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ARE SHARKS MORE DANGEROUS AT DUSK OR DAWN? TIMING OF CVC INVESTMENTS AND VENTURES' COMMERCIAL PERFORMANCE

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Abstract

The evidence on how corporate venture capital (CVC) investments affect investee ventures' commercial performance is mixed. An examination of the timing of CVC investments can offer new insights on this contention. Previous studies showed that the timing of ventures' resource acquisition is crucial for venture outcomes. However, these studies have overlooked the role of incumbents as a resource channel and the tradeoffs associated with timing. Building on resource dependence theory (RDT), we explore how the timing of CVC investments alters the power balance between investors and backed ventures, significantly influencing ventures' commercial performance. We further examine how the timing of venture board seats obtained by CVC investors affects this relationship. Using a dataset of 294 Norwegian ventures active in knowledge-intensive industries from 2004 to 2015, we offer evidence for a differential effect of early- vs. late-stage CVC investments, showing that late-stage investments significantly increase commercial performance. We also find that associating a venture board seat with a CVC investment moderates this effect; ventures are associated with greater commercial performance when late-stage investments come without board seats. We suggest that board seats prevent ventures from forming investment ties with additional CVC investors, limiting ventures' external ties crucial for market success.

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Keywords: corporate venture capital, investment timing, board members, resource acquisition, resource dependence theory, commercial performance

INTRODUCTION

Acquiring resources is crucial for new firms. Although startups are praised for their innovativeness, they are resource-constrained and face a liability of newness, threatening their survival (Brush et al., 2001; Stinchcombe, 1965). In addition to independent venture capitalists (IVCs) role in providing resources to new ventures (Hsu, 2006; Wang et al., 2021), scholars examined established firms as resource providers (Alvarez-Garrido & Dushnitsky, 2016). In particular, research focused on corporate venture capital (CVC) – minority equity investments from incumbent firms in private ventures (Gompers & Lerner, 2000) – as it provides ventures with complementary assets that affect their innovation (Chemmanur et al., 2014) and commercial outcomes (Bertoni et al., 2013). While scholars agree that CVC investments increase ventures' innovation outcomes (e.g., patents, scientific publications) (Alvarez-Garrido & Dushnitsky, 2016; Park & Steensma, 2013), their impact on ventures' commercial outcomes is unclear. Previous studies reported mixed results, including the reduced likelihood of receiving commercial trademarks (Uzuegbunam et al., 2019), no effect on product approvals (Pahnke et al., 2015), and a positive effects on sales growth (Bertoni et al., 2013). This study clarifies this relationship, providing insights on the relationship between CVC investment and investee ventures' commercial outcomes, examining the role of CVC investment timing.

The timing of ventures' resource acquisition has received increasing attention by management scholars. In fact, ventures require different resources during their development (Shepherd et al., 2021); for example, founders' social (Maurer & Ebers, 2006) and human capital (Tzabbar & Margolis, 2017) have different performance effects in ventures' early and late stages, and, early-stage decisions can create strong path dependencies for venture's growth (Beckman & Burton, 2008; Geroski et al., 2010). Similarly, the timing of resource acquisition from investors such as IVCs is critical for investee ventures' performance (Park & Tzabbar, 2016; Tzabbar & Margolis,

2017). Yet, the timing of CVC investment in startups and their implications have so far received less attention. A noteworthy exception is Kim and Park (2017), who examined early vs. late CVC investments as antecedents of venture patenting and the likelihood of IPO. Beyond a market-related outcome as IPO, which is commonly experienced by few ventures (Aldrich & Ruef, 2018), we currently have little guidance about how CVCs directly affect ventures' commercial performance, especially at different venture's development stages.

Examining CVC is crucial for ventures, since collaborating with an investor can make ventures overly dependent on that partner (Park & Steensma, 2012) or expose intellectual property (IP) to investor misappropriation (Dushnitsky & Shaver, 2009; Katila et al., 2008) such that commercial benefits for the venture dissipate (Pahnke et al., 2015). The risks and opportunities created by CVC may vary depending on the investment timing. Early-stage ventures may be at greater risk of misappropriation by investors due to their lack of defense mechanisms (Katila et al., 2008); however ventures may benefit more from CVC in early stages when they need more external resources (Kim & Park, 2017). In contrast, late-stage ventures may contrast appropriability threats effectively but may be unable to use the acquired resources for radical innovation if investors are interested in their current trajectories (Park & Tzabbar, 2016).

Combining the literatures on CVC investments and resource acquisition timing, our study examines the role of CVC investors at different venture development stages in relation to ventures' commercial performance. Building on resource dependence theory (Emerson, 1962; Pfeffer & Salancik, 1978) and primarily on the concept of power imbalance, we argue that variations in the power balance between investors and early- or late-stage ventures heterogeneously affect ventures' ability to leverage CVC resources to improve commercial outcomes. We examine both CVC

investments and CVC board seats from the perspective of the power-dependence relationships between a venture and its CVC investors.

