Parent Firm – Baby Venture Relationship in the Corporate Venture Capital Activity: Firm Structure and Environment as Contingencies

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Abstract

The steady growth of Corporate Venture Capital (CVC) activities demonstrates the importance for companies to continuously create innovations to sustain and increase competitive advantages. Gaining access to external sources of knowledge from entrepreneurial initiatives by using CVC investments compliments the internal R&D sourcing. Focusing on U.S listed parent firms of CVC units, this dissertation explores the impact of industry and firm-specific factors on CVC investment activity in high technology industries, as well as related effects on the company value.

I employ a U.S American panel dataset for the period from 2000 to 2020 consisting of 2.678 firm-year observations. Using the aggregate count of investments conducted as CVC activity, I find that higher absorptive capacity leads to significantly higher CVC activity. Conversely, I cannot find a significant relationship between environmental munificence and CVC activity. Moreover, I present evidence that firms which pursue CVC activities experience value creation and find that that parent firm value increases among firms making CVC investments that are operationally diffuse and operate in high munificent environments as well as for firms with a concentrated operational structure in low munificent environments.

This study illustrates that managers should be aware of these effects when deciding to invest in entrepreneurial ventures with the strategic intentions to source for innovations.

Keywords: *Corporate Venture Capital, CVC, CVC activity, firm value, absorptive capacity, environmental munificence, operational structure, high technology industries, contingencies*

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Resumo

O crescimento constante das actividades de Corporate Venture Capital demonstra a importância para as empresas de criar continuamente inovações para sustentar e aumentar as vantagens competitivas. Ganhar acesso a fontes externas de conhecimento de iniciativas empresariais através da utilização de investimentos de CVC complementa o sourcing interno de I&D. Centrando-se nas empresas-mãe americanas de unidades de CVC, esta dissertação explora o impacto de factores específicos da indústria e da empresa na actividade de investimento em CVC em indústrias de alta tecnologia, bem como os efeitos relacionados no valor da empresa.

Utilizamos um conjunto de dados de um painel americano do período de 2000 a 2020, que consiste em 2.678 observações de anos de empresa. Utilizando a contagem agregada dos investimentos realizados como actividade de CVC, constatamos que uma maior capacidade de absorção leva a uma actividade de CVC significativamente mais elevada. Pelo contrário, não encontramos uma relação significativa entre a munificência ambiental e a actividade de CVC. Além disso, apresento provas de que as empresas que prosseguem actividades CVC experimentam a criação de valor e descobrem que o valor dessa empresa mãe aumenta entre as empresas que fazem investimentos CVC que são operacionalmente difusos e operam em ambientes altamente munificentes, bem como para empresas com uma estrutura operacional concentrada em ambientes de baixo munificente.

Este estudo ilustra que os gestores devem estar conscientes destes efeitos quando decidem investir em empreendimentos empresariais, com as intenções estratégicas de fonte para inovações.

Palavras-chave: *Capital de risco corporativo, CVC, actividade CVC, valor firme, capacidade de absorção, munificência ambiental, estrutura operacional, indústrias de alta tecnologia, contingências*

Título: Empresa-Mãe - Relação de Capital de Risco para Bebés na Actividade de Capital de Risco Corporativo: Estrutura e Ambiente da Empresa como Contingências

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2SLS	Two-stage least squares	**LIQ**	Firm Liquidity
A	Total Assets	**MVE**	Market Value of Equity
AC	Absorptive Capacity	**NVCA**	National Venture Capital Association
Age	Firm Age	**OLS**	Ordinary least square regression
CVC	Corporate Venture Capital	**OS**	Operational Structure
DIV	Diversification	**Pp**	Percentage Points
e.g.	exempli gratia	**PS**	Preferred Stock
EM	Environmental Munificence	**ROS**	Return on Sales
etc.	et cetera	**ROE**	Return on Equity
et al.	et alia	**R&D**	Research and Development
GRO	Firm Growth	**SIC**	Standard Industrial Classification
i.e.	id est	**Size**	Firm Size
IVC	Independent Venture Capital	**Slack**	Firm Slack
TQ	Tobin's Q	**U.S.**	United States

1. Introduction

“2020 has ended with a record nontraditional participation in venture for both deal count and deal value, reaching past 4.000 deals and $125 billion, respectively (NVCA, 2021)”. This included rounds executed by established Corporate Venture Capital (CVC) arms as well as direct equity investments by corporations into Venture Capital (VC) - backed companies. According to PitchBook-NVCA Venture Monitor Q1 2021 such CVC investment activities accounted for more than 25% in value ($) and 50% in count of the overall US VC deals in 2020 with the beginning of 2021 showing an even larger proportion!

These numbers demonstrate not only the importance of CVC activity for the venture landscape, but signal that conducting CVC investments is seemingly very attractive for corporate investors. CVC investments have the potential to enable corporate investors to gather knowledge and information from early-stage companies to develop and integrate new technologies over time (Dushnitsky & Lenox, 2005b). The strategic motives of fueling innovation and exploring new developments from those investments are often times aligned with the long-term goal of increasing the value of the company (Drover et al., 2017). Therefore, it is necessary to find out to what extent certain factors initially influence the emergence of CVC activities and how these, just like CVC activities themselves, ultimately affect the value of the company. It is important to include both firm-specific and industry-specific factors.

Prior research focuses mainly on two different analyses. On one side, it examines the antecedents and the underlying behavioral and economic considerations of CVC activities. On the other side, it investigates the impact of CVC investments on firm innovation output. A combined analysis has not yet been carried out in this form by previous literature. Although Titus & Anderson (2018) focused on the impact of CVC activity, environmental munificence and operational structure on firm value and Sahaym et al. (2010) investigated the impact of environmental munificence and technological fit on CVC activity, a coherent consideration of the factors has been missing so far. To sum up, research widely ignored whether and when an established firm's competitive environment and resources, impact its willingness and ability to succeed in making investments in startups.

I use a U.S. American panel dataset of 2.678 firm-year observations over the period from 2000 to 2020. First, I analyze the impact of firm and industry-specific factors on CVC activity using two different measures: absorptive capacity and operational structure as firm-specific and environmental munificence as industry-specific. Second, I use these measures to analyze their impact on parent firm value. I test if firms’ absorptive capacity and the munificence of their industry environment have a significant effect on firms' CVC activity; and if CVC activity itself fosters parent firm value. Also, I observe the interaction between CVC activity, environmental munificence and operational structure on parent firm value.

The paper is structured as follows. Section 2 presents the applied theoretical framework and the literature review with the development of the hypothesis. Section 3 describes the data and sample selection. Section 4 discusses the methodology of the study; section 5 presents the results, section 6 concludes and section 7 addresses limitations and future research potential.

2. Literature Review & Hypothesis Development

2.1. Theoretical framework

CVC investments which are made by established corporations are direct minority equity investments into privately held entrepreneurial ventures (Drover et al., 2017). CVC activities are a vehicle for exploiting knowledge, fueling innovation and exploring new developments, meaning that corporate investors are having a strategical focus while aiming to incorporate innovative ideas from those investments (Drover et al., 2017). To start-up companies in return, corporate investors do not only provide capital and complementary assets, but also share their industry knowledge, network and customer access (Cumming, 2012).

The relationship between CVC activities and innovation creation has been examined widely in research. According to Cumming (2012) mainly internal R&D was used historically to pursue innovation. Although internal R&D is vital for firms to generate new information and knowledge to be able to compete in a continuously evolving and changing market environment (Lane & Lubatkin, 1998; S. M. Lee et al., 2015), also the external environment needs to be sourced in order to expand innovation and maintain the firms competitiveness (March, 1991). It is widely recognized across researchers that organizations are limited in creating innovations internally (Dushnitsky & Lenox, 2005b; Henderson, 1993).

The exploitation of external knowledge can therefore be employed by firms to get the better of these constraints (Cohen & Levinthal, 1990). The use of external sourcing measures to identify innovation potential outside the own boundaries has been taken up by firms including joint ventures, licensing, mergers and acquisitions and strategic alliances (Ceccagnoli et al., 2018; S. M. Lee et al., 2015). Recently, CVC has gained importance as one possibility for firms to gain access to external sources of knowledge from entrepreneurial initiatives (Dushnitsky, 2012; Pinkow & Iversen, 2020). Therefore, CVC investments enable corporate investors to gather knowledge and information from early-stage companies to develop and integrate new technologies over time (Dushnitsky & Lenox, 2005b). Also, CVC offers the opportunity to invest in innovations that are still unclear as to their future viability. With this mitigation of risk comes the potential to increase exposure as market conditions evolve and the viability of emerging technologies becomes clearer (Maula et al., 2013; Sahaym et al., 2010).

The relationship between CVC activity and internal R&D has experienced a new notion, as Dushnitsky & Lenox (2005a) presented evidence that both are rather compliments than substitutes, suggesting that firms pursue different types of innovation between internal R&D and CVC. CVC investments can be seen as a more radical way to explore new innovations, whereas internal R&D is needed to foster the development of proprietary core technologies. Furthermore, internal R&D creates firm expertise and expands the ability to identify, incorporate and exploit innovation potential of new ventures (Cohen & Levinthal, 1990; Sahaym et al., 2010). Research that focused on the antecedents to CVC activity decisions examined the underlying behavioral and economic considerations how and why corporate investors engage in CVC investing. CVC investments and R&D activity being compliments rather than substitutes (Dushnitsky & Lenox, 2005a) and the impact of R&D on the firm's learning ability or absorptive capacity (Cohen & Levinthal, 1989) suggest that there is a relationship between R&D and the conditions and results of CVC investments. In addition, the authors find that CVC investment activity is enhanced by both firm-level resources like absorptive capacity and cash flow availability and industry-level factors, as intellectual property protection and technological ferment. Firms are investing more in new ventures if the intellectual property protection in an industry is low and if the technological ferment is high. Also, firms are more likely to engage in CVC activity, the higher their cash flow and absorptive capacity (Drover et al., 2017; Dushnitsky & Lenox, 2005a). Basu et al. (2011) emphasize an interaction between industry-level factors and firm-level resources and state that industries with great competition intensity, high technological change and low appropriability are more active in CVC investing. Regarding firm-specific resources, experience from venture activities was also found to condition higher CVC investment activity.

2.2. Effects on CVC activity

2.2.1. Firm-specific: Absorptive capacity and operational structure

CVC activity aims at fostering the exploitation of knowledge, fueling innovation and exploring new developments. To be able to do so a firm needs the internal ability and competence to absorb and utilize the knowledge acquired to uncover the full innovation potential (Dushnitsky & Lenox, 2005a).

Absorptive Capacity

The role of absorptive capacity, defined as "a firm's capability to recognize the value of new knowledge, assimilate and exploit it" (Cohen & Levinthal, 1990). This definition operationalizes absorptive capacity as the firm´s ability to value, incorporate and apply new and external knowledge. In addition to that Mowery & Oxley (1995) provided a definition of absorptive capacity as the needed skillset to be able to adapt, incorporate and modify the imported knowledge that was accessed through external means of sourcing. Also, firms are able to learn from failures and develop capabilities for future success through absorptive capacity (Jeong et al., 2020). For firms, absorptive capacity has been proven to be a highly important, useful and vital prerequisite for being innovative, achieving a high financial performance and sustaining and developing a competitive advantage that sets them apart from other companies (Zahra & George, 2002).

Cohen & Levinthal (1990) introduced the concept of the absorptive capacity process with three steps, namely identification, assimilation and exploitation. Zahra & George (2002) later adapted and reevaluated their concept but introduced slight changes to the absorptive capacity process. They understood absorptive capacity as a "dynamic capability pertaining to knowledge creation and utilization" and reconceptualized the process into four dimensions, which are acquisition, assimilation, transformation and exploitation. The contribution of Zahra & George (2002) was to create two new components out of the four dimensions that lead to the dynamic capability of firms. Potential absorptive capacity consists of acquisition and assimilation and covers the firm's capability to interpret and understand the knowledge that has been acquired. Transformation and exploitation are part of the realized absorptive capacity dimension and touch on the capability to implement and leverage the external knowledge that was absorbed. They have separate but complementary roles, but are vital and crucial for improving company performance (Jeong et al., 2020; Zahra & George, 2002). The characteristics of absorptive capacity as a dynamic capability of firms was illustrated by various academics (Cohen & Levinthal, 1990; Flatten et al., 2011; Jeong et al., 2020; Lane et al., 2006; Zahra & George, 2002) and a few studies demonstrated the importance of absorptive capacity as an antecedent of CVC investing (Basu et al., 2011; Dushnitsky & Lenox, 2005a).

Dushnitsky & Lenox, (2005a) argue that corporate investors who possess greater absorptive capacity are likely to enter into a greater extent of CVC investments due their greater ability to exploit and explore knowledge from CVC investment activities. Sahaym et al. (2010) found that R&D investments are increasing firms' capabilities of perceiving and exploiting opportunities and thereby enhancing the appeal of CVC investments. Moreover, industries where higher absorptive capacities are manifested due to prior R&D investments exhibit greater endeavor in pursuing external innovation activities through the use of CVC. They suggest that absorptive capacity is the basis for investing in new technologies and ventures to foster future growth and that a complementary relationship between R&D and CVC exists. Supporting this argument, Gompers & Lerner (2001) found that firms in industries with high historic levels of R&D gain higher industry knowledge and absorptive capacity (Cohen & Levinthal, 1990), which helps them to assess the value proposition of unfolding technologies with innovative potential for future CVC investment activities.

