of the dependent variable is much larger than the mean (more than 5 times), the alpha factor is not equal to zero (see Table II) and the result of the poisson goodness of fit test was – as expected - highly significant. Because of the lack of fit with the zero-inflated poisson regression analyses, the zero-inflated negative binomial regression is used.

I decided to include a log function for the variables innovativeness of the CVC-backed start-up and the innovativeness of the CVC-funding corporate. These variables will be transferred to a log function because the data is very scattered and by using the log function the data meets more closely the statistical assumptions. By doing so, the effect of the variables transferred to a log function on the model gets less small while the direction remains the same.

Further, the data will be checked for fixed versus random effects, by using the Hausman test. In addition, the empirical data will be checked for multicollinearity, by using the Variance Inflation Factor (VIF). Which factor shows how much the variance of the coefficient estimate is being inflated by multicollinearity. As a rule of thumb, the value of the VIF analyses

should be below 10, otherwise, the model has to be adjusted (Neter, J., Kutner, M. H., Nachtsheim, C. J., & Wasserman, 1996). Finally, I will run a number of robustness checks. First of all, I will check the data for outliers. Second, I will consider alternative operationalization's for the dependent and independent variables. Third, I will change the time window of the study for example to 1991-2000 and 2000-2010 instead of 1991-2010 originally. Finally, I will remove variables from the models one by one.

## 4. Analysis and results

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Table I presents the descriptive statistics and correlation coefficients for the variables included in this study. On average, the CVC-backed start-ups included in the dataset registered 43.3 patents during the five-year time window after the investment year. However, this average gives a distorted view, because 58% of the start-ups achieved zero patents and others achieved a maximum of 2,466 patents during this period. On the contrary, the CVC-funding corporates included in this dataset registered on average 9,309 patents during the five years before the investment year. On average, the corporates had a ROA of 0.12 percent with a minimum of -1.65% and a maximum of 1.27%.

Furthermore, table I shows that there exists little correlation between the variables included in this study. I found the strongest interaction effect between the variables ‘return on assets’ and ‘investment year’ and between ‘years of experience corporate’ and ‘investment year’, respectively with a value of  $r = 0.347$  and  $r = 0.296$ . In comparison, the other variables show a relatively small interaction effect with  $r$ -values close to zero.

I tested the model for random versus fixed effects by using the Hausman test. However, it was not possible to run the Hausman test based on the dataset of this study, possibly due to the highly non-normal and overdispersed composition of the dataset. Even though, I expect that random effects - among others multiple predictors and complex correlation structures - will be applicable to the model. By calculating the variance inflation factor (VIF) for the regression variables, I examined the multicollinearity within the full model. None of the interaction effects was above the rule of thumb level of 10 (Neter, J., Kutner, M. H., Nachtsheim, C. J., & Wasserman, 1996). The highest results of the VIF calculation are found for both the independent variables, a VIF of 7.65 was found for the ROA a VIF of 7.81 for the patent count of the CVC-funding corporates. Because these values are well below the level of 10, I do not decide to change the model. That the dataset exists of little multicollinearity is also indicated by the relatively low correlation coefficients of table I. For the variables with slightly higher correlation coefficients it can be explained why there occurs some multicollinearity. For example, for ‘years of experience corporate’ and ‘patent count corporate’ the correlation coefficient is equal to  $r = 0.273$ . That there is a certain degree of multicollinearity between these two variables is plausible because one could expect that corporates with more years of experience do also have more experience in applying for patents.

**Table I: descriptive statistics and correlation coefficients**

	Mean	St. Dev	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Patent count start-ups	43.30	261.79	0.00	2,466.00	1.000									
(2) Return on assets (ROA)	0.12	0.45	-1.65	1.27	0.108	1.000								
(3) Patent count corporates (log)	3.79	3.86	0.00	13.00	0.016	-0.179	1.000							
(4) Start-up investment stage	2.39	1.19	1.00	6.00	-0.083	-0.012	-0.088	1.000						
(5) Geographical distance	0.45	0.50	0.00	1.00	-0.003	0.165	0.111	-0.095	1.000					
(6) Years of experience corporate	5.94	6.02	0.00	33.00	-0.001	-0.068	0.273	0.091	0.041	1.000				
(7) Start-up location	21.30	17.98	1.00	56.00	-0.076	-0.229	-0.008	-0.022	-0.155	0.003	1.000			
(8) Industry dummies	6.83	3.82	0.00	10.00	-0.012	0.034	0.068	-0.033	0.117	0.184	-0.067	1.000		
(9) Year dummies	2002	4.58	1991	2010	0.099	0.347	0.201	-0.020	0.098	0.296	-0.097	0.137	1.000	
(10) Start-up age at financing	21.80	17.41	0.00	60.00	-0.092	0.196	-0.147	0.176	-0.028	0.063	0.045	0.048	0.166	1.000