Using data from 294 Norwegian IVC-backed ventures active in knowledge-intensive industries in the period between 2004 and 2015, we provide evidence for a differential effect of early- and late-stage CVCs on ventures' commercial performance. We find that CVCs positively affect ventures' commercial performance in later development stages, compared to early-stage investments. In addition, we find that this effect is diminished when investors skew the power balance toward their interests through the addition of board seats. We explore the mechanisms behind these power imbalance dynamics. When the power balance shifts due to board seats, CVC investors affect ventures' strategies by preventing them from forming investment ties with additional CVC investors or by leading existing CVC investors to sell their shares and exit the investors' syndicate. This reduction of ties with other CVCs negatively affects ventures' commercial performance.

Our study offers three contributions. First, we add to the understanding of resource dependence relationships between investors and ventures (Hallen et al., 2014; Katila et al., 2008) and show that ventures may be exposed to adverse consequences of CVCs beyond misappropriation, including the shift in focus toward investors' interests at the cost of ventures' commercial outcomes. Second, we extend work on investors' implications on ventures' commercial performance (e.g., Pahnke et al., 2015; Uzuegbunam et al., 2019), showing the importance of timing as a mechanism through which CVCs affect venture performance. Finally, we contribute to the literature on the timing of ventures' resource acquisition, which focused mainly on the founding stage (e.g., Geroski et al., 2010) and on how resources acquired at founding are developed over time (Maurer & Ebers, 2006; Tzabbar & Margolis, 2017). We extend this debate by analyzing the effect of acquiring the same resources at different development stages.

THEORY

The Resource Dependence Between Ventures and Corporate Investors

In general, firms need external resources to survive and grow and they employ various tactics to reduce their dependency on such resources (Pfeffer & Salancik, 1978). The reduction of these dependencies leads to changes in strategic orientation, improved performance (Drees & Heugens, 2013; Hillman et al., 2009), and survival (Pfeffer & Salancik, 1978). The main tactics for reducing resource dependence are avoidance, cooptation, and resource constraint absorption (Pfeffer & Salancik, 1978). Avoidance describes the actions that organizations take to remove the need for specific resources, including changing internal activities to avoid dependency and finding substitutes for external resources (Emerson, 1962; Pfeffer & Salancik, 1978). In the case of ventures, they use avoidance when potential partners might misappropriate their resources (Colombo & Shafi, 2016; Katila et al., 2008). They forego investments or turn to other sources, substituting equity finance with non-equity funding (e.g., government funding), before considering transferring ownership to investors (e.g., CVC) (Pahnke et al., 2015). Yet, as ventures need partners to acquire resources, they regularly bargain with established firms over partnerships to ease constraints (Hallen, 2008; Hallen et al., 2014).

Cooptation describes the addition of external members to an organization's leadership (e.g., external board directors), which increases resource flows between the focal firm and the party represented by the external board member (Hillman et al., 2009; Pfeffer & Salancik, 1978). As per new ventures, they use cooptation, adding investors to their board to improve decision-making and resource acquisition. Prior work found that corporate investors with a venture board seat transfer more knowledge and increase learning (Garg, 2013; Maula et al., 2009; Wadhwa & Kotha, 2006).

Resource constraint absorption gives the dependent organization direct access to the external actors' resources (Casciaro & Piskorski, 2005; Pfeffer & Salancik, 1978). Full constraint

absorption is achieved through mergers and acquisitions (Pfeffer, 1972a), whereas partial absorption relies on formal contracts such as alliances (Pfeffer & Leong, 1977). We conceptualize CVC investments as partial constraint absorption, as ventures gain control over investor resources, such as financial capital and operational assets, through a contractual arrangement. Studies on ventures' alliances (e.g., Diestre & Rajagopalan, 2012; Shan et al., 1994) and CVC investments (e.g., Katila et al., 2008; Pahnke et al., 2015) show that constraint absorption comes with costs and benefits associated with such partnerships.

Until now, the entrepreneurial finance literature has not systematically conceptualized how ventures use all three RDT tactics concomitantly to reduce their dependencies on external resources. However, this is important, as ventures continuously evaluate tradeoffs between avoidance, cooptation, and constraint absorption to obtain the investor portfolio most useful to them. So, providing guidance on the joint use of these tactics is relevant for the outline of an entrepreneurial strategy, in particular in connection to venture-investor relationships. Building on prior work that has examined how ventures use avoidance tactics in relation to CVCs (Katila et al., 2008; Pahnke et al., 2015), we complement and extend this research showing ventures' use of constraint absorption and cooptation in concert when dealing with corporate investors.

Power Balance in Venture-Corporate Investor Relationships

Whether firms use resource constraint absorption depends on the interdependence between the focal firm and the external actor (Emerson, 1962; Pfeffer & Salancik, 1978). The weaker actor (i.e., the venture) tries to reduce its resource constraint. This is more likely to happen when both actors are mutually dependent on each other's resources (i.e., when they cannot engage with other actors to reach the same outcome) and less likely when there is a large power imbalance (i.e., when one actor needs the relationship much more than the other) (Casciaro & Piskorski, 2005). In other

words, an external actor's power is based on its counterpart's dependence (Emerson, 1962). In the case of new ventures, the dependence on their corporate investors' resources rests on ventures' need to access CVCs' resources, and it fades as the availability of alternative resource providers increases (Uzuegbunam et al., 2019).