Hence, hypothesis 1 is based on the premise that high absorptive capacity of a firm has a positive influence on the amount of CVC activities it performs (Sahaym et al., 2010)

H1: *Higher levels of Absorptive Capacity will lead to higher levels of CVC activity*

Operational Structure

In order to capture the influence of and on CVC activities, the inclusion and consideration of structural factors influencing CVC activities are also of great importance in the analysis. It is therefore advisable to take a closer look at the influence of operational structure, as it is an important factor influencing the company's decisions concerning investments and value creation (Garg et al., 2003).

To define operational structure, I follow the approach of Titus & Anderson (2018), who operationalize operational structure as the extent to which a company is either more concentrated or differentiated, relative to the business segments of annual reporting and financial statement reporting. According to Hurley & Hult (1998) firms which have a concentrated operational structure centralize their strategic decision-making among a very limited number of executives, whereas operationally diffuse structured firms are known to delegate decision-making authority also to lower hierarchical levels (Chandler, 1991). Galunic & Eisenhardt (2001) define operational structure as the way how a company organizes its decision-making authority and strategy development across its business segments. An important difference between operational concentration and diffusion is that executives with decision-making authority in concentrated firms have a greater awareness regarding the strategic challenges (Eisenmann & Bower, 2000). Due to this awareness of the decision-making executive, Basu et al. (2011) argue that the likelihood that a CVC investment creates new value increases and more effective decisions are made (Hashai, 2015).

2.2.2. Industry-specific: Environmental munificence

The concept of environmental munificence has received growing awareness in recent years since it plays an important role in the relationship between organizational performance and learning. This study aims to explore how the concept of environmental munificence affects CVC investment activities and firm value. Environmental munificence refers to the "extent to which the environment could support sustained growth of the firms" (Starbuck, 1976), meaning the "scarcity or abundance of critical resources needed by firms operating within an environment" (Castrogiovanni, 1991). This means that the expansion and survival of firms within an environment is influenced by the resources available within that same environment. Research has indicated that when resources are abundantly available, firms are enabled to pursue their growth whereas in times of resource scarcity and declining munificence, the competition intensifies and firms become less likely to engage for growth (Castrogiovanni, 1991). Therefore, a low level of environmental munificence means that there exists a scarcity of resources and a high level of environmental munificence expresses that resources are plentiful (J. Y. Lee et al., 2020).

A munificent industry environment creates a greater abundance of firm resources while simultaneously diminishing competition for and dependencies upon these (Boyd, 1990). Those resources can be employed for different strategic and corporate goals and initiatives like the sourcing of external knowledge to foster innovation from entrepreneurial ventures through CVC investing. In addition, the more munificent the environment is and hence the greater firms capabilities and resources are, the better firms are able to apply learning (Li et al., 2013). In the state of low environmental munificence, firms in contrast should be cautious and modest with regard to the balance of exploration and exploitation activities (Li et al., 2013). In fact, firms are less likely to pursue explorational activities due to constrained resources (Sahaym et al., 2010). In these less munificent environments, where growing rivalry for diminishing resources among firms endangers the firms' continued existence within their respective industry, the growth of sales is limited due to future growth being a less focal point (Castrogiovanni, 1991). Firms in these industries focus less on expanding their investment activities, but rather on consolidating, reducing costs while governing and controlling the threats to their survival (Sahaym et al., 2010).

In contrast, in industries with a high level of environmental munificence excess resources can be used to pursue strategic goals through tools like CVC investment and surveil the market for innovative and unfolding technologies and market trends. Therefore, resource-rich environments foster the exploration of new competencies and technologies in the market, which will also increase firm value. This process of exploration typically begins in associated industries due to already existing internal knowledge within the firm in these areas (Sahaym et al., 2010). Furthermore, the existence of excess resources can intensify the competition within the industry for innovation and foster the pursuance of distinct initiatives like CVC investments (Gompers et al., 2005; Sahaym et al., 2010).

This leads to the second hypothesis:

***H2**: Higher levels of environmental munificence will lead to higher levels of CVC activity.*

2.3. The relationship of CVC activity and firm value

Due to the character of CVC – being used primarily for strategic reasons like the sourcing of knowledge and technologies – research has mainly focused on the respective success. Papers like Belderbos et al. (2018) and Dushnitsky & Shapira (2010) have evaluated the performance of CVC investments from a strategic standpoint, analyzing their ability to foster technologic and knowledge improvements. A lot of research has been conducted focusing on the relationship between CVC investments and firm innovation outputs. However, the conditions under which parent firm value is influenced by CVC activity are less researched. Nevertheless, the literature provides three important assumptions: Dushnitsky & Lenox (2006) argue that CVC investments have increased parent firm value, provided the companies have entered into them for strategic rather than financial motives. In addition, Yang et al. (2014) have found evidence that there is a U-shaped relationship between the level of portfolio diversification of the CVC investments and the creation of firm value. Both suggest that the creation of firm value is an appropriate focal-dependent variable for CVC activity under the assumption that the firm value incorporates the investors current assessment and their future expectation to create value from strategic actions (Brush et al., 2000; Titus & Anderson, 2018).

Therefore, I will address the firm value dimension of corporates from entering into CVC investment activity leading to the following hypotheses:

***H3**: Higher CVC activity positively influences firm value.*

It has been demonstrated that corporate investors are following mainly strategic objectives as gaining access to knowledge and technologies when engaging into CVC activities. Anyhow if firms acquire and implement knowledge this information could help companies also to improve their firm valuation. Also, it has been illustrated that corporate investors which have greater experience in conducting CVC deals are more successful in capturing and handling deals with entrepreneurial ventures (Siegel et al., 1988). An important factor in this relationship is that a substantial amount of prior CVC activity generates important learnings for corporate investors and empowers them to make superior choices (Yang et al., 2009). Benson & Ziedonis (2009) show that information which has been obtained through the acquisition of start-ups increases the returns to corporate investors. The importance of absorptive capacity as a moderator of the relationship between financial performance and its venturing activities has been demonstrated by Zahra & Hayton (2008), who found that the effects of venturing activities on financial performance depend upon the companies' state of absorptive capacity. Also, Dushnitsky & Lenox (2006) found that firms' CVC investing activity has a substantial impact on increasing Tobin's Q and that CVC pursued for strategic goals is likely to create firm value. In a recent paper, Fels et al. (2021) provided a systematic evaluation of the factors that are influencing the performance of CVCs, finding that a complex setting of organizational relationship, managerial influence and focus, portfolio composition and corporate knowledge are direct determinants of CVC performance. Also, Titus & Anderson (2018) contribute by assessing contingencies like operational structure and environmental munificence to the firm that create conditions that smooth the relationship between CVC investment and firm value. They suggest that understanding those contingencies is vital to extract the greatest strategic benefit for firm value from CVC investment activities, which leads to the fourth hypothesis:

H4: *There is a three-way interaction effect between CVC activity, environmental munificence and operational structure on firm value, that increases most among firms which have a high CVC activity, are operationally concentrated and operate in industries with high environmental munificence.*

3. Data and sample selection

In the following, I provide an overview on how the data extraction and sample selection was conducted. The research focuses on CVC activities in the U.S. as there is enough data accessible. I obtained CVC investment data from Private Equity Screener for a period from 2000-2020.

First, private equity investments are selected in the universe. Subsequently, investments are selected as entity type in order to display all deals of investors, which means that each fund participant from an investment round will be included and the same company may be displayed in multiple observations. Venture capital deals are selected as deal type, and a period from 01.01.2000 to 31.12.2020 is defined as the investment horizon. I choose this investment horizon because I want to ensure that results are not impacted and biased by the internet bubble years of the later 1990s. Subsequently, the investments are limited to the U.S. market.

Afterwards only investments in high technology companies are considered, because firms in high technology industries normally use CVC investments to access innovations and new technologies (Basu et al., 2011). In accordance with prior research conducted by Sahaym et al. (2016) and Vaaler & McNamara (2008) I include only high technology firms[1]. After merging the individual data samples for each high technology industry, the resulting data sample comprises of about 142.000 observations. Subsequently, I adjust the data sample of investments for undisclosed fund names and companies, as no corporate investor can be allocated to those investments, which would result in a biased investment frequency and no accounting and financial data of the corresponding corporate investor can be retrieved. After adjusting the data sample, about 122.000 observations remain.

Next, a categorization is made to find out which investments are conducted by CVCs and which by IVCs. Based on existing compilations of linking corporate venture vehicles to the backing company (Jeong et al., 2020) and extensive research in internet databases like Crunchbase, an overview of corporates and their CVC units is created and a classification into investments backed by CVCs or IVCs is undertaken. A list of all companies and their corresponding CVC investment arm can be found in the Appendix. In case the investment is conducted by a CVC, a value of 1 is assigned. If the investment is instead conducted by an IVC, a value of 0 is assigned.

Finally, the dataset of approximately 122.000 observations is divided into around 113.500 investments of IVC origin and around 8.500 investments of CVC origin. Since this scientific study deals with the impact on and of CVC investment activities at the corporate level, the data set with the remaining 8.500 observations alone is used for further analysis.

[1] SIC 28 (chemicals and allied products), 35 (industrial machinery and computer equipment), 36 (electronics and other electric equipment), 38 (instruments and related products), 48 (communications), and 73 (business services-software)

After adjusting the data to obtain only the relevant investment data, I derive the Ticker[2] of each parent company of the corresponding CVC unit to be able to obtain accounting and market data on the firm. Subsequently, all companies whose market and accounting data cannot be retrieved to construct the variables were sorted out. This includes companies that are not listed on the U.S. stock exchange and are private, which adjusts the data sample to about 6.000 investment observations in the CVC area. I download financial and accounting data from Compustat for the period from 2000 to 2020. If there are missing data for one or more variables, the corresponding observations for firm *i* in year *t* is excluded from the dataset to ensure a complete and consistent dataset. Afterwards the dataset consists of 160 companies and 4.496 investments over a time span of 20 years from 2000 to 2020. Also, after the revision of the dataset a total of 2.678 firm-year observations serve as the basis for my analysis.

The concept of environmental munificence is important for this thesis and requires the construction of a second dataset, as there is limited availability of data to construct this variable. This second dataset is based on the first dataset but only covers the years 2017 to 2020 and thus significantly fewer observations. To construct the dataset, I replicate the procedure as mentioned above. The dataset includes 1.148 investments, 137 companies, and 462 firm-year observations. I use two-digit SIC codes to present the investments according to the domestic industries of the corporate investors, which are all publicly traded companies in the U.S. It can be derived from the table that most investments into high technology industries, are conducted by corporate investors from the same industries. Therefore, I present the number of companies that are domiciled in these six main industries based on a two-digit SIC code level in the table below. It shows that 110 out of 160 companies, present in the data sample, which is equal to 68,75% are domiciled in a high technology industry. To conduct my data analysis, I use the data analytics program Stata V.14 from Stata Corporation.

Table 1

Company Overview by Industry

SIC	**28**	**35**	**36**	**38**	**48**	**73**	**Total**
Investors' number	22	13	19	10	13	33	110

The table presents the distribution of corporate investors across the six main industries. The assignment of the industries is done according to the SIC- code at a two-digit level.

[2] A ticker is the stock symbol of a unique series of letters assigned to a security for trading purposes. Stocks listed on the New York Stock Exchange (NYSE) can have four or fewer letters. Nasdaq-listed securities can have up to five characters (Head et al., 2009).

3.1. Measures

All main variables were restricted to the 1st and 99th percentile, thus removing outliers that would have introduced biases from the dataset and improving data quality.

3.1.1. CVC activity

Given the motivation for the research question and the theoretical framing, CVC activity serves as the dependent variable to test hypothesis 1 and 2 and is used as an independent variable in hypothesis 3 and 4 measuring the impact on firm value. Different approaches are used in research to measure CVC activity. Basu et al. (2011) take the formation of new CVC partnerships and operationalize it as the number of new portfolio firms in which a firm *i* made CVC investments in year *t*. To account for CVC Activity, I follow the approach of Sahaym et al. (2010) who take the aggregate count of corporate venture deals by each investor firm as the measure. According to their methodology and in accordance with Titus & Anderson (2018) I center CVC activity and also the other predictor variables to ease interpretation. Using Datastream Private Equity Screener, I search for all private equity deals and investments in high technology industries (SIC: 28, 35, 36, 38, 48, 73) during the time period from 01.01.2000 to 31.12.2020. For every firm *i* I use the aggregate count of investments in year *t* to measure CVC activity.