\* the correlation coefficients are significant if the r-value is greater than 0.185 for  $p < 0.01$ , 0.141 for  $p < 0.05$  and 0.118 for  $p < 0.1$ .

**Table II: results of zero-inflated negative binomial regression analyses:  
CVC-funding impact on the innovativeness of the start-up**

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
<i>Main effects</i>								
Financial performance CVC-funding corporate			1.326 (1.018)	-8.379 (7.290)	1.181 (0.975)	2.561** (1.169)	1.484* (0.924)	-9.118 (7.183)
Innovativeness CVC-funding corporate			0.039 (0.087)	0.023 (0.087)	0.328 (0.364)	0.045 (0.080)	-0.119 (0.106)	-0.139 (0.344)
<i>Moderators</i>								
Financial performance * Investment stage				4.754 (3.495)				5.736 (3.552)
Innovativeness corporate * Investment stage					-0.118 (0.146)			0.005 (0.123)
Financial performance * Geographical distance						-2.412 (1.582)		-1.902 (1.538)
Innovativeness corporate * Geographical distance							0.321** (0.155)	0.302* (0.171)
<i>Interaction variables and control variables</i>								
Investment stage 1 t/m 5		-0.173 (0.289)	-0.339 (0.349)	-0.266 (0.362)	-0.141 (0.412)	-0.236 (0.341)	-0.485 (0.332)	-0.345 (0.432)
Geographical distance		0.985 (0.635)	0.956 (0.703)	1.163* (0.695)	0.851 (0.707)	0.963 (0.704)	-0.533 (0.980)	-0.162 (1.007)
Years of experience corporate	0.002 (0.060)	0.0425 (0.057)	0.029 (0.058)	0.024 (0.059)	0.018 (0.061)	- (0.061)	0.027 (0.057)	0.019 (0.059)
Industry dummies	yes	yes	yes	yes	yes	yes	yes	yes
Year dummies (investment year)	yes	yes	yes	yes	yes	yes	yes	yes
Investment stage undefined		omitted	omitted	omitted	omitted	omitted	omitted	omitted
Start-up age at financing	0.024 (0.017)	0.029* (0.016)	0.011 (0.021)	0.006 (0.020)	0.019 (0.022)	0.021 (0.021)	0.018 (0.020)	0.021 (0.020)
Constant	-13.603 (610.864)	-12.710 (516.125)	-12.473 (541.355)	-12.058 (339.386)	-3.005 (10.799)	-12.686 (555.541)	-10.947 (343.344)	-12.013 (416.489)
Inalpha	2.222*** (0.116)	2.145*** (0.119)	2.073*** (0.131)	2.063*** (0.131)	1.995*** (0.783)	2.059*** (0.131)	2.040*** (0.132)	2.016*** (0.132)
alpha	9.226 (1.074)	8.544 (1.016)	7.950 (1.041)	7.867 (1.030)	7.355 (5.763)	7.837 (1.028)	7.689 (1.013)	7.504 (0.989)
Number of observations	182							
Standard error								
*** p<0.01, ** p<0.05, * p<0.1								

Table II presents the zero-inflated negative binomial regression analyses for the Control Model (1), Control Model and direct effect moderators (2), Main Effects Model (3), Interaction Effects Models (4 up to 7) and Full Model (8). The execution of the regression analysis was not possible with the same variables for all the eight models, probably because of the composition of the database and by the statistical assumptions that may not be met. As a result, I decided to keep the variable “years of experience corporate” out of the regression analysis for model 6, so that the analysis could be carried out. The effect of leaving this variable out of the regression analysis of model 6 has been checked based on the other models. I found that leaving this variable out of the regression analysis will have a limited effect on the result of the model and will only slightly change the effect of the other variables involved in the regression analyses.