Ventures are especially dependent on external resources compared to established firms (Daily et al., 2002). CVC research posits that the power balance between a venture and its investors is skewed toward the corporate investors, as it is more critical for ventures to obtain external resources than it is for CVCs to gain access to ventures' resources (Katila et al., 2008; Uzuegbunam et al., 2019). Ventures accept this power imbalance, because CVC investors help to close resource gaps beyond what IVCs can offer alone.

The intuition behind the idea that there is a difference in power balance between early- and late-stage ventures' investment relationships, such that late-stage ventures have more power than early-stage ventures, is not entirely new (Katila et al., 2008; Park & Tzabbar, 2016). Funding rounds in later stages generally require much larger investments than seed and early stage (PitchBook, 2019), leading to increased commitment by investors. From an RDT perspective, increasing financial commitment is likely to reduce power imbalance between investor and venture (Uzuegbunam et al., 2019). While early-stage ventures are especially dependent on the assets of professional investors, late-stage ventures are more structured and rely more on their internal operations (Park & Tzabbar, 2016). In addition, in later development stages ventures rely less on resources from a single partner and begin to manage their interorganizational relationships more strategically for their benefit and resource needs (Hite & Hesterly, 2001). Ventures are likely to be more powerful and have more idiosyncratic information toward investors when their IPs are more developed, creating favorable information asymmetries for entrepreneurs and placing both actors on more

equal footing (Park & Tzabbar, 2016). As a result, the venture-investor power imbalance is likely to be less severe than in early-stage investments and becomes contingent on CVC investors' ability to provide relevant resources in addition to innovation outcomes. We propose that ventures' development stages affect the outcomes of constraint absorption via CVC investments due to heterogeneous levels of power imbalance over time.

CVC Investments and Commercial Performance

CVC investments increase ventures' innovation outcomes, such as patenting, scientific publications, and copyrighting (Alvarez-Garrido & Dushnitsky, 2016; Chemmanur et al., 2014; Uzuegbunam et al., 2019). However, scholars found mixed results for CVC investments' effects on ventures' commercial outcomes. Prior work showed negative effects, such as a reduced likelihood of receiving commercial trademarks (Uzuegbunam et al., 2019); null effects, such as the lack of an effect on product approvals (Pahnke et al., 2015); positive effects, such as sales growth (Bertoni et al., 2013). We reason that these mixed findings reflect corporate investors' primary interest in accessing knowledge assets when investing in ventures (Benson & Ziedonis, 2009; Dushnitsky & Lenox, 2005; Pahnke et al., 2015) rather than nurturing investee ventures market-oriented activities. From an RDT perspective, sub-units of large organizations build and retain their power and receive resources internally if they provide valuable resources for the organization (Salancik & Pfeffer, 1974). In the case of CVCs, the investing unit provides IPs for its parent organization (Basu et al., 2016) and gains internal legitimacy in doing so (Souitaris et al., 2012). Therefore, if CVC units are unable to obtain knowledge and foster learning, they lose internal legitimacy and thus their claim on internal resources. Ma (2020) found corroborating evidence for this, observing that corporate investors shut down CVC units when they reduce their external search for innovation and focus on internal research and development (R&D). As a result,

CVC investors are likely to deprioritize ventures' commercial goals, because they are more interested in building innovation capabilities than commercial capabilities (Pahnke et al., 2015).

Given new ventures' substantial resource constraints, an extensive focus on innovation likely comes at the expense of other value-generating activities (Rosenbusch et al., 2011; Song et al., 2008). This is exemplified by ventures that use their investor' commercial infrastructure, such as distribution channels and sales personnel (Basu et al., 2011), rather than developing in-house commercial infrastructure (Uzuegbunam et al., 2019). Thus, while CVC investments enhance ventures' innovation outcomes, they often seem to do so at the expense of their commercial outcomes (Uzuegbunam et al., 2019). CVCs can exert such influence because they have power advantages vis-a-vis other investors due to their ownership of market-specific resources (e.g., proprietary IP and expert equipment) (Uzuegbunam et al., 2019), that are especially suitable for stimulating innovation (Alvarez-Garrido & Dushnitsky, 2016; Chemmanur et al., 2014).

As previously highlighted, early- and late-stage ventures have different resource needs (Park & Tzabbar, 2016) and different means to counterbalance investors' influence, which are more effective for late-stage ventures (Katila et al., 2008). Thus, while CVCs can be expected to steer ventures toward a primary focus on innovation (Uzuegbunam et al., 2019), this interest is likely to be more pronounced in early-stage investments than later-stage. In fact, early-stage investors emphasize ventures' innovative potential during their investment due diligence (Baum & Silverman, 2004). Consequently, resource constraint absorption through early CVC investment is likely to result in a focus on innovation outcomes at the expense of commercial outcomes. This shift in ventures' focus could also explain why patenting outcomes are stronger in early-stage investments than late-stage investments (Kim & Park, 2017). In fact, research on IVC investments (Park & Tzabbar, 2016) and CVC investments (Kim & Park, 2017) shows that late-stage

investments have relatively little effect on innovation outcomes. This indicates that, in later stages, ventures mainly consider corporate investors as valuable if they provide resources beyond innovation, as ventures can otherwise rely on their established resource base.