3.1.2. Firm value (Tobin's Q)

Tobin's Q is used as a proxy to measure the impact on firm value. It is a ratio that relates the firms market value to the replacement costs of the firm's assets (Titus & Anderson, 2018). I decide to use Tobin's Q instead of other performance metrics due to different reasons. Tobin's Q is based on market instead of accounting data and combines the effect on firms short- and long-term performance in a single variable (Yang et al., 2014). An advantage of the measure is that it not only takes risks into account but also captures long-term prospects, like future expected earnings (Jeong et al., 2020; Lubatkin & Shrieves, 1986; Uotila et al., 2009). Further it is likely to be unaffected from possible reporting twists (Jeong et al., 2020; Lindenberg & Ross, 1981) and also it reduces serial correlation and enhances causal adjacency (Stulz, 1994). Moreover, recent research has demonstrated that Tobin's Q is a valuable instrument, showing a substantial impact of CVC investing on Tobin's Q (Dushnitsky & Lenox, 2006; Jeong et al., 2020). Additionally, the interpretation of Tobin's Q is quite straightforward as a value of 1 indicates that the investors evaluate the market value of the firm to be equal to the value of the firm's assets. Higher values of Tobin's Q signal better market valuations and growth opportunities than those with lower values and a Tobin's Q above 1 signals a positive perspective in the market evaluation for the firm's growth opportunities (Chung & Pruitt, 1994). A ratio below 1 instead indicates that investors assess the companies value to be below the replacement value of the company's assets (Brush et al., 2000). Following the methodology of (Chung & Pruitt, 1994) who developed a simple approximation of Tobin's Q, I compute Tobin's Q as follows:

$$Tobin's\ Q = \frac{Market\ Value\ of\ Equity_{it} + Preferred\ Stock_{it} + \big(Curent\ Assets - (Long - term\ debt + current\ liabilities)\big)_{it}}{Total\ Assets_{it}} = \frac{MVE_{it} + PS_{it} + DEBT_{it}}{A_{it}} \quad (1)$$

The market value of equity (MVE) is computed as the firms closing share price is multiplied with the total common shares outstanding in a given quarter *t*. The Preferred Stock (PS) is calculated by the liquidating value of the firms outstanding preferred stock in a given quarter *t*. To measure DEBT, the differential value of the sum of long-term debt with current liabilities subtracted with current assets was calculated for a given quarter *t*. To measure Total Assets (A), the value of total assets for a given quarter *t* was used. All financial and accounting performance data employed for the calculation of Tobin's Q is extracted from Compustat. Tobin's Q is used as the dependent variable to test for firm value in the hypothesis 3 and 4.

3.1.3. Absorptive capacity

The operationalization of absorptive capacity has proved to be able to measure using various and different indicators. Geroski (2005) use R&D costs, whereas Cohen and Levinthal (1990) use R&D intensity to measure the absorptive capacity and Mowery et al. (1996) use firm size instead. Zahra & George (2002) create potential and realized absorptive capacity as two new components of the established concept with four dimensions. They measure realized absorptive capacity as the number of patents held at the time of an IPO and the potential absorptive capacity is measured as the amount of development costs to IPO (Geroski, 2005). Aligned with the literature, I measure absorptive capacity according to Cohen & Levinthal (1990) and use R&D intensity. The data for this study is obtained from Compustat.

$$R\&D\ intensity = \frac{R\&D\ expenditures}{Sales} \quad (2)$$

3.1.4. Environmental munificence

To measure environmental munificence, many researchers use continuous variables such as total employment, price-cost margin, industry growth rate or industry sales (Park & Mezias, 2005). In this study, I use growth of sales to operationalize the presence of munificence in industry environments. Following the methodology of Keats & Hitt (1988), I acquire industry sales from Compustat. I use five-year average growth in net sales during the relevant time period for each industry. Afterwards, I enter the natural logarithm of the annual figures across all firms in each relevant industry into a time-series-regression with time being the independent variable. To capture the growth rate of industry sales to demonstrate the presence of munificence in each industry environment, the antilogs of the resulting regression slope coefficient are used (Keats & Hitt, 1988; Sahaym et al., 2010).

$$y_t = \alpha_0 + \alpha_1 * \mathrm{t} + \varepsilon_t \mathrm{x} \quad (3)$$

Environmental munificence is used as an independent variable to test hypothesis 2 and 4. Thus, I try to determine if it affects the CVC investment activity and firm value. The interest in whether the degree of environmental munificence strengthens CVC activities in different industries gives insights into the impact general industry specific parameters which are firm independent - have on the pursuit of CVC activities. Further, the concept of environmental munificence is used to estimate firm value as a main effect and as part of two- and three-way interaction terms with CVC activity and operational structure.

3.1.5. Operational structure

To measure operational structure, I use the aggregate number of 2-digit SIC codes in which firm i is conducting business in, to operationalize the variable (Hashai, 2015; Lichtenberg, 1992; Liebeskind & Opler, 1992). I retrieve the data from Compustat. Consequently, higher values reflect a more scattered operational structure, whereas lower values indicate an operational concentration on fewer business segments. Operationally diversified firms have acquired knowledge and business structures in different segments, which might impact their CVC investments opportunities and affect firm value. The methodology I use differs from the approach used by Titus & Anderson (2018), who take reported business segment sales as the basis and where higher values indicate higher concentration of the firm’s operations, while lower values reflect a diffuse operational structure. Operational Structure is used as an independent variable in hypothesis 4.

3.1.6. Control variables

The study controls for several firm- and industry-level variables to mitigate specific effects inside firms and industries. This information is retrieved from Compustat.

In detail, I use *firm size*, *firm slack, firm age, firm growth, firm liquidity, firm leverage, diversification, ROA, absorptive capacity and Industry Q* as controls in the analysis.

Firm size (size) is measured using the natural logarithm of annual net sales of each company in the focal period and accounts for size effects as an antecedent to firm performance. Also, by including to control for firm size, size effects due to firms' scope and scale on external venturing activities are parsed out. The Behavioral Theory of the Firm suggests that *firm slack* improves the stability and adaptability of a firm, hence it has a positive influence on firm performance and value (Miner, 2006). Also, an environment with high slack is beneficial for innovation, whereas firms with low slack tend to be more cautious (Sahaym et al., 2010). Therefore, it is also controlled for *slack,* which is measured as a firms debt-to-equity ratio according to (Bromiley, 1991; Luger, 2014). I also control for *firm age* (age), as the age may influence firm performance and their CVC activity both negatively or positively (Hannan & Freeman, 1984; Jeong et al., 2020). Older companies might be hesitant to pursue innovation as inertia might hinder these companies to explore new ventures (Zahra, 1991; Zahra & Hayton, 2008). Based on these possibly contradictory effects, it is controlled for *age*. Data for *age* is obtained from Compustat, using the first firm-year with non-missing annual closing price of the fiscal year (prcc_f) as the year of 'birth', meaning the IPO-year. I then subtract the IPO-year from the respective year of the period (2000-2020) to calculate the corresponding age. Furthermore, I control for *firm growth* (growth) as the growth can influence Tobin's Q as well as a the firms CVC activity (Dushnitsky & Lenox, 2006). *Growth* is measured by calculating the growth in return on sales (ROS). To calculate ROS, I divide annual operating income after depreciation by net sales. I then compute the growth rate of the annual returns.

Moreover, I control for *firm liquidity*, measured as the firm's current ratio meaning the firms current assets to current liabilities, which is an indicator of excess and uncommitted resources (Basu et al., 2011). Firms with greater liquidity can allocate resources to CVC activities without the necessity to make internal compromises (Dushnitsky & Lenox, 2005a). *Firm leverage* is measured as the firm's total debt to total assets (Hoskisson et al., 2002). Firms using high amounts of leverage may not have the resources or are more hesitant in pursuing CVC activities as they might be financially constrained with interest and principal repayments (Zahra, 1991). To account for industry factors, I introduce *Industry Q* into the model following the methodology of Dushnitsky & Lenox (2006) and Titus & Anderson (2018), who use the mean level of Tobin's Q for each industry.

According to the literature, I apply the concept used to measure a technological fit between the investor and entrepreneurial venture, to implement the variable called *diversification of CVC investments (diversification)*. A technological fit occurs if a corporate investor and an entrepreneurial venture have a match "when both the CVCs parent firm and the entrepreneurial firm are in the same 2-digit SIC or 3-digit SIC code" (Robinson, 2008). Robinson (2008) operationalize technological fit as a dummy variable that equals 1, if the corporate investor and the entrepreneurial firm are in the same 2-digit SIC code and 0, if else. I apply this concept to the *diversification* variable, which is equal to 1, if the corporate investor at least conducts one investment into an entrepreneurial venture that is not in the same 2-digit SIC code per year and 0, if else. I use Compustat to retrieve the SIC codes of the corporate investors and Thomson Reuters Private Equity Screener to obtain the related SIC code of the investment that is conducted into the entrepreneurial venture. I also include *industry dummies* based on two-digit SIC codes to control for industry variation in financial performance and CVC activity. The sample of companies consists of 25 different industries that the industry dummies are differentiating. At last, I also include *year dummies* for each year to control for time-varying sources of unobserved heterogeneity at the firm level.

4. Methodology

My analysis is divided into two main parts. As a first step I test the influence of different variables on CVC activity, especially the concept of absorptive capacity, which is a firm-specific capability, and environmental munificence, which is measured at the industry level. In the next step, I test the effect of CVC activity, absorptive capacity, environmental munificence and operational structure on firm value in two different regressions. I also test whether there is an interaction effect, between CVC investments, environmental munificence and operational structure on parent firm value.

In the regressions, I control for several firm-specific characteristics, including industry dummies and for changing economic conditions over time using year-fixed effects. The Durbin-Wu-Hausman test statistic suggests a correlation between the unobserved firm fixed effects and the explanatory variables for all four regressions. Therefore, the random effect estimator will cause inconsistent results. The implementation of fixed-effects models to obtain consistent coefficient estimates from the given data is more appropriate in this context. For that reason, industry dummy variables are added to the regressions to control the influence within each industry. In the models, fixed-effect estimations are applied to avoid endogeneity and omitted variables concerns, relying on the eventual correlation between the fixed, unobservable part of the error term and some explanatory variables (Prior et al., 2008).

4.1. The impact on CVC activity

The aim of the work is to investigate the influence of different variables on CVC activity. First, the relationship of absorptive capacity and operational structure on CVC activity will be investigated and to account for hypothesis 1, the following relationship was tested:

$$CVC_{it} = \beta_0 + \beta_1 AC_{it} + \beta_2 OS_{it} + \beta_3 (AC * OS)_{it} + \beta_4 Lev_{it} + \beta_5 Size_{it} + \beta_6 Slack_{it} + \beta_7 Age_{it} + \beta_8 Liquidity_{it} + \beta_9 RoA_{it} + \beta_{10} Growth_{it} + \gamma_1 Industry_{it} + \gamma_2 Year_{it} + \varepsilon_{it} \quad (4)$$

Hypothesis 1 can be confirmed if the coefficient of β_1 is a significant and positive value. Also, if the coefficient β_2 is significant which measures the main effect of operational structure on CVC activity, we can state that there is relationship between operational structure and CVC activity. Furthermore, β_3 measures the interaction effect between absorptive capacity and operational structure.

Besides measuring the impact of absorptive capacity and operational structure on CVC activity, the concept of environmental munificence is implemented to account for industry specific competitive intensity and how it relates to the quantity of CVC investments conducted. In addition, I include an interaction term between environmental munificence and absorptive capacity and additional control variables are examined to verify the interaction between CVC activity and environmental munificence. The relationship to account for hypothesis 2 is tested as follows:

$$CVC_{it} = \beta_0 + \beta_1 EM_{it} + \beta_2 AC_{it} + \beta_3 (EM * AC)_{it} + \beta_4 Leverage_{it} + \beta_5 Size_{it} + +\beta_6 Slack_{it} + \beta_7 Age_{it} + \beta_8 Liquidity_{it} + \beta_9 RoA_{it} + \beta_{10} Industry\ Q_{it} + \gamma_1 Industry_{it} + \gamma_2 Year_{it} + \varepsilon_{it} \quad (5)$$

To test hypothesis 2, whether environmental munificence influences CVC activity, an ordinary least square regression (OLS) was conducted. Hypothesis 2 predicts that the coefficient β_1 should be positive and statistically significant.

4.2. The impact on firm value

After observing the impact of absorptive capacity, environmental munificence and operational structure on CVC activity, I focus on the impact of these variables and CVC activity on firm value. In order to do so, I create two regression models. The first model evaluates the impact of CVC activity and absorptive capacity on firm value to test for hypothesis 3 and is constructed as follows:

$$\begin{aligned} TQ_{it} = \beta_0 + \beta_1 CVC + \beta_2 AC + \beta_3 \mathrm{ROA} + \beta_4 Size_{it} + \beta_5 Age_{it} + \beta_6 Leverage_{it} \\ + \beta_7 Growth_{it} + \beta_8 Slack_{it} + \beta_9 Liquidity_{it} + \beta_{10} DIV_{it} + \gamma_1 Industry_{it} \\ + \gamma_2 Year_{it} + \varepsilon_{it} \end{aligned} \tag{6}$$

The second regression model measures the impact of CVC activity, environmental munificence and operational structure on firm value including two- and three-way interaction terms between the explanatory variables to test for hypothesis 4. To construct this model I replicate the methodology of Titus & Anderson (2018) as an estimation approach.

$$\begin{aligned} TQ_{it} = \beta_0 + \beta_1 CVC + \beta_2 EM + \beta_3 OS + \beta_4 (CVC * EM)_{it} + \beta_5 (CVC * OS)_{it} \\ + \beta_6 (EM * OS)_{it} + \beta_7 (CVC * EM * OS)_{it} + \beta_8 \mathrm{ROA} + \beta_9 Size_{it} + \beta_{10} AC_{it} \\ + \beta_{11} Leverage_{it} + \beta_{12} Growth_{it} + \beta_{13} Slack_{it} \\ + \beta_{14} Liquidity_{it} + \beta_{15} Industry\ Q_{it} + \gamma_1 Industry_{it} + \gamma_2 Year_{it} + \varepsilon_{it} \end{aligned} \tag{7}$$

I use time-series cross-sectional models to predict for firm value *i* at time *t*. In equation 6, I solely test the impact of CVC activity and absorptive capacity on firm value using a dataset from 2000 to 2020. In equation 7, I use a three-way interaction model with CVC activity, environmental munificence and operational structure as dependent variables and include all possible lower order interactions to test for the impact on firm value using a sample from 2017-2020.