The regression analysis generated the following results. The proposed positive direct effect of the innovativeness of the CVC-funding corporate on the innovativeness of the CVC-backed start-up (hypothesis 1) was not supported, because for the direct effect model (model 3) a positive but not significant effect was found ( $\beta = 0.039$ ,  $p = 0.65$ ). Hypothesis 2, proposing a negative relationship between the financial performance of the CVC-funding corporate and the innovativeness of the CVC-backed start-up, was not supported for the direct effect model because a positive and not significant effect was found ( $\beta = 1.326$ ,  $p = 0.19$ ). Therefore, in contrast with my expectation, it seems that collaborating with a CVC-funding corporate with better financial performance positively impact the innovativeness of the CVC-backed start-up and that collaborating with a more innovative CVC-funding corporate positively impact the innovativeness of the CVC-backed start-up, although these findings are not significant.

In addition to the direct effects, I proposed that the moderator start-up investment stage negatively impact the effect that financial performance of the CVC-funding corporate has on the innovativeness of the CVC-backed start-up (hypothesis 3). This hypothesis is not supported by the data of this study because the regression analysis shows a positive and not significant effect on the full model ( $\beta = 5.736$ ,  $p = 0.11$ ). Therefore, it seems that the moderator start-up investment stage has a positive effect on the relationship that the financial performance of the CVC-funding corporate has on the innovativeness of the CVC-backed start-up and that this moderation effect comes close to a significant effect. Additionally, hypothesis 4 proposing a negative moderating effect that the start-up investment stage has on the relationship of the innovativeness of the CVC-funding corporate on the innovativeness of

the CVC-backed start-up, is not supported because a slightly positive and no significant effect was found for the full model ( $\beta = 0.005$ ,  $p = 0.97$ ).

Furthermore, I predicted a negative moderating effect of the geographical distance on the effect that the financial performance of the CVC-funding corporate has on the innovativeness of the CVC-backed start-up. The analysis exposes a not significant negative moderating effect in both the interaction effect model 6 ( $\beta = -2.412$ ,  $p = 0.13$ ) and the full model ( $\beta = -1.902$ ,  $p = 0.22$ ). Therefore, hypothesis 5 is not supported, although the negative direction of the moderating effect is demonstrated by this study. Finally, I projected that the moderator geographical distance negatively impacts the effect that the innovativeness of the CVC-funding corporate has on the innovativeness of the CVC-backed start-up (hypothesis 6).

Based on the regression analyse, I found for interaction model 7 ( $\beta = 0.321$ ,  $p = 0.04$ ) and the full model ( $\beta = 0.302$ ,  $p = 0.08$ ) a positive and significant effect, meaning that Hypothesis 6 is not supported and that the direction of this moderating effect is opposite.

Finally, I ran a number of robustness checks. First, I checked for outlier data for the dependent and the independent variables that may affect the result of the analysis. For the dependent variable, the total patent count over the first five years seems to end up for three start-ups with an unrealistic large number of patents. Specifically, the patent count for these start-ups are more than 100 times bigger than the mean (43.3) and cannot be explained on the basis of the nature of these start-ups. Additionally, even most of the CVC-funding corporates hardly attain these numbers of patents during a five-year period. For the independent variable measured by the ROA, I found one outlier with a value that is about 20 times more negative than the other most negative value (-30 vs. -1.65) within the dataset. As a result, I dropped the outlier data for the dependent and independent variables.

The results of the regression analyses did not affect substantially by dropping the three outliers of the dependent variable. In contrast, leaving the outlier of the independent variable out of the dataset has more impact on the results of the regression analyses. Mainly, because a large number of the outlier changes the effect that the independent variable has on the dependent variable. The mean ROA of the CVC-funding corporates changed from -0.032 to 0.120 by only dropping the outlier. Because it is expected that this specific CVC-funding corporate had a reason to lower the net income during that year. As a result, the independent variable comes close to a normally distributed variable.



Second, I considered alternative operationalization's for the dependent and independent variables. For example, I ran the regression analysis by using the Return on Equity (ROE) instead of the ROA and by using different time windows (instead of 5 years, also 3 and 4 years) for both the variable innovativeness of the CVC-funding corporate and for the innovativeness of the CVC-backed start-up. All the different variable used to operationalize the dependent and independent variable of this study did not significantly change the outcome of the analysis. All the other operationalization's resulted in a slightly different effect of the independent variables on the dependent variable. Third of all, I changed the time window of the study from originally 1991-2010 to 1991-2000 and 2000-2010. The change of the time window resulted in a slight change of the effects. However, like the other robustness checks, a change in the time window did not significantly change the results of the analysis. Finally, I removed the variables from the model one by one, which did also not significantly change the results of the analysis. Consequently, the robustness tests executed have shown that the model is robust.