Concerning non-innovation-related outcomes, research finds that early-stage CVC investments diminish the likelihood of exit through IPO and acquisition (Kim & Park, 2017; Yang et al., 2009). Prior research also shows that ventures in later development stages engage in a wider array of commercial activities with their partners, such as licensing deals (Ceccagnoli et al., 2018) and alliances (Van de Vrande & Vanhaverbeke, 2013). While early-stage ventures focus primarily on developing knowledge assets, late-stage ventures increasingly demand resources for the growth of internal commercial infrastructure (Baum et al., 2000). In the light of these arguments, we formulate the following hypothesis:

> *Hypothesis 1: Conditional on receiving CVC investment, ventures in later development stages show a greater commercial performance than ventures in early stages.*

Corporate Board Seats and Ventures' Commercial Performance

The experience and involvement of external investors in the board is a main determinant for ventures' trajectories and performance. Venture investments grant professional investors strong control rights, such as the replacement of key managers or pre-purchase rights of further equity (Gompers et al., 2020; Lerner, 1995). Moreover, board seats granted to CVC investors lead to increased investor participation in corporate governance (Gompers & Lerner, 2000; Paik & Woo, 2017). In addition, corporate investors are especially interested in managing resource exchanges between ventures and investors (Garg, 2013). Empirical research echoes this observation, providing evidence that ventures and CVC investors exchange more knowledge when the CVC investor is on the board (Maula et al., 2009; Paik & Woo, 2017; Wadhwa & Kotha, 2006). We

interviewed venture managers and founders who received CVC to validate these claims. We found agreement at large, as a software venture's manager describes: "*They* [CVC] *are involved in decision making. If they are on the board they are involved. They are much less involved when they are not on the board*."

RDT conceptualizes an organization's board of directors as its connection to the external environment (Pfeffer & Salancik, 1978). The main functions of the board are to reduce resource dependence and to act as a conduit for the inflow of external resources (Pfeffer, 1972b, 1973). Boards are a cooptation mechanism that enable resource flows from one party to another by socializing members of external organizations through personal exchanges (Pfeffer & Salancik, 1978). External board members provide resources from their environment and increase firm performance (Hillman et al., 2009), whereas organizations that are more dependent on external resources need to rely more on outside directors (Pfeffer, 1972b, 1973). Early-stage organizations, which do not have access to rich resource pools, have fewer options for gaining external resources than mature organizations. This increases the importance of external board members and their potential effects on performance (Hillman et al., 2009; Lynall et al., 2003).

We expect heterogeneous effects of external board seats on ventures' performance outcomes at different venture development stages. Since firms have to rely more systematically on external board members in early stages, their influence might become path-dependent for later development stages (Lynall et al., 2003). For ventures, the addition of an investor board seat is likely to affect the venture-investor power imbalance, strengthening investor effects (Beckman et al., 2014). When external board members provide resources from their environment, they often do so with the interests of their focal organization in mind (Pfeffer & Salancik, 1978). Thus, ventures are likely to develop more strongly toward the preferences of the corporate investor (Polidoro Jr &

Yang, 2021). This is exacerbated by board members' disproportionate influence in early-stage ventures, which have smaller boards than late-stage ventures (Ewens & Malenko, 2020; Vandenbroucke et al., 2016). As one interviewee (founder) reports: *I tried to prevent the* [CVC] *board seat and had many caveats for the CVC. What the CVC can do depends on whether the* [founding] *team still holds majority* [in the venture]. *Founder power is really important.*"

In contrast, CVC investments without a board seat provide additional resources without the same monitoring. Consequently, ventures enjoy greater autonomy in choosing how to invest the additional resources. Ventures in later stages can be expected to manage resource inflows more strategically (Hite & Hesterly, 2001). In summary, even though ventures become more rigid in later stages and tend to continue on existing trajectories, board seats are likely to change ventures' trajectories by shifting the power balance toward investors. Thus, late-stage board seats (along with investments) are likely to refocus ventures toward investor interests. When investors are assigned to a board seat in late-stage investments, ventures are more limited in the use of the CVC's resources to enhance their commercial performance due to the conflicting interests between the two parties. Further interviews with founders corroborate this. One founder formulates it like: "*Power in the cap table and power in the board leads to too much influence."* Thus, in line with our previous arguments, we formulate the following hypothesis (Table 1 summarizes all hypotheses):

> *Hypothesis 2: The positive relationship between ventures' later development stages and ventures' commercial performance is negatively moderated by CVC investor board seats, so that the presence of a board seat assigned to a CVC investor negatively moderates the relationship between early vs. late stage and venture commercial performance.*

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EMPIRICS

Empirical Setting

We test our hypotheses using matched employer-employee data of the population of Norwegian ventures founded 2004-2015, provided by Statistics Norway (SSB). Employer-employee matched databases are population datasets, collected systematically by countries for the computation of economic indicators. Their use in research has significantly increased due to their high quality. Norwegian data have been used in previous research on entrepreneurship (e.g., Hvide & Møen, 2010; Luzzi & Sasson, 2016). In general, the Norwegian economy is similar to other high-income OECD countries in terms of industrial dynamism and sector split (World Bank, 2019). In terms of investments in new ventures, Norway ranked above the average European venture investment per inhabitant in the 2010s (Dealroom.co, 2018). An advantage of our dataset is that it provides detailed data on firm ownership, investor characteristics, venture characteristics, and venture performance at the population level. In addition, we can ascertain effects on ventures' performance using annual commercial performance data from private firms (Hvide & Møen, 2010). This allows us to go beyond prior commercial outcomes, measuring the actual revenues that ventures achieve.