5. Results

5.1. Descriptive statistics

Table 2 reports the descriptive statistics for the CVC data (panel A), explanatory variables (panel B), and control variables (panel C). The mean of CVC activity is 1.6789.

As expected, the mean value of CVC activity is closer to zero, but the standard deviation of ±5.0520 indicates that there is a wide variation of the amount of CVC activities in which companies engage in. For Tobin's Q the mean value is 3.1649, which means that on average the market valuation of the sample companies is more than three times higher than their intrinsic value with a standard deviation of ±1.7351. The absorptive capacities' mean account at 0.0934 with a standard deviation of ± 0.1639. For operational structure which measures the aggregate count of business segments at a 2-digit SIC-code level where the company operates in the mean is 2.6217 with a standard deviation of ±1.6997. In the sub sample, I find that environmental munificence has a mean of 1.0647 and a low variation of ±0.1554. The mean score of diversifications is 0.2939 and signals that the sample companies tend to invest within their own industry rather than breaking industry boundaries (SD: ±0.4556).

In total, the results indicate that, on average, firms are committed towards CVC investment activities and receive market valuations that are multiples above their intrinsic values. Financial and accounting data suggests that companies on average are not highly levered with a mean of 0.2018 and a standard deviation ±0.1612 and obtain positive returns with a mean of 0.0509 and a standard deviation of ±0.1239.

Table 2

Descriptive statistics

Variable	Mean	SD	Min	Max	N
Panel A:					
CVC Activity	1.6789	5.0520	0	66	2678
Tobin's Q	3.1649	1.7351	0.9507	15.952	2678
Panel B:					
Absorptive Capacity	0.0934	0.1639	0	3.1688	2678
Operational Structure	2.6217	1.6997	1	8	2678
Environmental Munificence*	1.0647	0.1554	0.5455	1.8610	462
Panel C: Control variables					
ROA	0.0509	0.1239	-2.2318	0.4612	2678
Leverage	0.2018	0.1612	0	1.0495	2678
Size	26287.8	38443.9	9	386064	2678
Slack	0.7720	1.7448	-9.4501	22.5169	2678
Liquidity	2.0596	1.7741	0	27.3924	2678
Age	29.1396	16.4847	1	70	2678
Growth	-0.0321	0.4119	-2.0247	1.8198	2678
Diversification	0.2939	0.4556	0	1	2678

This table reports the main descriptive statistics on the two dependent variables, (Panel A), explanatory variables (Panel B) and the control variables (Panel C) for 2000-2020. Variables marked (*) are reported for an in-sample period from 2017-2020. The table includes only non-industry-adjusted, non-standardized or non-transformed measures.

5.2. Correlation results

Table 3 provides the Pearson correlation matrix for the dependent variables (panel A), the explanatory variables (panel B), and the control variables (panel C) for the data frame from 2000 to 2020. Table 10 in the Appendix provides the correlation overview for the variables used in the dataset for the time frame from 2017 to 2020. As expected, CVC activity is positively linked to firm value, measured as Tobin's Q. Furthermore, the absorptive capacity is positively correlated to CVC activity (0.0567) and to firm value (0.2949). Therefore, correlation coefficients suggest that firms with greater CVC activity and bigger absorptive capacity have a higher firm value. Also, ROA shows a positive association towards CVC activity (0.0563), which is lower and to Tobin's Q (0.2674). The results state that leverage is negatively correlated to both CVC activity (-0.0712) and to Tobin's Q (-0.2249), which indicates that higher levered companies tend to have a lower firm value and conduct less CVC investment activities.

Furthermore, the correlation coefficients show that firm size is negatively connected to firm value (-0.2394) and positively to CVC activity (0.1993). This result suggests that smaller firms tend to be less valuable than bigger ones, but that firms of smaller size tend to conduct more CVC activities. Interestingly, slack resources that have been expected to foster CVC activity are negatively correlated to CVC investing activity (-0.0421) and firm value (-0.2070) as well. Also, liquidity is positively correlated to CVC activity (0.0203) and Tobin's Q (0.4045) which shows that companies with higher liquidity have a larger level of CVC activity and receive a higher firm valuation. Furthermore, a low positive relationship is observed between growth and CVC activity (0.0096) and Tobin's Q (0.0271), which indicates that growing firms tend to have higher CVC investing activities and firm valuations. For firm age, a contrasting relationship could be observed as there is a negative relationship between age and firm value (-0.2351) and a positive relationship between age and CVC activity (0.0137), indicating that older firms are conducting higher amounts of CVC investing activities.

It is noticeable that environmental munificence is slightly positively correlated (0.0797) with firm value, while operational structure is negatively correlated (-0.2646). Looking at the interaction variables, only the interaction of EM*OS has a slight negative correlation (-0.1310) with TQ, while the other interactions (CVC*EM: 0.0970; CVC*OS: 0.0535; CVC*EM*OS: 0.0253) have a slight positive correlation with firm value.

Table 3

Correlation table

	1	2	3	4	5	6	7	8	9	10	11	12
1. CVC	1.0000											
2. TQ	0.1092	1.0000										
3. AC	0.0567	0.2949	1.0000									
4. OS	-0.0177	-0.0141	-0.0178	1.0000								
5. RoA	0.0563	0.2674	-0.1781	-0.0079	1.0000							
6. Lev	-0.0712	-0.2249	-0.0481	-0.1236	-0.0693	1.0000						
7. Size	0.1993	-0.2394	-0.3816	-0.0458	0.2407	0.1215	1.0000					
8. Slack	-0.0421	-0.2070	-0.1255	-0.0548	-0.0195	0.4114	0.1326	1.0000				
9. Liq	0.0203	0.4045	0.3024	-0.0184	0.0685	-0.1902	-0.4331	-0.1484	1.0000			
10. Age	0.0137	-0.2351	-0.1745	-0.0072	0.1189	0.1904	0.4160	0.1205	-0.2076	1.0000		
11. GRO	0.0096	0.0271	-0.0608	-0.0010	0.1107	-0.0505	0.0412	0.0162	0.0001	0.0433	1.0000	
12. DIV	0.3351	0.0045	0.0608	-0.0219	0.0080	0.0021	0.1201	-0.0506	0.0099	0.0077	0.0242	1.0000

This table reports the main descriptive statistics for the dependent variables, explanatory variables and control variables for 2000-2020. All variables are defined in Table 8. The table includes only nonindustry-adjusted, standardized, or transformed measures. N = 2648; Number of firms: 160

5.3. Regression results

5.3.1. Impact of absorptive capacity and operational structure on CVC activity

Table 4 presents the multivariate regression results of absorptive capacity and operational structure as a function of CVC activity. In model 1 of Table 4, I enter the control variables. In model 2, I enter the main effects of absorptive capacity and operational structure on CVC activity and in model 3, I include an interaction term between both. The addition of the independent variables enhances the proportion of the variance that is predictable from the model. Hypothesis 1 proposes that absorptive capacity enhances CVC activity. The coefficient of absorptive capacity is positively related to CVC activity in model 2 ($\beta = 3.082$, $p < 0.01$) at a significance level of 1% and in model 3 ($\beta = 2.745$, $p < 0.01$) at a significance level of 1%. Therefore, hypothesis 1 is supported which is also consistent with prior research (Basu et al., 2011; Dushnitsky & Lenox, 2005a; Sahaym et al., 2010).

The positive relationship of absorptive capacity with CVC activity indicates that corporate investors who possess greater absorptive capacity are likely to enter into a greater extent of CVC investments. This might be due to their greater ability to explore and exploit knowledge from the same CVC investment activities (Dushnitsky & Lenox, 2005a). My results support the assumption that there is a complementary relationship between absorptive capacity and CVC activity (Sahaym et al., 2010). Instead, further analysis indicates a negative and insignificant relationship between operational structure and CVC activity in model 2 ($\beta = -0.031$, $p > 0.1$) as well as in model 3 ($\beta = -0.351$, $p > 0.1$).

My findings support the suggestion that the operational structure of a firm does not explain its CVC investment frequency due to insignificant results. Also, the interaction between absorptive capacity and operational structure on CVC activity is observed in the third model. I obtain a negative, yet insignificant relationship for the interaction term ($\beta = -0.718$, $p > 0.1$) and the main effect of operational structure ($\beta = -0.351$, $p > 0.1$). As stated above, the coefficient of absorptive capacity remains to be significantly positive at a significance level of 1%. Due to the insignificance of the interaction term the interpretation is quite straightforward. I cannot contend that the influence of operational structure on CVC activity is enhanced when the levels of absorptive capacity are high nor when they are low. Having high absorptive capacity, a company should be in the position to seek out innovations from other industries and sectors externally to absorb, internalize and utilize them. Also, firms with a diverse operational structure that operate in different business segments could have gained access to more entrepreneurial initiatives due to their business scope, resulting in increasing CVC activity. Therefore, to investigate this relationship the interaction term between both was introduced into the model. Clearly, this suggestion cannot be supported due to results presented.

The results follow the theoretical framework of absorptive capacity and operational structure that were discussed in section 2.2 and implied that the extent of absorptive capacity of a firm has a positive influence on the amount of CVC activities it performs, whereas the same cannot be concluded for operational structure.

The results highlight that firms with greater absorptive capacity display greater efforts towards pursuing innovations using CVC. I therefore argue that a company's absorptive capacity provides the basis for conducting investments in many and diverse entrepreneurial ventures to get hold on new technologies as an option for future growth. In accordance with Sahaym et al. (2010) I argue that the relationship between CVC activity and absorptive capacity is complementary. I also contend that the operational structure of a firm generally does not explain the motivation of a firm to conduct CVC investments. The operational structure of a firm explains the variety of business segments the company operates in. The results show that operational structure does not have a direct, linear influence on the use of CVC investments and it also does not have an influence as a moderator of absorptive capacity on CVC activity. It cannot be stated that diffuse companies conduct more CVC investments compared to companies who have a concentrated structure. Diversification of operations could have had an influence on CVC activity as the need for innovations and expertise in different and various industries could lead to an increase in investment activity. On the other hand, being an expert in multiple industries could decrease the need for CVC investment activity as ideas and knowledge can be applied to new contexts internally to create innovations. Instead, results show that indeed operational structure cannot explain CVC activity and that other variables - like absorptive capacity - are better suited to explain the phenomenon of CVC investment activities.

Among the control variables, I find that particularly two variables, size and liquidity, are significantly positive and leverage significantly negative associated with CVC activity across all models. Focusing solely on the impact of the control variables on CVC activity as presented in model 1 I find leverage, ROA and age being significantly negative related to CVC activity and size and liquidity significantly positive connected to CVC activity. Overall, this study supports the underlying idea of absorptive capacity being the foundation for exploring new competencies using CVC investments (Sahaym et al., 2010). The relationship between absorptive capacity and CVC activity indicates that companies with a high level of R&D are more likely to engage in higher levels of CVC activity. In contrast the operational structure is not significant related to CVC activity and results show that there is neither an influence of operational structure on CVC activity when levels of absorptive capacity are high nor when they are low.