## 5. Discussion and conclusion

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### Discussion & conclusion

Strategy scholars strive to understand the factors that impel the survival rate and growth rate of start-ups. Prior literature has established that the initial state of a start-up has profound and long-lasting effects on the subsequent development and outcomes of the start-up (e.g. Alvares-Garrido & Dushnitsky, 2016; Dobrev & Gotsopoulos, 2010; Kim & Park, 2017; Marquis & Tilcsik, 2013). However, there has been relatively little consideration of a start-up's early relationship with external investors – among others CVC-funding corporates – as potential sources of imprinting (Kim & Park, 2017). In order to fill this void, this study has focused on the CVC-funding relationship between start-ups and corporates and how this relationship impacts the innovativeness of the CVC-backed start-up. The findings of this study based on 236 start-ups on the continent of North America seem to support the concept of imprinting.

This study has generated a number of interesting findings based on the empirical data. First and foremost, in contrast with the expectation, the findings of this study show a slightly positive but not significant relationship between the innovativeness of the CVC-funding corporate and the innovativeness of the CVC-backed start-up. Therefore, it seems that the direction of the direct effect will be positive and thus it is likely that the more innovative the CVC-funding corporate is, the more innovative the CVC-backed start-up will be in the future. This finding could be explained by the central argument of the imprinting theory, because based on prior literature it is predicted that the more innovative the CVC-funding corporate is the more the CVC-backed start-up potentially can learn from its external investor, benefitting the future innovativeness of the CVC-backed start-up.

Second, I found that a better financial performance of the CVC-funding corporate seems to have a positive direct effect on the innovativeness of the CVC-backed start-up, although this finding was not significant. Therefore, based on the results of this study, it seems that the financial performance of the CVC-funding corporate has a positive effect on the innovativeness of the CVC-backed start-up rather than a negative direct effect, as was expected based on prior literature. Especially, I found for the financial performance of the CVC-funding corporate a relatively strong and positive effect compared to the effect of the innovativeness of the CVC-funding corporate, which seems to make the variable financial performance of the CVC-funding corporate a strong predictor for the future innovativeness of

the CVC-backed start-up. Based on this results, the by prior literature proposed impact of the orientation of the CVC-fund is confirmed by the dataset of this study, although the findings of the direct effects were not significant (e.g. Dushnitsky & Lenox, 2006; Hallen et al., 2014).

Furthermore, there were two variables expected to moderate the direct effects. First, the potential moderating effect of the start-up investment stage was examined. In general, the results of this study show that both direct effects are subject to a positive moderating effect of start-up investment stage, although these effects were not significant. Only the interaction effect on the effect of the financial performance of the CVC-funding corporate on the innovativeness of the CVC-backed start-up meets almost a significance level of  $p = 0.10$ . Accordingly, it is likely that the CVC-funding during later investment stages are resulting in more innovative CVC-backed start-ups. This empirical finding seems to contradict the central argument of the imprinting theory because a positive effect was found instead of a negative effect which one should expect based on the existing literature. Nevertheless, a full contradiction with the imprinting theory cannot be claimed as the effects found are not significant. However, this surprising result can be explained by the fact that there may be other factors that impact the innovativeness of the CVC-backed start-up, which impact could be stronger than the imprinting effect itself. For example, it could be that CVC-funding corporates are better able in selecting the most innovative start-ups during later investment stages because these start-ups are more developed, making it easier for the CVC-funding corporates to predict the long-term innovativeness of these start-ups.

Second, I found an especially interesting result relating to the moderating effect of the geographical distance. Because based on the empirical data an opposite and significant effect of the moderator geographical distance was found for hypothesis 6 than was expected from prior literature. Consequently, this study demonstrates that the positive relationship that the innovativeness of the CVC-funding corporate has on the innovativeness of the start-up becomes stronger as the distance between the start-up and the corporate increases. One possible explanation for this finding could be that when the distance between the CVC-backed start-up and the CVC-funding corporate increases, the CVC-backed start-up will be able to attract other resources of the CVC-funding corporate due to the different local circumstances in which the corporate and the start-up must adapt. Therefore, men could expect that start-ups and corporates acting in different areas are forced to develop complementary resources to survive the local market circumstances. As a result, the CVC-backed start-up can benefit from these complementary resources of a CVC-funding corporate

to become more innovative. Additionally, I found that it is likely that the negative moderating effect of the geographical distance on the negative relationship that the financial performance of the CVC-funding corporate has on the innovativeness of the start-up gets stronger when the distance increases, though this effect was not significant. Consequently, this study shows that the distance between the CVC-backed start-up and the CVC-funding corporate matters when it comes to the innovativeness of the CVC-backed start-up.