Sample Construction

Our target population encompasses all independent, private, for-profit ventures in knowledge-intensive industries that are less than ten years old. First, to permit comparisons between ventures' commercial outcomes, we restrict our sample to knowledge-intensive industries in Norway, such as information- and communication technologies, R&D, maritime, and natural resources.[1] These industries are all capital-intensive and seek external investments. Second, we exclude ventures that are in non-private, non-profit sectors, shell corporations, special purpose investment vehicles and corporate subsidiaries. Fourth, to reduce unobserved heterogeneity between ventures' quality, we

[1] For an industry list, please see Appendix A.

restrict our sample to IVC-backed ventures (Alvarez-Garrido & Dushnitsky, 2016; Paik & Woo, 2017), of which 45 percent received at least one CVC investment (on average, each CVC-backed venture has 2.27 CVC investors and 4 investments). We capture only investors with Norwegian entities, as foreign owners that do not invest through a Norwegian entity are not available in the register. This approach results in a panel of 294 firms across 32 industries (3-digit NACE) and 1,729 firm-year observations. Our sampled ventures' average age is 3.9 years, which is similar to previous studies in the CVC literature (e.g., Benson & Ziedonis, 2009; Park & Steensma, 2012).

Measures

Dependent variable: *Commercial performance* is operationalized as the venture's annual total operating revenues (in 1,000 Norwegian crowns [NOK]) and natural log transformed. Whereas sales data for ventures are rarely accessible in venture research and in CVC research (except for survey studies e.g., Bertoni et al., 2013), we have access to ventures' annual revenues. This extends prior studies, which rely on event-based measures, such as IPOs (Kim & Park, 2017; Wang & Wan, 2013) or proxy measures of performance, such as product approvals (Pahnke et al., 2015) or commercial trademarks (Uzuegbunam et al., 2019).

Independent variables: First, *Venture stage* is a categorical variable based on the venture's age, which is transformed in three categories: early- (1-3 years), intermediate- (4-6 years), and late-stage (7-9 years). This categorization corresponds to prior measures of venture development stages (Kim & Park, 2017). The second independent variable is *CVC investment*, defined as a binary variable that equals to 1 when a venture receives CVC in a focal year, and 0 otherwise. We identify investment by accessing firms' ownership structures, which contain the ownership data of non-public firms. Finally, the variables *CVC board* and *CVC no board* are decomposed in two nested binary variables based on whether any of the CVC investors has obtained a board seat along

with the investment. When a CVC investor has received a board seat, *CVC board* equals 1 and *CVC no board* 0. When a CVC investor has received no board seat *CVC board* equals 0 and *CVC no board* equals 1 (both variables equal 0 in the absence of CVC investment). Nested binary variables have been used in the CVC literature to compare different investor characteristics (Alvarez-Garrido & Dushnitsky, 2016; Bae & Lee, 2020).

We control for characteristics at the CVC investor, IVC investor, and venture level. *Accessibility of CVC investors*[2] is measured as a ratio from 0 to 1 that denotes whether the venture is in the same region in Norway as the investors. We assign the value 1 if an investor and venture are in the same region and 0 if they are not, calculating the ratio as the sum for all investors in any given year, divided by the total investors. Accessibility controls for physical access to CVC investors, which increases ventures' innovation outcomes (Alvarez-Garrido & Dushnitsky, 2016). *Total years of CVC* is measured as natural logarithm of cumulative years of CVC investment to account for the effects of experience with investors and expose to venture financing (Paik & Woo, 2017). It is transformed to account for outliers in investment duration. *Number of CVC investors* is measured as count and used to control for the inflow of resources from more than one CVC investor (Kim & Park, 2017; Paik & Woo, 2017). *CVC interindustry* is measured as binary variable and denotes whether at least one of the CVC investors is in the same industry (Kim et al., 2019). *CVC investors' R&D intensity* and *CVC investors' revenue* are measured as natural logarithm of investors' R&D intensity and revenues in 1,000 NOK to control for investor size and strategic orientation toward innovation (Bae & Lee, 2020).

Total IVC equity is measured as ownership in percent, *Total years of IVC* is measured as natural logarithm of cumulative years of IVC investment, and *IVC board seat* is measured as count for the

[2] Not all ventures receive CVC. We alter this variable to *accessibility* of any investor (IVC/CVC) in the first stage

number of board seats that ICVs have in the venture. All three variables control for the influence if ICV investors. *Board size* is measured as total number of board directors in the venture and accounts for the influence from inside- and outside directors (Garg, 2013; Gompers et al., 2020). *Employees* is measured as natural logarithm of venture employees and *Total assets* is measured as natural logarithm of ventures' total assets in 1,000 NOK. Both control for ventures' differences in resource endowment and size. *Employee equity* is measured as employees' ownership in the venture in percent and used to control for the independence of a venture's decision-making (Paik & Woo, 2017). *Employee education* is measured as the average years of the venture team's higher education. It is included because educational background affects opportunity identification, representing a part of the human capital endowment (Gruber et al., 2012). Finally, we include dummies for industry, region and year in in our regressions on likelihood of CVC investment, as well as venture fixed effects in our regressions on ventures' commercial performance.