Table 4

Effect of AC on CVC activity

	Model 1		**Model 2**		**Model 3**	
CVC	ß	S. E	ß	S. E	ß	S. E
Absorptive Capacity			3.082***	0.674	2.745***	0.738
			(0.000)		(0.000)	
Operational Structure			-0.031	0.599	-0.351	0.600
			(0.603)		(0.560)	
AC*OS					-0.718	0.642
					(0.263)	
Control Variables						
Leverage	-3.367***	0.771	-3.455***	0.770	-3.462***	0.770
	(0.000)		(0.000)		(0.000)	
Size	1.171***	0.077	1.242***	0.786	1.242***	0.769
	(0.000)		(0.000)		(0.000)	
Slack	-0.069	0.061	-0.049	0.061	-0.046	0.061
	(0.259)		(0.422)		(0.452)	
Age	-0.018**	0.018	-0.015*	0.008	-0.046*	0.008
	(0.025)		(0.057)		(0.053)	
Liquidity	0.242***	0.065	0.211***	0.065	0.213***	0.065
	(0.000)		(0.001)		(0.001)	
ROA	-1.826**	0.832	-1.210	0.840	-1.161	0.841
	(0.028)		(0.150)		(0.167)	
Growth	-0.003	0.066	0.006	0.066	0.004	0.066
	(0.966)		(0.929)		(0.947)	
Constant	1.980**	0.918	2.121**	0.916	2.121**	0.916
	(0.031)		(0.021)		(0.021)	
Observations	2648		2648		2648	
Adjusted R^2	0.1287		0.1351		0.1352	
R^2	0.1468		0.1537		0.1541	
Industry Dummies	Yes		Yes		Yes	
Year Dummies	Yes		Yes		Yes	

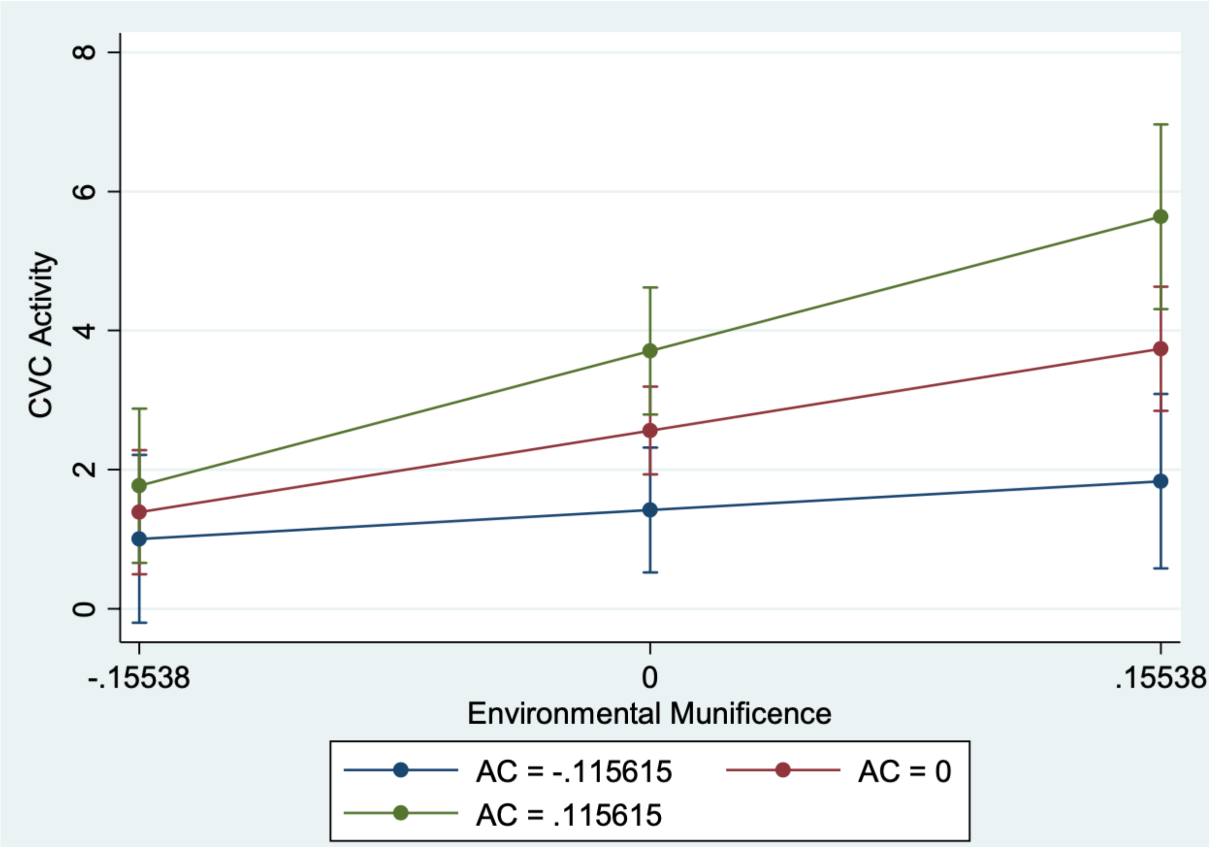
*This table presents results from fixed effects regressions of AC, OS and control variables on the CVC from 2000-2020 with year and industry dummies for the whole sample. Model 1 just includes the control variables. Model 2 presents the main effects of AC and OS on CVC activity. Model 3 tests the full research model that is specified in equation (3). CVC activity is estimated by year and industry. The p-values are given in brackets and are two-tailed. The symbols ***, **, and * represent the significance level at the 1%, 5% and 10%, respectively.*

5.3.2. Impact of absorptive capacity and environmental munificence on CVC activity

This section presents the multivariate regression results of absorptive capacity and environmental munificence as a function of CVC activity for a constrained data sample from 2017 to 2020. The empirical evidence reflecting the role of environmental munificence in the relationship between absorptive capacity and CVC activity is shown in Table 11. The results in column 1 show that the coefficient for absorptive capacity is positive and significant ($\beta = 6.788$, $p < 0.05$) towards CVC activity, providing in sample robustness check towards the results presented in the chapter above. Hypothesis 1 holds.

I introduce environmental munificence into the model and find that the variable is not suitable to contribute to an explanation of CVC, since I obtain a negative coefficient but insignificant results ($\beta = -0.612$, $p > 0.1$). Hypothesis 2 cannot be supported. Interestingly, Sahaym et al. (2010) have come to a similar, insignificant result regarding the relationship between environmental munificence and CVC - but with a slightly positive coefficient. It can therefore neither be said that higher levels of environmental munificence lead to higher levels of CVC activity nor that CVC activity will be higher when levels of environmental munificence will be lower. I further include an interaction term between absorptive capacity and environmental munificence into the model. The purpose of this interaction variable is to gain knowledge about the question if the influence of absorptive capacity on CVC investment activity is strengthened or weakened by the level of environmental munificence. The coefficient of the interaction term is positive at a significance level of 5% ($\beta = 32.507$, $p < 0.05$). This result supports the assumption that the influence of absorptive capacity on CVC activity is stronger in industries where the levels of environmental munificence are high. Also, this result is supported by the findings of Sahaym et al. (2010) who find that the relationship between R&D intensity (absorptive capacity) and CVC investments is more strongly positive when levels of environmental munificence are high than otherwise.

Figure 1: Interaction of absorptive capacity and environmental munificence on CVC activity (linear adjusted predictions with 95% CIs)



Plotting the relationship of absorptive capacity and environmental munificence on CVC activity in Figure 1 with a range of values between ±1 standard deviation of environmental munificence and absorptive capacity shows a distinct improvement in CVC activity. Turning the attention towards the control variables, I find that size and liquidity are significantly positively related to CVC activity. In contrast, two variables, age and ROA are significantly negatively associated with CVC activity. The results state that CVC activity increases with liquidity and size. Furthermore, results indicate that CVC activity is significantly lower for younger firms ($\beta = -0.042$; $p < 0.1$), and companies with higher ROA.

To conclude, I find similarities to the results of Sahaym et al. (2010) in the relationship and interplay of absorptive capacity and environmental munificence on CVC activity. Absorptive capacity increases CVC activity and for the main effect of environmental munificence I cannot find significance. Regarding the role of the relationship between environmental munificence and absorptive capacity on CVC Activity, I also find a similar outcome and conclude that it shows a positive and significant impact.

5.3.3. The effect of CVC activity and absorptive capacity on firm value

In this section, I shift the focus from looking at the impact on CVC investment activities to the effect of different parameters on firm value, as measured by Tobin's Q. In a first consideration, I turn to the effects of absorptive capacity and CVC on TQ over a period from 2000 to 2020. In Table 5, I present the results of the multivariate regression. Hypothesis 3 proposes that higher CVC Activity positively influences firm value. The results presented in Model 2 of Table 6 show that the coefficient for CVC Activity is slightly positive and significant ($\beta = 0.017$; $p < 0.05$) at a 5% significance level. Therefore, hypothesis 3 is supported, which stands in contrast to the findings of Titus & Anderson (2018) who do not find support for a main effect of CVC investment activity on parent firm value. Also, the effect of absorptive capacity on firm value was observed. I obtain a positive and significant relationship for the main effect of absorptive capacity ($\beta = 1.756$, $p > 00.1$) on firm value at a 1% significance level.
This study presents evidence that a firms CVC investment activity into entrepreneurial ventures has a small positive and significant impact on the firms Tobin's Q. This implies that CVC is associated with firm's value creation. My findings support the results of Dushnitsky & Lenox (2006) who find that firms which pursue CVC activities experience more value creation and that greater CVC investment increases firm value. In addition, absorptive capacity also has a significant positive impact on firm value. It can therefore be concluded that a high level of receptiveness and willingness to embrace new technologies and innovations and to search for them externally through CVC activities has a positive and significant influence on company value. However, the motives for this and the underlying contexts are not part of this analysis. Nonetheless, one could assume, and thus follow the understanding of Dushnitsky & Lenox (2006) that in particular the strategic motives that companies pursue with the implementation of CVC activities are decisive for this.

Regarding the control variables, I find that four variables, leverage, slack, age and diversification, are significantly negative associated towards firm value across all models. Contrasting, I receive significantly positive relationships for liquidity and ROA with firm value, which indicates that firm value increases with higher liquidity ($\beta = 0.243$; $p < 0.01$) and better financial performance ($\beta = 3.773$; $p < 0.01$). Instead, results indicate that firm value decreases if leverage ($\beta = -1.428$; $p < 0.01$) and diversification ($\beta = -0.139$; $p < 0.05$) increase.

Table 5

Effect of CVC activity and AC on firm value

	Model 1		Model 2	
TQ	ß	S. E	ß	S. E
CVC Activity			0.017***	0.006
			(0.003)	
Absorptive Capacity			1.756***	0.183
			(0.000)	
Control Variables				
Leverage	-1.453***	0.212	-1.428***	0.209
	(0.000)		(0.000)	
Size	0.043**	0.022	-0.015	0.022
	(0.047)		(0.494)	
Slack	-0.094***	0.017	-0.083***	0.017
	(0.000)		(0.000)	
Growth	-0.003	0.018	0.003	0.018
	(0.860)		(0.876)	
Age	-0.009***	0.002	-0.007***	0.002
	(0.000)		(0.001)	
Liquidity	0.263***	0.018	0.243***	0.018
	(0.000)		(0.000)	
ROA	3.408***	0.229	3.773***	0.227
	(0.000)		(0.000)	
DIV	-0.049	0.059	-0.139**	0.060
	(0.399)		(0.021)	
Constant	3.645***	0.253	3.769***	0.249
	(0.000)		(0.000)	
Observations	2648		2648	
Adjusted R^2	0.4354		0.4572	
R^2	0.4474		0.4691	
Industry Dummies	Yes		Yes	
Year Dummies	Yes		Yes	

*This table presents results from fixed effects regressions of AC and CVC activity proxies and control variables on firm value for 2000-2020 with year and industry dummies for the whole sample. Model 1 only includes the control variables on Tobin's Q. Model 2 measures the effects of AC and CVC on TQ. The p values are given in brackets and are two-tailed. The symbols ***, ** and * represent the significance level at the 1%, 5%, and 10%, respectively.*

5.3.4. The effect of CVC activity, environmental munificence and operational structure on firm value

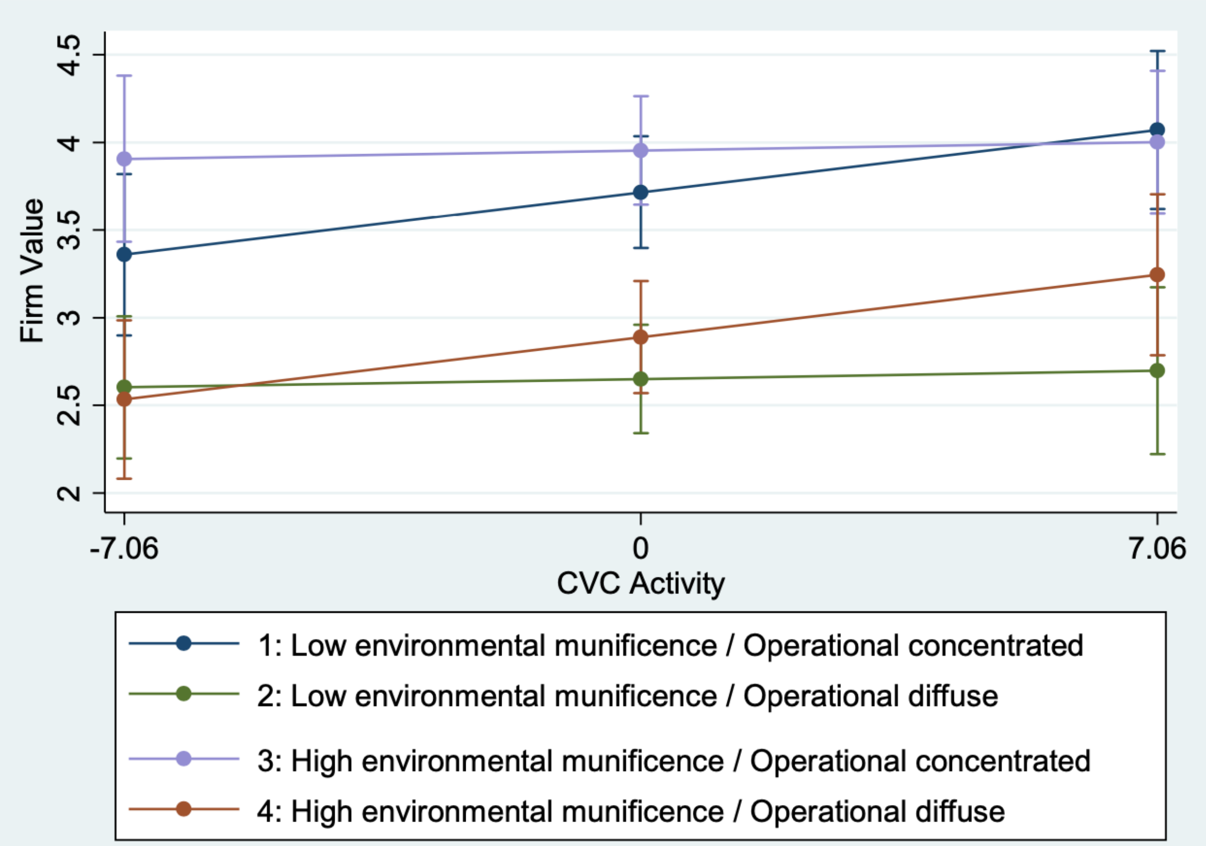
Lastly, I extend the above regression model by including two further independent variables that have already been discussed previously – environmental munificence and operational structure. The inclusion of new variables leads to a narrowing of the data and concerns a period from 2017 to 2020. I present the results in Table 6, model 1 contains only the effect of the control variables on firm value. Model 2 contains the two-way interactions between the explanatory variables and in Model 3, I test the full research model that was specified in equation 7, also including the three-way interaction term between CVC, environmental munificence and operational structure. The addition of the independent variables and interaction terms enhances the proportion of the variance that is predictable from model 1 to 3. In Hypothesis 3, I suggest that CVC activity increases firm value. Results presented in Chapter 5.3.3. show that this hypothesis can be supported. Regression results shown in Table 6 provide further evidence for this finding, as the coefficient of CVC activity on firm value is significantly positive in model 2 ($\beta = 0.049$; $p < 0.05$) and in model 3 ($\beta = 0.038$; $p < 0.05$), both at a 5% significance level.