### **Limitations and further research**

Despite the contributions of this study, there are, of course, a number of limitations that may open up new opportunities for further research. In consequence of this study, six main limitations that call for further research are defined. First, this study is restricted to CVC-backed start-ups and CVC-funding corporates who are located in North America because the needed data was available for this continent. However, future studies might try to generalize the findings of this study to other continents and national contexts. Due to the cultural and economic differences between the different parts of the world, other results could be found for different areas.

Second, another possible shortcoming is that the innovativeness of both the CVC-backed start-ups and the CVC-funding corporates is operationalized only by measuring the patent count during the research period. Although it is generally accepted to measure innovativeness by the patent count, it could be that not all the innovative activities – of especially the start-ups – are captured by the patent count. For example, not every start-up decides to register an innovation via a patent because it is a long and slow process which makes their invention public as well. Future research could consider using other operationalizations of the innovativeness, for example by looking at the R&D inputs, patent citations and/or new product announcements (Hagedoorn & Cloudt, 2003).

Further, although this study showed that there is a relationship between the innovativeness of the CVC-backed start-up and the type of CVC-funding corporate, I was unable to directly observe the reason why a start-up with a certain CVC-funding corporate is more innovative than others. Future research with rich qualitative data instead of only quantitative data could perhaps describe the mechanisms that occur between the CVC-backed start-ups and the CVC-funding corporates that lead to more innovativeness of the CVC-backed start-up.

Four, because of the quantitative research method, I was only able to examine the effect of the geographical distance on the relationship between the independent variables and the dependent variable. Therefore, it was not possible to observe the mechanisms through which the geographical distance impacts the innovativeness of the CVC-backed start-up. There is, however, evidence that an organization's capacity to learn is not absolute but rather varies with the learning context (Lane et al., 2001). Scholars have argued that transparency (Hamel, 1991) and that differences in partner nationality and culture influences the success of the collaboration, particularly the ability to benefit from knowledge spillovers (Lane et al., 2001). Although the literature has examined the different ways in which knowledge spillover can take place between the start-up and the corporate, further research could focus on the specific mechanisms of knowledge spillovers during the CVC-funding that affect the innovativeness of the CVC-backed start-up.

Five, this study opens the possibility for further research for investigating the impact of the selection effect of the CVC-funding corporate on the innovativeness of the CVC-backed start-up. Although this study is limited to the imprinting effect, it could be possible that certain corporates are more effective in selecting potentially more innovative start-ups at an early investment stage. If this will be the case, a man could argue that the future innovativeness of a CVC-backed start-up is not (only) caused by the imprinting effect of the CVC-funding corporate on the CVC-backed start-up but also by the fact that the corporate has the ability to select start-ups which will become innovative in the future.

Finally, future research should also have a look at the causality between the independent and dependent variables within the model, which could lead to endogeneity. Which can arise for a variety of reasons, amongst others due to, measurement errors, autoregression with auto-correlated errors, simultaneity, and omitted variables. Endogeneity could have an impact on the outcome of this study because the dependent variable will, in that case, be influenced by the independent variables, by which a loop of causality could occur. Therefore, future research needs to look at the dependency between independent and dependent variables more in detail.

### **Managerial implications**

In addition to the academic implications discussed in this study, the results also generate some interesting managerial implications for both the founder(s) of a start-up as for the

management of a CVC-funding corporate. First and foremost, having an idea of what the influence can be of attracting external capital on the start-ups' most valuable resource – innovation - can support the start-up in attracting the right CVC-funding corporate. This study shows that it matters for a start-up to choose their CVC-funding corporate consciously.