Empirical Strategy

We analyze *Commercial performance* as a function of *Venture stage*, *CVC investment*, *CVC board,* and *CVC no board*. To do so, we estimate a fixed effects panel OLS regression with robust standard errors clustered at the venture level. Lastly, we take several steps to reduce the effect of possible endogeneity issues. We recognize that investors select the ventures they invest in (and vice versa) and this might raise issues of endogeneity in the relationship between CVC investment and ventures' *Commercial performance*. Also, ventures that receive CVC investment may be systematically different from ventures that do not (Park & Steensma, 2013). To limit concerns about endogeneity, we estimate a two-stage selection model that includes first-stage residuals in the second stage (Terza et al., 2008; Wooldridge, 2010).

The first stage is a probit model with *CVC investment* as dependent variable and *Venture stage, Employees, Employee equity, Employee education, Investor accessibility, CVC interindustry, CVC investor R&D intensity, CVC investor revenue* as independent variables. In addition, the first stage includes region, industry, and year dummies. In the first stage, we include the instrument *CVC availability,* which is the relative CVC availability in a particular industry as total CVC investments in the preceding year divided by IVC investments in the preceding year (Dushnitsky and Shaver, 2009). We thus assume that industry level supply of CVC investments is unrelated to a focal venture's characteristics, yet each venture is more likely to receive CVC when availability is high, ceteris paribus. This instrumental variable was chosen because it captures the likelihood of a venture to access CVC financing, while not being directly related to venture commercial performance. The second stage is an OLS regression with *Commercial performance* as the dependent variable and the full set of lagged independent variables. We lag all independent variables to reduce simultaneity bias. In addition, we include fixed effects at the venture, industry, and year levels in the second stage. This two-stage and instrumental variable empirical strategy follows an established approach in the prior CVC research (Alvarez-Garrido & Dushnitsky, 2016; Kim & Park, 2017; Paik & Woo, 2017).

RESULTS

Table 2 contains the descriptive statistics, Table 3 the correlation matrix, and Table 4 the first-stage results of the probit regression model estimating the likelihood that ventures receive a CVC investment. Examining the dependent and independent variables, a venture reports on average total revenues for approximately 174,000 NOK (log value = 5.158). CVC investments without associated board seat (mean = 0.08) are more common than CVC investments with associated board seat (mean = 0.05) (t=2.85). Examining the correlation matrix, we control for

multicollinearity and find no indication that it is a concern in our data (highest variance inflation factor (VIF) = 6.05, associated with number of CVC investors, and mean VIF = 4.15). In Model 1 in Table 4, the instrumental variable *CVC availability* is significant and positive (β=3.822, p=0.018), as expected (Alvarez-Garrido & Dushnitsky, 2016). The regression coefficient for *venture stage* is significant and negative (β=-0.138, p<0.001), indicating that younger ventures are more likely to receive *CVC investment.* Colombo and Shafi (2016) equally find a negative effect of age on the propensity to receive CVC in early-stage ventures.

---------- INSERT TABLES 2, 3, AND 4 HERE ----------

Models 1 and 2 in Table 5 show the second-stage results of the OLS regressions, estimating the effect of *CVC investment* in interaction with *Venture stage* on *Commercial performance*. The coefficients for *First-stage residuals* are moderately significant in Model 2 (β=0.578, p=0.087). Controlling for this, the remaining associations between *Commercial performance* and investor characteristics are likely based on investors' treatment effects (Alvarez-Garrido & Dushnitsky, 2016). H1 states that CVC investments in later venture development stages have a greater effect on ventures' commercial performance than early-stage investments. In line with prior studies (Pahnke et al., 2015), Model 1 reports no direct effect of *CVC investment* on *Commercial performance* (β=0.156, p=0.454). Model 2 shows positive and significant results (β=1.401, p=0.007) for *CVC investment* in late-stage ventures compared to early-stage investments. CVC investment at the intermediate stage influences *Commercial performance* (β=0.877, p=0.062) when compared to investment at the early stage. The difference between the effects at the intermediate stage and the late stage is large ($\beta_{7\text{-}9} - \beta_{4\text{-}6}$=0.524), but not significant (t= -1.42, p=0.157). This provides evidence that later-stage CVC investments affects positively ventures' commercial performance more than early-stage investments. These results grant support to

Hypothesis 1. We illustrate this graphically in Figure 1. Accounting for the log transformation of the dependent variable,[3] late-stage investments increase *Commercial performance* threefold when compared to early-stage investments. In monetary terms, *Commercial performance* rise between 174,000 NOK - 528,000 NOK (mean 350,000 NOK), whereas the median *Commercial performance* for all ventures is 774,000 NOK.