In model 2, I observe the impact of the two-way interaction terms between CVC activity, environmental munificence and operational structure on firm value. I find a significantly negative interaction of CVC and environmental munificence ($\beta = -0.267$, $p < 0.05$) and of CVC and OS ($\beta = -0.017$, $p < 0.05$) in the relationship with firm value at a 5% significance level. Also, both interaction terms are still significant in model 3. The negative coefficient for the interaction between CVC activity and environmental munificence suggests that decreasing environmental munificence strengthens the relationship between CVC activity and firm value. This result supports the finding of Titus & Anderson (2018), who observe a significant decrease in firm value when firms conduct CVC investments in industries with high environmental munificence. Also, the negative coefficient for the interaction term between CVC activity and operational structure suggests that firm value decreases when operationally diversified firms make CVC investments. Although using a different approach to measure operational structure, I present further evidence for the findings of Titus & Anderson (2018) who conclude that parent firm value increases when operationally concentrated firms make CVC investments. My results contribute to looking at the opposing relationship. While Titus & Anderson (2018) find that parent firm value increases when operationally concentrated firms make CVC investments, my results illustrate that in fact the converse is also of significance. Indeed, I find that firm value decreases when firms with a diffuse operational structure engage in CVC activity – not looking at other contingencies.

My results suggest that CVC activity among companies that are operationally diffuse does not materialize firm valuation. In addition, firms that are pursuing CVC activities are receiving negative valuation gains when they operate in industries of high environmental munificence. In hypothesis 4, I propose that there is a three-way interaction effect between CVC activity, environmental munificence and operational structure on firm value, which increases most among firms that have a high CVC activity, are operationally not diffuse and operate in industries with high environmental munificence. Model 3 includes the three-way interaction term for which I find a significantly positive coefficient ($\beta = 0.224$, $p < 0.05$) at a 5% significance level.

Due to the complexity of interpreting three-way interaction effects from the coefficient alone, I plotted the relationship between the variables in Figure 2. The results show the relationship between firm value and CVC activity at different combinations of CVC activity, operational structure and environmental munificence. I observe an increase in value among firms making CVC investments that are operationally diffuse and operate in high munificent environments. Also, I find that firm value increases for companies making CVC investments that are operationally concentrated and are domiciled in industries with low munificent environments. Therefore, I do not find support for the three-way interaction as proposed in hypothesis 4.

Figure 2. The joint influence of CVC activity, operational structure and environmental munificence on firm value (Adjusted Predictions with 95% CIs)



With regard to the control variables I find three variables to be consistently positive and significant at a 1% significance level and one variable to be consistently negative and significant across all four models. In the fourth model, I find that ROA ($\beta = 8.604$; $p < 0.01$), absorptive capacity ($\beta = 7.570$; $p < 0.01$) and liquidity ($\beta = 0.200$; $p < 0.01$) increase firm value. Instead, I observe a significantly negative relationship of size ($\beta = 0.147$; $p < 0.05$) with Tobin's Q at a 5% significance level, which indicates that firm value slightly decreases if size increases.

Overall, it can be stated that CVC activities for companies that are operationally diffuse and operate in industries with low environmental munificence and for firms with a concentrated operational structure in high munificent environments are related to increases in firm value. I suggest that firms that are making CVC investments should always consider their investments with regard to their structure and their industry environment, as they might experience opposite effects than originally intended on firm value.

Table 6

Effect of CVC Activity, EM and OS on Firm Value

TQ	Model 1 ß	Model 1 S. E	Model 2 ß	Model 2 S. E	Model 3 ß	Model 3 S. E
CVC Activity			0.049***	0.016	0.038**	0.016
			(0.003)		(0.019)	
Environmental Munificence			-1.094	1.056	-0.729	1.052
			(0.301)		(0.489)	
Operational Structure			-0.073	0.053	-0.115**	0.054
			(0.169)		(0.034)	
CVC*EM			-0.267**	0.089	-0.196**	0.091
			(0.003)		(0.032)	
CVC*OS			-0.017*	0.009	-0.042***	0.012
			(0.063)		(0.001)	
EM*OS			-0.247	0.305	0.118	0.324
			(0.418)		(0.715)	
CVC*EM*OS					0.224***	0.071
					(0.002)	
Control Variables						
Size	-0.178***	0.056	-0.188***	0.062	-0.147**	0.062
	(0.001)		(0.003)		(0.017)	
ROA	7.264***	0.740	8.067***	0.798	8.604***	0.808
	(0.004)		(0.000)		(0.000)	
AC	7.493***	0.672	7.367***	0.690	7.570***	0.686
	(0.000)		(0.000)		(0.000)	
Leverage	-0.725	1.162	-0.829	1.151	-0.878	1.139
	(0.533)		(0.472)		(0.441)	
Growth	0.059*	0.249	0.044	0.052	0.040	0.051
	(0.051)		(0.386)		(0.430)	
Slack	0.580	1.162	0.694	1.151	0.749	1.140
	(0.616)		(0.547)		(0.511)	
Liquidity	0.188***	0.054	0.207***	0.056	0.200***	0.055
	(0.001)		(0.000)		(0.000)	
Industry Q	0.003*	0.018	0.003	0.019	0.003	0.018
	(0.083)		(0.150)		(0.119)	
Constant	3.381***	0.739	3.06***	0.778	3.416***	0.771
	(0.000)		(0.000)		(0.000)	
Observations	462		462		462	
Adjusted R^2	0.5603		0.5708		0.5796	
R^2	0.5937		0.6089		0.6179	
Industry Dummies	Yes		Yes		Yes	
Year Dummies	Yes		Yes		Yes	

*This table presents results from fixed effects regressions of the CVC, EM as well as the OS proxies and control variables on firm value over the period of 2017-2020 with year and industry dummies for the whole sample. Model 1 only includes the control variables. In Model 2 the main effect of CVC, EM and OS is added. Model 3 contains also the two-way interaction terms. In Model 4 the three-way interaction term of CVC, EM and OS is added. The p values are given in brackets and are two-tailed. The symbols ***, ** and * represent the significance level at the 1%, 5%, and 10%, respectively.*

5.4. Additional tests and robustness checks

I conducted multiple checks to investigate the robustness of my findings. I use robust standard errors to check if standard errors are affected and if t- and p-values are still significant for the findings I have presented to decrease the probability of making a type-1 error. Also, I include fixed effects into the models to take problems of unobserved variance into account, which could influence the results (Antonakis et al., 2010). Additionally, I implement a two-stage least squares (2SLS) procedure to address the problem of potential endogeneity, which could include conjunction between CVC activity and firm value. According to Semadeni et al. (2014) and Titus & Anderson (2018) by addressing the problem of endogeneity in the direct effect, it is not necessary to estimate a 2SLS model with instrumental variables also in the interaction terms. Following Basu et al. (2011), I use one year lagged CVC activity as an instrumental variable for CVC activity. According to Kennedy (2008) lagged values of endogenous variables are exogenous because they are predetermined constants in ascertaining current period's values of the endogenous variable. Using a one-year lag between independent and dependent variable reduces the potential of reverse causality.

In the first-stage regression the instrumental variable is a significant predictor ($\beta = 0.0193$, $p < 0.01$) of the assumed endogenous variable, which is displayed by significant p-value (Stock et al.; 2002). In the second-stage equation, I test for weak identification using Cragg- Donald test to check whether the instruments that I use in the model are actually defining the endogenous model. I evidence a significant F-statistic for the model (Andrews & Stock, 2005; Stock et al., 2002). Conducting the robust standard errors test for hypothesis 1, indicates still a significantly positive relationship of absorptive capacity with CVC activity ($\beta = 2.745$, $p < 0.01$) and no significant relationship of operational structure ($\beta = -0.351$, $p > 0.1$) and the interaction term of operational structure and absorptive capacity ($\beta = -0.718$, $p > 0.01$) with CVC activity. Testing robust standard errors for the results of hypothesis 2 confirms the significantly positive relationship of absorptive capacity on CVC activity ($\beta = 6.778$, $p < 0.05$) as well as the significantly positive relationship of the interaction term of AC and EM on CVC activity ($\beta = 32.507$, $p < 0.05$). Regarding the results of hypothesis 3 that were presented also for robust standard errors, a positive and significant effect of CVC Activity ($\beta = 0.01$, $p < 0.01$) and absorptive capacity ($\beta = 1.756$, $p < 0.01$) on firm value can be confirmed. Furthermore, the results of hypothesis 4 were tested for robust standard errors and remained mainly unchanged. However, the effect of CVC activity on firm value becomes insignificant ($\beta = 0.037$, $p > 0.1$) but the three-way interaction term ($\beta = 0.222$, $p < 0.05$) remains to be significantly correlated to TQ. Significantly negative related to TQ remain to be operational structure ($\beta = -0.118$, $p < 0.05$) and the two-way interactions of CVC activity and environmental munificence ($\beta = -0.192$, $p < 0.1$) and CVC activity with operational structure ($\beta = -0.041$, $p < 0.05$). Through the robustness checks, my results underline the impact of absorptive capacity on CVC activity and how factors like environmental munificence, CVC activity and operational structure interact with firm value.

6. Conclusion

The investigation of this study was motivated by the lack of a deep understanding of different impacting factors on CVC activity and the relationship of CVC activity and firm value. This study employs a US-American panel dataset of 2.678 firm-year observations covering the period from 2000 to 2020 to evaluate the impact of absorptive capacity, environmental munificence and operational structure on CVC activity and firm value. Also, the relationship between CVC activity and firm value is observed. The study employs industry-specific factors like environmental munificence and firm-specific factors like absorptive capacity. I perform fixed-effects regressions and use a large set of control variables. I find that firms with greater absorptive capacity display greater efforts towards pursuing innovations using CVC. Thus, absorptive capacity is an important capability to get hold on new technologies as an option for future growth through CVC investments.

Further analysis includes that the operational structure of a firm generally does not explain the motivation of a firm to conduct CVC investment activities. Also, environmental munificence shows a consistently insignificant association with CVC activities. Thus, neither it can be stated that higher levels of environmental munificence lead to higher levels of CVC activity nor that CVC activity will be higher when levels of environmental munificence will be lower. In an additional analysis, I also examine the connection between the above-mentioned variables, CVC activity and firm value. This analysis aims to clarify whether CVC activity is enhancing firm value. Further, I analyze how parent firm value among firms making CVC investments is affected by operational structure and environmental munificence. In my sample, I find a slight positive and significant effect of CVC activity on firm value, giving support to the results by Dushnitsky & Lenox (2006) who find that firms which pursue CVC activities experience more value creation and that greater CVC investment increases firm value. Also, I observe a significant decrease in firm value when firms conduct CVC investments in industries with high environmental munificence. Furthermore, I suggest that firm value decreases when operationally diversified firms make CVC investments.

Plotting the three-way interaction effects instead reveals that parent firm value increases among firms making CVC investments, that are operationally diffuse and operate in high munificent environments as well as for firms with a concentrated operational structure in high munificent environments. It is therefore vital for managers to consider CVC activities with regard to the corporate structure and the industry environment, as the impact on firm value differs for the combinations of structure and environment. I conduct several robustness tests, in which results hold for different specifications. In most cases, my main results are confirmed.