In contrast with what was expected beforehand, based on the empirical data it seems that start-ups who are attracting CVC-funding from a corporate with a better financial performance are likely to turn out to be more innovative in the end, although this finding was not significant. Interestingly though, the financial performance of the CVC-funding corporate seems to be the best predictor when it comes to the future innovativeness of the CVC-backed start-up because the effect of the financial performance of the CVC-funding corporate on the innovativeness of the CVC-backed start-up is relatively large and the standard deviation of this variable is relatively small. In other words, the innovativeness is less relevant than the financial performance of the CVC-funding corporate in predicting the future innovativeness of the CVC-backed start-up.

In addition, this study shows that the geographical distance between the CVC-backed start-up and the CVC-funding corporate matters in relation to the future innovativeness of the start-up and is the opposite than one should expect from the existing literature. Therefore, this study demonstrates that the positive relationship that the innovativeness of the CVC-funding corporate has on the innovativeness of the start-up becomes stronger as the distance between the start-up and the corporate increases. Thus, it is the best for start-ups looking for CVC-funding to consider the financial performance of the CVC-funding corporate and the geographical distance with their potential CVC-funding corporate.

This study presents also managerial implications relevant for the CVC-funding corporates. As the reason for CVC-funding corporates is to take an option on the potential innovativeness of the start-up (Schildt et al., 2005; Weiblen & Chesbrough, 2015), it is worth for these corporates to consider the start-up investment stage and the geographical distance between the start-up and the corporate. Based on the empirical analyses, I found that investments during a later investment stage will cause the innovativeness of the CVC-funding start-up positively, although this finding is not significant. In addition, the geographical distance moderates the relationship between the CVC-backed start-up and the CVC-funding corporate. Surprisingly, the relationship of the innovativeness of the CVC-backed start-up and the innovativeness of the CVC-funding corporate seems to benefit of a greater spatial distance

between the start-up and the corporate, although this finding was not significant. Moreover, this study presents that the relationship of the financial performance of the CVC-funding corporate and the innovativeness of the CVC-backed start-up benefits from a larger spatial distance. Accordingly, CVC-funding corporates can take these insights into account when they consider investing in a start-up.

In conclusion, this study responds to the call for research on how imprinting affects the innovativeness of a CVC-backed start-up. The study not only examines how the financial performance and the innovativeness of the CVC-funding corporate affect the innovativeness of the CVC-backed start-ups but also reveals how the start-up investment stage and the geographical distance between the CVC-backed start-up and CVC-funding corporate might moderate the innovativeness of the CVC-backed start-up. In doing so, based on this study, it is likely that it matters for the CVC-backed start-up to choose their CVC-funding corporate consciously. Mainly by looking at the financial performance of the CVC-funding corporate and by looking at the geographical distance between the start-up and the potential CVC-funding corporate.

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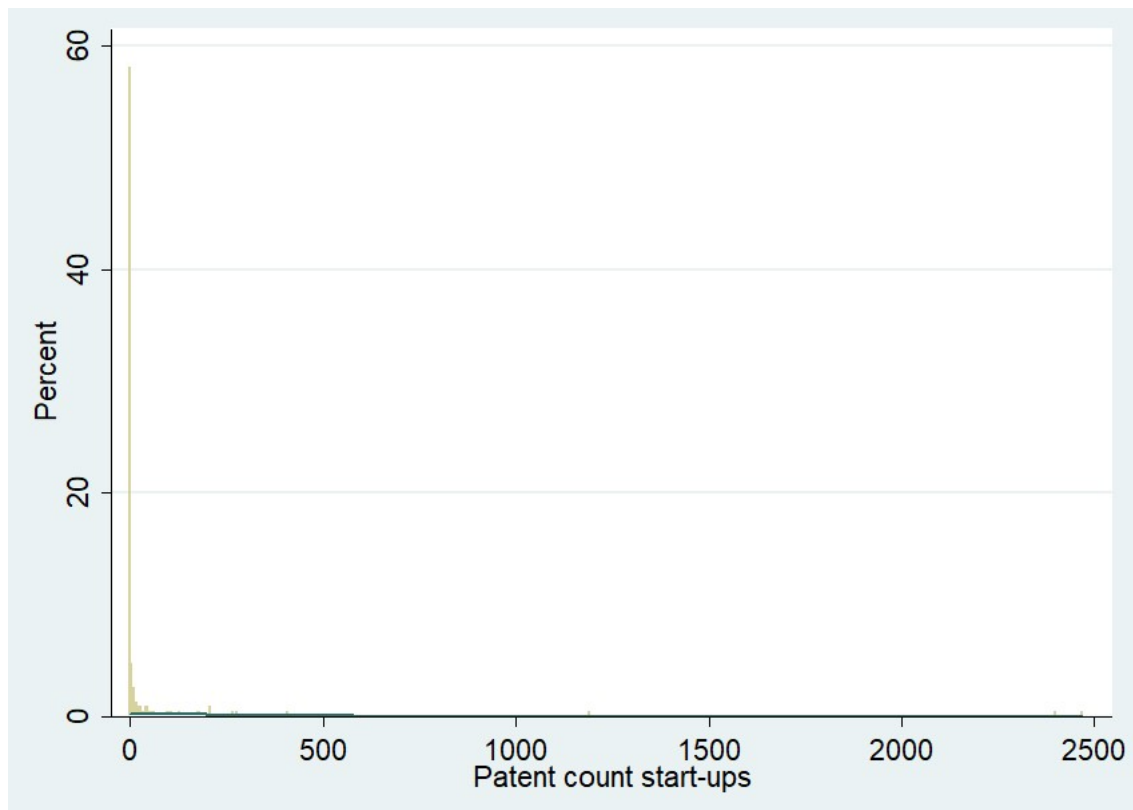
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## Appendix I