---------- INSERT TABLE 5 AND FIGURE 1 HERE ----------

Model 1 and Model 2 in Table 6 show the second-stage results of the OLS regressions, estimating the effect of *CVC board* and *CVC no board* in interaction with *Venture stage* on *Commercial performance*. H2 states that the positive relationship between ventures' later development stages and ventures' commercial performance is negatively moderated by CVC investor board seats. In Model 1 we report estimates of the direct effects of CVC investments with and without the allocation of an investor board seat. According to the results of Model 1, we find no evidence for a direct effect of *CVC board* on *Commercial performance* (β=0.396, p=0.138). Model 2 displays the interaction effects and shows a positive and significant coefficient (β=1.224, p=0.009) for *CVC no board* in late-stage ventures compared with early-stage ventures. In contrast to investment without board seats, investments with allocated board seat show a large difference between early-stage and late-stage that is weakly significant (β=1.480, p=0.090). This is in line with our predictions for Hypothesis 2. Comparing the intermediate stage (*4-6*) to the late stage (*7-9*) for investments with *CVC no board*, there is not a significant difference in the coefficient ($\beta_{7\text{-}9} - \beta_{4\text{-}6}$=0.11; t=-0.21; p= 0.831). For effect sizes, we note that late-stage investments (stage 7-9) with

[3] Effect size in % = (exp(β)-1)*100), in our case ((exp(1.401)-1)*100) = 3.04. In TNOK: exp(5.158)*3.04

CVC no board increase *Commercial performance* by more than twofold (x2.4) compared to early-stage investments (stage 1-3). We illustrate this graphically in Figure 2.

---------- INSERT TABLE 6 AND FIGURE 2 HERE ----------

Possible Mechanisms

Our main argument is that late-stage investments affect ventures' commercial performance to a greater extent than early-stage investments. We argue that this effect can be attributed to investors' power imbalance that shifts ventures' focus away from their own commercial interests toward investors' main interest of innovation outcomes. We show that an increase in investors' power imbalance over ventures through the addition of investor board seats exacerbates the effect of venture-investor power imbalance, diminishing ventures' commercial performance. In this section we explore possible underlying mechanisms to explain how investor board seats drive this effect.

Ventures use the addition of new investors to limit the power of the current investors over the venture (Ma et al., 2013; Makarevich, 2018). Moreover, larger syndicates lead to smaller shares for each individual investor, which gives the venture greater relative power in relation to any single investor (Garg, 2013; Lei et al., 2017). While the power imbalance between the syndicate and the venture may still be skewed toward the investors, coordination and collaboration costs between investors are likely to reduce the power of investors over the venture (Lei et al., 2017). Similarly, the literature on ventures' alliances finds that concurrent partnerships with multiple established firms lead to incased resource appropriation by ventures, as corporates monitor and balance each other rather than colluding against the venture (Knoben & Bakker, 2019). Consequently, investor board seats likely, at least in part, might reflect investors' attempt to dissuade ventures from forming investment relationships with new corporate investors. Our interviews gave further support to these claims. A founder phrases is succinctly: "*There are issues with competition if a*

CVC has too much equity and a board seat. They [CVC] *ask whether they* [CVC] *can buy from a competitor and potential partners ask whether they* [potential corporate partners] *can buy from their direct competitor* [CVC]".

To test for this possibility, we re-estimate the second-stage regressions with *Δ number of investors* in the following year as dependent variable (Table 7). *Δ number of investors* is measured as change in count of other CVC investors in a venture in year t+1 after the focal CVC investment. Model 1 reports OLS regressions on *Δ number of investors*, while Model 2 reports its inverse hyperbolic sine transformation (IHS), which provide a more conservative treatment of outliers. Since the change in the number of CVC investors is highly skewed and contains negative values, we use the IHS function[4] to reduce the influence of extreme values but retain easily interpretable results (Burbidge et al., 1988; Sauerwald et al., 2016).

---------- INSERT TABLE 7 HERE ----------

Both Models 1 and 2 in Table 7 show that there is a decrease in number of investors for late-stage investments with an associated board seat compared to not having a board seat. To examine whether the effect is due to divestment of existing investors or due to decreasing investment of new CVC investors, we split the analyses in Model 1 into two probit analyses. In Table 7, Model 3 ascertains whether the likelihood of obtaining additional investors increases in the following year while Model 4 whether the likelihood that current investors divest increases in the following year after granting the new CVC investor a board seat. We observe 256 additional CVC investments and 154 cases in which corporate investors divest. Model 3 suggests that the likelihood of obtaining new CVC investors in late-stages decreases significantly after granting a CVC investor a board

[4] $\sinh^{-1}(x) = \log(x + (x^2 + 1)^{1/2})$.

seat (β=-1.623, p=0.005). Similarly, Model 4 shows that the likelihood that current CVC investors divest increases (β=3.107, p=0.027). These results indicate that CVC investors who gain additional board seats use these control rights to hinder new CVC investors from investing. Moreover, existing investors sell their shares after such rights are granted, indicating a substitution effect.