7. Contributions, limitations and future research

The study joins previous literature work with significant extensions. The research is extended by providing an indication of the relationship between CVC activity and firm value for US-American listed companies and examining the influence of industry-specific concepts like environmental munificence and firm-specific capabilities like absorptive capacity on firm value as well as on CVC activity. How does the absorptive capacity developed by R&D investments serve as the basis for new competencies by the mean of CVC activities? How do the pressures and opportunities provided by the industry environment impact CVC activity and firm value? Managers should be aware of the very practical impacts of these findings. I find similarities to the results of Sahaym et al. (2010) in the relationship and interplay of absorptive capacity and environmental munificence on CVC activity. Absorptive capacity increases CVC activity. My results have implications for managerial decision-making regarding innovation when assuming that pursuits for exploration like CVC activity create value of firms. Anyhow, besides the exploration for innovation through CVC activities also internal R&D can lead to innovation outputs and increases in firm value. It is therefore important for managers to enhance the complementary aspect of both (Dushnitsky & Lenox, 2005b; Gompers & Lerner, 2001) and to find an optimal balance between internal innovation creation and external exploration

As a central point, the findings suggest a joint influence of environmental munificence and operational structure on the CVC activity firm value relationship. Firms that conduct CVC investments can only increase their firm value when the firm is operationally diffuse and operates in a high munificent environment or if it is concentrated and operates in low munificent environments. To further observe this relationship, e.g. why diffuse firms are able to increase their firm value through CVC activities in high munificent environments would be an interesting topic for future research. As suggested by Titus & Anderson (2018) I provide further support for the attention based view of the firm by Ocasio (1997) and the theory that the ability of CVC investments as one possibility of entrepreneurial investment opportunities to drive the value of the parent firm is contingent upon "the coherence of attentional structures focusing managerial attention towards the most strategically relevant and value enhancing opportunity" (Titus & Anderson, 2018, p. 26). One possible explanation for this finding could be that the benefits from CVC activities are less critical in environments with high munificence (Sirmon et al., 2007) and managers of operationally diffuse firms may be less willing to take risks. The present study serves as a basis for understanding the impact of different factors on CVC activity on the one hand and the relationship between CVC activity, environmental munificence and operational structure on firm value on the other hand. However, it has several limitations whose improvement I leave to future research. One limitation is related to the number of years applied in my second sample, as database access limitations lead to a restricted sample for the years of 2017 – 2020.

Thirdly, I aggregate my data for CVC activity to the 2-digit SIC code level despite the availability of Compustat data at the 4-digit level. This incurs the problem that the more aggregated the industries are, the more likely it is that the true industry effects in the population are obscured because intra-industry variation is systematically enhanced, and the estimated industry effects are driven to the sample mean. This would result in an underestimation of the contribution to total variance and in an artificially low variance of estimated industry effects (Ruefli & Wiggins, 2003). Furthermore, I acknowledge that the validity of using Tobin's Q as a mean for firm value is contingent on the presumption that investors and capital markets rationally price firms' securities. A further limitation of this study was the limited access to databases like VentureXpert database or Thomson Reuter's Institutional Holdings 13F database. Therefore, data needed to be treated and prepared manually which can more easily cause errors in data handling. Also, some possible control variables were not able to retrieve due to mentioned database access limitation. As an example, dedicated and transient shareholders influence Tobin's Q according to corporate governance literature. Also, I use the aggregate count of CVC investments to measure CVC activity. As mentioned in section 2.1 research has used different ways to operationalize CVC activity. Therefore, it would be valuable for future research to challenge the reliability of my findings with different datasets.

Moreover, future research should include a greater variety of industries aside from the high technology industries that I use in this analysis. Also, using a wider period focusing on the impacts of environmental munificence is seen as an important contribution to provide further perceptions on the topic. Valuable future research would also include addressing the ways and strategies how firms internalize, apply and convert the knowledge and know-how they have acquired from their CVC activities. Lastly, the exploration of the specific characteristics of the entrepreneurial venture and the parent firm require more research, as it remains widely unobserved how those attributes influence the relationship between the venture and the firm and if the CVC activities conducted result in successful innovations and enhance firm value.

Appendix

Table 7

Definition of variables

Variable	Explanation
AC	Level of R&D intensity, measured as R&D expenditure scaled by total sales.
AC*OS	Interaction variable multiplying absorptive capacity with operational structure
AC*EM	Interaction variable multiplying absorptive Capacity with environmental munificence
Age	Current year subtracted by the founding year of the company.
CVC	CVC activity obtained from Private Equity Screener. Aggregate count of corporate venture deals by each investor firm (Sahaym et al., 2010).
CVC*EM	Interaction variable multiplying CVC activity with environmental munificence
CVC*OS	Interaction variable multiplying CVC activity with operational structure
CVC*EM*OS	Interaction variable multiplying CVC activity with environmental munificence and operational structure
Cash Flow	Natural logarithm of annual firm cash flow that is income before extraordinary items (i.e., income after interest and taxes) plus depreciation and amortization
Diversification	Dummy variable measuring if a firm is conducting investments outside their own industry boundaries. Equal to 1, if the aggregate count of CVC investments outside the own industry measured at the two digit SIC-code level is greater or equal than 2 and 0, if else.
EM	Industry sales obtained from Compustat database, using five-year average growth in net sales during the relevant time period for each industry. The natural logarithms across all firms were entered into a time-series regression and the antilogs of the regression slope coefficients were used to capture the growth rate of each industry (Keats & Hitt, 1988).
EM*OS	Interaction variable multiplying environmental munificence with operational structure
Growth	Growth in Return on sales, measured as the percentage change of annual operating income after depreciation over net sales.
Industry	Industry dummies.
Industry Q	Calculated as the mean level of Tobin's Q for each two-digit SIC code industry in a given year.
Leverage	Leverage measured as total debt including current to total assets.
Liquidity	Liquidity measured as the firm's current assets to current liabilities, the current ratio.
OS	Operational structure measured as the aggregate count of industries at the two-digit SIC code level, where the firm is operating in according to Compustat database.
ROA	Return on Assets measured as net income to total assets.
Size	Company size measured as the natural logarithm of annual net sales
Slack	Slack measured as firm's debt-to-equity ratio.
TQ	Tobin's Q measured as the product of the sum of Market value of equity, preferred stock and DEBT divided by total assets (Chung & Pruitt, 1994).
Year	Year dummies.

Table 8

Overview: Parent firms and corresponding CVC units

#	Parent Firm	Investing Vehicle
1	3M CO	3M New Ventures, 3M Corporation
2	ABB LTD	ABB Technology Ventures, Abb Technology Ventures Ltd
3	ABBOTT LABORATORIES	Abbott Biotech Ventures, Abbott Ventures Inc, Abbott Laboratories
4	ACCENTURE PLC	Accenture Technology Ventures, Accenture Ventures, Cibc Capital Partners
5	ADOBE INC	Adobe Ventures, Adobe Inc
6	ADVANCED MICRO DEVICES	AMD Ventures LLC, AMD Ventures
7	AETNA INC	Aetna Ventures, Aetna Ventures, LLC
8	AGILENT TECHNOLOGIES INC	Agilent Ventures
9	ALEXANDRIA R E EQUITIES INC	Alexandria Venture Investments, Alexandria Real Estate Equities Inc
10	ALIBABA GROUP HLDG	Alibaba Capital Partners
11	ALPHABET INC	Google Ventures, Google Capital, Gradient Ventures, Gradient Ventures LLC
12	ALTRIA GROUP INC	Altria Ventures Inc
13	AMAZON.COM INC	Alexa Fund, Amazon.com Inc
14	AMGEN INC	Amgen Ventures, Amgen Inc
15	ANALOG DEVICES	Analog Devices Enterprises
16	ANTHEM INC	Zaffre Investments LLC
17	AOL INC	AOL Ventures Fund, AOL
18	APPLE INC	Apple Computer Strategic Investment Group, Apple Inc
19	APPLIED MATERIALS INC	Applied Ventures LLC , Applied Technology Co Ltd
20	ARCELORMITTAL	ArcelorMittal SA
21	ARCHER-DANIELS-MIDLAND CO	Archer Daniels Midland Ventures
22	ASTRAZENECA PLC	Medimmune LLC
23	AT&T INC	AT&T Ventures, AT&T Inc, AT&T Corp, Venture Management Services
24	AUTODESK INC	Autodesk Ventures, Autodesk Inc
25	BAUSCH HEALTH COMPANIES INC	Bausch & Lomb Inc
26	BAXTER INTERNATIONAL INC	Baxter Ventures, Baxter International Inc
27	BEA SYSTEMS INC	BEA Systems Inc
28	BECTON DICKINSON & CO	BD Ventures, BD Ventures LLC
29	BEST BUY CO INC	Best Buy Capital LP

30	BIOGEN INC	Biogen Idec New Ventures Inc, Biogen New Ventures Inc
31	BOEING CO	Boeing Ventures, HorizonX Ventures, Boeing Co & Consolidated Subsidiaries
32	BOSTON SCIENTIFIC CORP	BTG International, BTG International Ltd
33	BP PLC	BP Ventures
34	BRISTOL-MYERS SQUIBB CO	Bristol-Myers Squibb Co
35	BUNGE LTD	Bunge Ventures
36	CADENCE DESIGN SYSTEMS INC	Cadence Design Systems, Inc. , Cadence Design Systems Inc
37	CATERPILLAR INC	Caterpillar Venture Capital Inc
38	CBRE GROUP INC	CBRE Strategic Partners U.S. Value 7, L.P., CBRE Global Investors LLC
39	CELGENE CORP	Celgene Corporation
40	CENTERPOINT ENERGY INC	Reliant Energy Ventures Inc, Reliant Equity Investors LLC
41	CHESAPEAKE ENERGY CORP	Chesapeake NG Ventures Corporation, Chesapeake Emerging Opportunities Club LLC, Chesapeake Energy Corp, Broventure Capital Management
42	CHEVRON CORP	Chevron Technology Ventures, Chevron Technology Ventures Investments, CTTV Investments Funds, Chevron Technology Ventures LLC
43	CIGNA CORP	Cinergy Ventures LLC
44	CIRRUS LOGIC INC	Cirrus Logic, Inc. , Cirrus Logic Inc
45	CISCO SYSTEMS INC	Cisco Investments, Cisco Investments Inc, Cisco Systems Inc (Pre-Merger)
46	CITRIX SYSTEMS INC	Citrix Startup Accelerator, Citrix Systems Inc
47	CME GROUP INC	CME Ventures LLC
48	COMCAST CORP	Comcast Ventures, Comcast Interactive Capital
49	COMVERSE TECHNOLOGY INC	Comverse Investments, Ltd. , Comverse Investments Ltd, Comverse Technology Inc
50	CONCUR TECHNOLOGIES INC	Concur Perfect Trip Fund, CONCUR TECHNOLOGIES INC
51	CONOCOPHILLIPS	ConocoPhillips Technology Ventures
52	CONSTELLATION BRANDS	Constellation Ventures, Sanchez Midstream Partners LP, HPS Investment Partners LLC
53	CORNING INC	Corning Innovation Ventures, Corning Inc
54	CYPRESS SEMICONDUCTOR CORP	Cypress Semiconductor Corporation
55	DELL TECHNOLOGIES INC	Dell Ventures, Dell Technologies Capital, Dell Ventures LP

56	DISNEY (WALT) CO	Disney Accelerator, TWDC Enterprises 18 Corp
57	DOW INC	Dow Venture Capital, Dow Chemical Co
58	DTE ENERGY CO	DTE Energy Ventures Inc, Dte Energy Technologies Inc, DTE Energy Ventures, Inc.
59	DUPONT DE NEMOURS INC	DuPont Ventures
60	EASTMAN CHEMICAL CO	Eastman Ventures
61	EASTMAN KODAK CO	Eastman Kodak Company
62	EDWARDS LIFESCIENCES CORP	Edwards Lifesciences, Edwards Lifesciences Corp
63	ELECTRO SCIENTIFIC INDS INC	Electro Scientific Industries, Inc., Electro Scientific Industries Inc
64	ELECTRONICS FOR IMAGING INC	Electronics For Imaging Fund I
65	EMC CORP/MA	EMC Ventures
66	ENI SPA	Eni Next LLC
67	EQUINOR ASA	Equinor Venture AS, Energy Capital Management AS, Equinor Technology Ventures AS
68	EW SCRIPPS -CL A	Scripps Ventures LLC
69	EXELON CORP	Exelon Capital Partners
70	FIRST DATA CORP	First Data Corporation
71	FLEX LTD	Lab IX, Flex Ltd
72	FORD MOTOR CO	Ford Smart Mobility LLC, Ford Motor Co
73	FULLER (H. B.) CO	H.B. Fuller Ventures, H.B. Fuller Company
74	GARTNER INC	Gartner Group, Inc., Gartner Inc
75	GENERAL ELECTRIC CO	GE Capital, GE Equity, GE Healthymagination Fund, GE Investments Private Placement Partners, GE Ventures, General Electric Venture Capital Corp, GE Ventures Inc, General Electric Co, General Electric Capital Corp
76	GENERAL MILLS INC	General Mills, General Mills Inc
77	GENERAL MOTORS CO	General Motors Ventures LLC, GM Capital Partners, GM Ventures, General Motors International Holdings Inc, General Motors Pension Fund
78	GLAXOSMITHKLINE PLC	SR One, Sr One Ltd, Smithkline Beecham Corp
79	GRAHAM HOLDINGS CO	Graham Holdings Co
80	HEWLETT PACKARD ENTERPRISE	Hewlett-Packard Ventures, Hewlett Packard Pathfinder, HP Inc, Hewlett-Packard Strategy and Corporate Development, HP Tech Ventures
81	HUMANA INC	Humana Ventures

82	ICOS CORP	ICOS Corporation
83	INCYTE CORP	Incyte Pharmaceuticals, Inc., Incyte Corp
84	INFOSYS LTD	Infosys Innovation Fund, Infosys Technologies Ltd, Infosys Ltd
85	INTEL CORP	Intel 64 Fund, Intel Communications Fund
86	INTL BUSINESS MACHINES CORP	IBM Venture Capital Group, International Business Machines Corp
87	JOHNSON & JOHNSON	Johnson & Johnson Innovation-JJDC Inc
88	JONES LANG LASALLE INC	JLL Spark Global Venture Fund
89	JUNIPER NETWORKS INC	Juniper Networks Inc,
90	KELLOGG CO	Eighteen94 Capital, Eighteen94 Capital LLC
91	KONINKLIJKE PHILIPS NV	Philips Venture Capital Fund BV
92	KRAFT HEINZ CO	Evolv Ventures Fund
93	L3HARRIS TECHNOLOGIES INC	L3harris Technologies Inc
94	LILLY (ELI) & CO	Eli Lilly & Company, Eli Lilly and Co
95	LOCKHEED MARTIN CORP	Lockheed Martin Ventures, Lockheed Martin Corp,Lockheed Corp
96	LUMEN TECHNOLOGIES INC	CenturyTel Inc, Lumen Technologies Inc
97	MCKESSON CORP	McKesson Ventures LLC, McKesson Corp
98	MECKLERMEDIA CORP	internet.com Venture Fund, INT Media Group, MecklerMedia Corp
99	MEDTRONIC PLC	Medtronic Inc
100	MERCK & CO	Merck Ventures, Merck Global Health Innovation Fund, Merck Capital Ventures LLC, Merck Global Health Innovation Fund LLC, Merck Ventures BV, Merck & Co Inc
101	MICROSEMI CORP	Vitesse Semiconductor Corporation, Microsemi Communications Inc
102	MICROSOFT CORP	M12, Microsoft Corp
103	MILESTONE SCIENTIFIC INC	Milestone Medica Corporation
104	MOTOROLA SOLUTIONS INC	Motorola Solutions Venture Capital, Motorola Mobility Ventures
105	NATIONAL FINANCIAL PRTNRS CP	NFP Ventures LLC
106	NEXTEL COMMUNICATIONS INC	Nextel Ventures
107	NIKE INC -CL B	Nike, Inc., Nike Inc
108	NORTONLIFELOCK INC	NortonLifeLock Inc
109	NOVELL INC	Novell Ventures Inc, Novel Technology Capital Fund I LP
110	NVIDIA CORP	NVIDIA GPU Ventures, NVIDIA Corp
111	OMNICOM GROUP	Omnicom Group Inc.