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*Figure 2: dependent variable innovativeness CVC-backed start-ups*

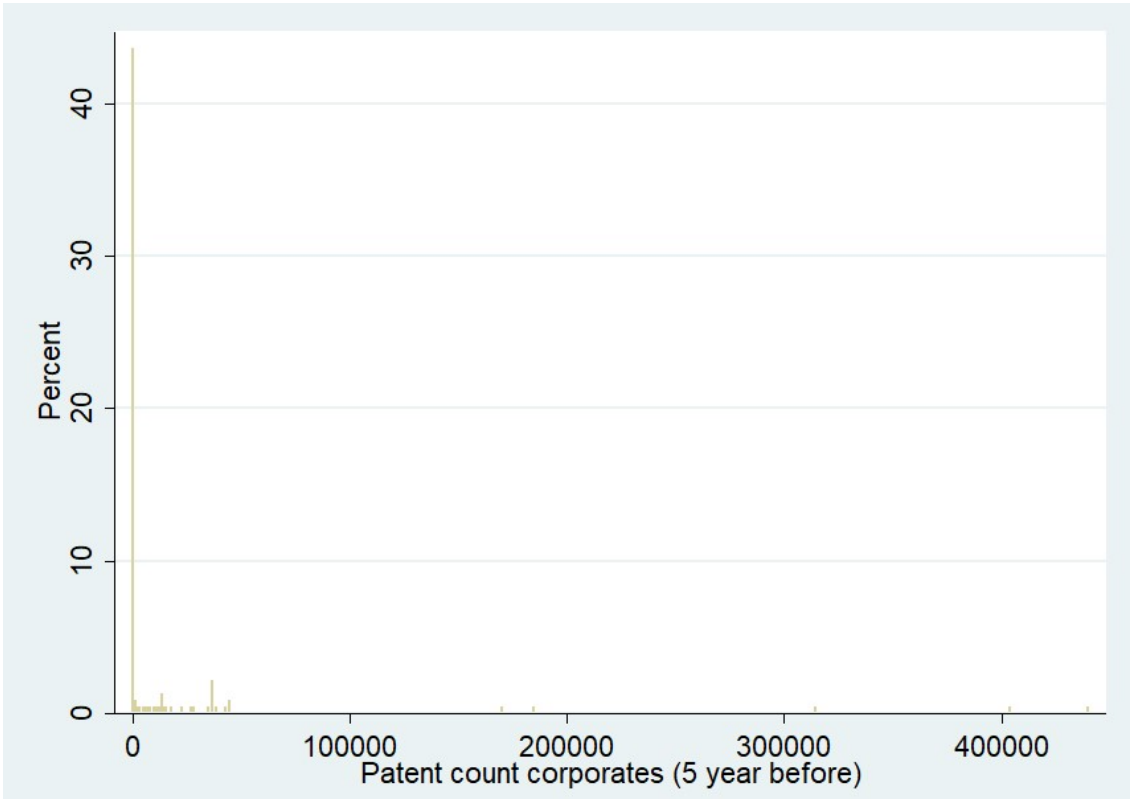


Figure 3: independent variable innovativeness CVC-funding corporate