112	ORACLE CORP	Oracle Venture Fund, Oracle America Inc
113	ORBOTECH LTD	Orbotech Technology Ventures LP
114	PAYPAL HOLDINGS INC	PayPal Ventures
115	PFIZER INC	Pfizer Venture Capital, Pfizer Venture Investments, Pfizer Inc
116	PG&E CORP	Pacific Venture Capital, PG & E Corporation
117	PRESIDIO INC	Presidio Ventures, Inc., Presidio Ventures Inc
118	PROCTER & GAMBLE CO	Procter & Gamble Co
119	QUALCOMM INC	Qualcomm Ventures
120	QUEST SOFTWARE INC	Quest Software, Quest Software Inc
121	RAYTHEON TECHNOLOGIES CORP	Raytheon Ventures
122	RED HAT INC	Red Hat Ventures
123	REX AMERICAN RESOURCES CORP	Rex Health Ventures I, L.P.
124	ROGERS COMMUNICATIONS - CL B	Rogers Ventures, Rogers Communications Inc, Rogers Ventures Ltd
125	SALESFORCE.COM INC	Salesforce Ventures, Salesforce Ventures LLC
126	SANDISK CORP	SanDisk Ventures, Sandisk LLC
127	SAP SE	Sapphire Ventures LLC, SAP iO
128	SCIENCE APPLICATIONS INTL CP	SAIC Venture Capital Corporation, SAIC Technologies Fund I LLC, SAIC Capital Co Ltd
129	SEAGATE TECHNOLOGY PLC	Seagate Technology PLC
130	SEI INVESTMENTS CO	SEI Ventures Fund, SEI Ventures Inc
131	SEMPRA ENERGY	Sempra Ventures -Unspecified Fund
132	SOUNDVIEW TECHNOLOGY GRP INC	Soundview Technology Corp
133	STEEL CONNECT INC	@Ventures
134	STEEL PARTNERS HOLDINGS	Adaptec, Inc, STEEL PARTNERS HOLDINGS LP
135	STMICROELECTRONICS NV	STMicroelectronics NV
136	SYNGENTA AG	Syngenta Ventures
137	SYNOPSYS INC	Synopsys Inc
138	TEGNA INC	Gannett, Tegna Inc
139	TELEFONICA SA	Telefonica Ventures, Telefonica SA
140	TELUS CORP	TELUS Ventures
141	TENET HEALTHCARE CORP	Tenet Healthcare Corporation
142	TEXAS INSTRUMENTS INC	TI Ventures, Granite Ventures LLC
143	THE9 LTD -ADR	Fund9, The9 Ltd
144	THOMSON-REUTERS CORP	Thomson Reuters Ventures

145	TIME WARNER INC	Time Warner Investments, Warner Media, LLC.
146	TRIBUNE PUBLISHING CO	Tribune Ventures, TRIBUNE VENTURES (TRIBUNE CO)
147	TRIQUINT SEMICONDUCTOR INC	Qorvo Us Inc
148	UNILEVER PLC	Unilever Ventures Ltd, Unilever Technology Ventures Fund BV, UTV, Unilever Ventures Ltd
149	UNITED MICROELECTRONICS CORP	UMC Capital Corp
150	UNITED PARCEL SERVICE INC	UPS Strategic Enterprise Fund, UPS Strategic Enterprise Fund
151	UNIVERSAL CORP/VA	Universal Music Group
152	VERISIGN INC	Verisign Inc
153	VERIZON COMMUNICATIONS INC	Verizon Ventures, Verizon Communications Inc
154	VISA INC	Visa International Fund, Visa Inc
155	WILTEL COMMUNICATIONS GROUP	Wiltel Communications Group Inc
156	WORKDAY INC	Workday Ventures
157	WPP PLC	WPP Ventures
158	XEROX HOLDINGS CORP	Xerox Venture Capital
159	XILINX INC	Xilinx Inc
160	ZEBRA TECHNOLOGIES CP	Zebra Ventures

Table 9

Observations by Year and Industry

The table presents the distribution of investments across years and industries. The assignment of the industries is done according to the Standard Industry Classification (SIC) code of the corporate investor.

Year	13	20	21	26	27	28	29	30	33	35	36	37	38	42	48	49	51	57	59	60	62	63	64	65	67	73	80	82	87	99	Total
2000	0	0	0	0	0	37	1	0	0	22	93	1	5	3	30	2	0	0	0	0	1	0	0	0	0	26	2	1	0	0	224
2001	0	3	0	0	0	39	3	0	0	32	89	1	15	3	20	9	0	0	0	0	2	0	0	0	0	37	1	0	0	0	254
2002	3	4	0	0	0	29	2	0	0	6	52	2	11	2	15	2	0	0	0	0	1	0	0	0	0	10	1	0	1	0	141
2003	4	1	0	0	0	40	4	0	0	8	40	1	14	0	11	1	0	0	0	0	0	0	0	0	1	8	0	1	1	0	135
2004	2	0	0	0	0	37	5	0	0	6	61	0	7	1	15	1	1	0	0	0	0	0	0	0	2	6	0	0	0	0	144
2005	0	1	0	0	0	39	4	0	0	8	55	0	15	2	14	1	0	0	0	0	0	0	0	0	5	7	0	0	2	0	153
2006	0	0	0	0	0	47	9	0	0	24	83	0	10	5	12	2	0	0	0	0	0	0	0	0	5	4	0	0	1	0	202
2007	1	0	0	0	0	61	5	0	0	15	81	1	9	5	18	3	0	0	0	0	0	0	0	0	4	10	0	0	2	0	215
2008	0	2	0	0	0	53	10	0	1	17	65	1	10	7	15	3	0	0	2	0	0	1	0	0	2	8	0	0	1	0	198
2009	0	2	0	0	0	32	4	0	1	14	37	0	4	3	9	2	0	2	2	0	0	0	0	0	4	11	0	0	0	0	127
2010	1	0	0	2	0	39	5	0	0	13	37	0	5	2	15	1	0	2	1	0	0	0	0	0	2	11	0	0	0	0	136
2011	2	1	0	1	0	41	1	0	0	16	33	3	5	2	14	1	0	1	1	0	0	0	0	0	5	30	0	0	0	0	157
2012	1	0	0	2	0	42	0	0	0	8	38	0	4	1	22	0	2	0	0	1	0	0	0	0	1	45	0	0	0	0	167
2013	4	0	0	0	0	34	2	1	0	17	69	0	1	1	35	1	0	1	0	0	0	0	0	0	1	77	0	1	0	0	245
2014	1	0	1	1	0	37	1	1	0	18	98	1	3	1	46	2	1	1	0	0	0	0	0	0	1	100	0	0	0	0	314
2015	1	7	0	2	0	36	4	0	0	17	69	4	3	3	36	1	3	0	0	0	1	3	0	1	3	88	0	1	0	0	283
2016	0	5	0	1	0	19	2	0	0	16	41	2	8	0	33	0	3	0	5	0	4	2	0	0	1	65	0	0	3	0	210
2017	0	2	0	0	0	31	3	0	0	13	46	1	17	0	31	0	0	0	2	1	3	2	0	0	9	101	0	1	3	0	266
2018	0	4	0	1	0	28	3	0	0	20	39	7	23	0	27	0	0	0	13	1	1	3	0	4	12	132	0	0	3	0	321
2019	0	6	0	3	0	22	7	0	0	19	47	8	1	1	25	0	5	0	8	1	3	4	0	4	9	162	0	0	4	0	339
2020	0	4	0	1	0	18	6	0	0	24	45	10	4	0	17	0	0	0	5	1	0	4	0	4	3	115	0	0	4	0	265
Total	**20**	**42**	**1**	**14**	**0**	**761**	**81**	**2**	**2**	**333**	**1218**	**43**	**174**	**42**	**460**	**32**	**15**	**7**	**39**	**5**	**16**	**19**	**0**	**13**	**70**	**1053**	**4**	**5**	**25**	**0**	4496

Table 10

Correlation table 2017-2020

This table presents the correlation coefficients between Tobin's Q and CVC Activity and the independent variables and corresponding interaction terms and control variables for the data sample for the years 2017-2020. All variables are defined in Table 8.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. TQ	1.0000															
2. CVC	0.1120	1.0000														
3. EM	0.0797	0.1592	1.0000													
4. OS	-0.2646	-0.0265	-0.0561	1.0000												
5. CVC*EM	0.0970	0.7810	0.0117	0.0025	1.0000											
6. CVC*OS	0.0535	-0.0465	0.0044	-0.2245	-0.0503	1.0000										
7. EM*OS	-0.1310	0.0027	0.0233	0.0955	-0.0967	0.0418	1.0000									
8. CVC*EM*OS	0.0253	-0.0584	-0.1748	0.0412	-0.1387	0.5310	-0.2824	1.0000								
9. AC	0.4968	0.1164	-0.0830	-0.2674	0.1064	0.0475	-0.0091	-0.0351	1.0000							
10. ROA	0.4243	-0.0227	0.0601	-0.0883	0.1219	0.2526	-0.1255	-0.0484	0.0997	1.0000						
11. Leverage	-0.1380	-0.1337	-0.0005	0.0829	-0.1095	0.0651	0.0174	0.0092	-0.1442	0.0883	1.0000					
12. Size	-0.1913	0.2091	-0.0797	0.2340	0.2251	0.0676	-0.0049	-0.0213	-0.2127	0.1577	0.0194	1.0000				
13. Slack	-0.1928	-0.0668	0.0237	0.0470	-0.0682	0.0470	0.0010	0.0175	-0.0829	-0.0336	0.3909	0.0928	1.0000			
14. Liquidity	0.3121	0.0602	-0.1013	-0.0310	0.1059	0.0563	0.0447	0.0425	0.2292	0.1925	-0.2067	-0.3088	-0.1402	1.0000		
15. Growth	0.0392	0.0323	0.0290	-0.0220	-0.0014	-0.0199	-0.0609	0.0132	-0.0139	0.0405	0.0004	0.0405	0.0152	-0.0351	1.0000	
16. Industry Q	0.2715	0.0976	-0.0724	-0.1511	0.1059	-0.0654	-0.0833	0.0292	0.3858	0.0952	0.0103	-0.2097	-0.0031	0.0941	0.0021	1.0000

Table 11

Effect of Absorptive Capacity and Environmental Munificence on CVC activity

CVC	Model 1	S. E
Absorptive Capacity	6.778**	3.367
	(0.045)	
Environmental Munificence	-0.612	4.975
	(0.902)	
Absorptive Capacity*Environmental Munificence	32.507**	15.863
	(0.041)	
Control Variables		
Leverage	-2.394	2.479
	(0.335)	
Size	2.310***	0.271
	(0.000)	
Slack	-0.217	0.178
	(0.224)	
Growth	0.075	0.243
	(0.757)	
Age	-0.042*	0.023
	(0.073)	
Liquidity	1.050***	0.265
	(0.000)	
ROA	-15.918***	3.559
	(0.000)	
Industry Q	0.001	0.002
	(0.322)	
Observations	462	
Adjusted R^2	0.1871	
R^2	0.2541	
Industry Dummies	Yes	
Year Dummies	Yes	

*This table presents results from fixed effects regressions of AC, EM and control variables on CVC activity over the period of 2017-2020 with year and industry dummies for the whole sample. The p-values are given in brackets and are two-tailed. The symbols ***, ** and * represent the significance level at the 1%, 5%, and 10%, respectively.*

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