We hypothesize that this rearrangement of ventures' CVC investor portfolio explains some of the differences in the commercial performance effects of early- and late-stage CVC investments. We report additional descriptive statistics of new CVC investors and divesting CVC investors after *CVC board* and *CVC no board* (Table 8). The likelihood of obtaining new investors is lower for ventures who allocate a board seat to a CVC investor (Table 7, Model 3); when they receive new investors, these are, on average, fewer CVC investors and active in different industries than the investors holding a board seat (Table 8). Moreover, new investors have smaller equity shares when prior investors hold a board seat. In the case of late-stage ventures, the shares are on tenth the size of the investments of the CVC investment round with a board seat (Table 8). This suggests that new investors have substantially lower influence on the venture when prior investments include a board seat for CVC investors. This is suggestive that CVC investors protect their influence more successfully and alter the ventures' investors syndicate when they change the power balance through a board seat.

---------- INSERT TABLE 8 HERE ----------

Current investors are more likely to divest from ventures that appoint a CVC board seat as part of their new investments (Table 7, Model 4). When investors divest from ventures that have allocated a new CVC board seat, they are fewer and from industries similar to that of the new investors who hold a board seat. Also, relative to the investors who obtain a board seat, new investors obtain smaller equity shares (70 percent compared to investors who obtain a board seat). Compared to

the divestments of investors after a new investment without a board seat, the divestments are much smaller in terms of equity share (Table 8). This suggests that divestments are more likely and larger when focal investments include a board seat for CVC investors. Investors protect their influence more successfully and alter the composition of the ventures' CVC investors when the power balance shifts toward investors with a board seat.

DISCUSSION

Analyzing 294 Norwegian IVC-backed ventures in knowledge-intensive industries, we find that CVC investments have a differential effect on early- and late-stage ventures' commercial performance. This extends prior research on ventures' commercial outcomes post-CVC investment (Pahnke et al., 2015). CVC investments influence the commercial performance of ventures more strongly in late-stage investments. We attribute these findings to arguments grounded in resource dependence theory: early-stage ventures have less power and are more heavily influenced by the CVC investor's main goal – knowledge creation (Ma, 2020) – whereas late-stage ventures are able to appropriate more value for their own commercial organization due to a more balanced relationship with CVC investors. We further investigate the effects of CVC board seats on their potential to change the venture-investor power dynamics and to influence venture outcomes. We find that board seats granted to a CVC investor limit ventures' commercial performance. In contrast, we find that ventures without CVC investors on their boards can appropriate CVC resources to improve their commercial outcomes. We analyze this effect further and find that CVC board seats prevent ventures from taking on additional corporate investors, even leading some investors to sell their shares in ventures. This partially explains ventures' lower commercial performance, as it diminishes access to investors. We corroborate research on negative effects of

divestment of IVC investors on ventures' market valuation, limiting ventures' commercial outcomes (Shafi et al., 2020).

Our study contributes to the understanding of whether and how the timing of CVC investment affects ventures' performance outcomes. Extending prior work (Kim & Park, 2017), we show that investment timing has a significant effect on ventures' commercial performance. We propose that these differences in the effect on commercial performance reflect differences in venture-investor power dynamics for early- and late-stage ventures. As ventures have less power in the venture-investor relationship in early stages (Park & Tzabbar, 2016), their post-investment focus shifts toward the main interest of the investor. This can result in the prioritization of investors' interest over ventures' short-term commercial gains (Uzuegbunam et al., 2019). Whereas prior studies found mixed results on the commercial outcomes of ventures in relation to CVC investment (Bertoni et al., 2013; Pahnke et al., 2015; Uzuegbunam et al., 2019), we show that this might be partially attributable to CVC investment timing. We find that late-stage (vs. early stage) ventures' commercial performance increases after investment. Also, we show that when the venture-investor power imbalance increases, such as through the addition of a board seat assigned to the corporate investor, the positive effects of late-stage investments on commercial performance is dissipated. As investors are mainly concerned with knowledge gains, late-stage investments that include a CVC board seat produce smaller commercial gains for ventures than late-stage investments without such a board seat.

We contribute to the growing literature on the timing of ventures' resource acquisition (Maurer & Ebers, 2006; Park & Tzabbar, 2016), adding novel inferences about corporate investors as resource providers. We show that resources acquired at different venture development stages lead to different performance outcomes. Building on previous work, we show that the board can alter

these effects as a channel for resource transfer. Thus, the dynamics in venture- investor relationships are more complex than previously assumed. While venture executives influence investment outcomes (Park & Tzabbar, 2016), board members also have an effect on performance. This extends prior work on the antecedents of board seat allocation in minority equity partnerships (Devarakonda & Reuer, 2019), offering explanations of their outcomes.

We also contribute to the understanding of resource dependence relationships between ventures and their investors. In the context of CVC, we have a unique opportunity to analyze relationships between established firms and ventures. We find that such ventures use resource constraint absorption (e.g., CVC investments) and cooptation (e.g., external board members) in concert. Prior studies on RDT have mainly examined only one of the three RDT mechanisms. We show that using both mechanisms in concert can profoundly influence outcomes and lead to different results in ventures' pursuit of reducing resource dependencies. Weaker actors should therefore pay special attention to their use of different tactics to reduce dependency (e.g., cooptation, constraint absorption and avoidance), as these might inadvertently influence each other.

Moreover, we offer mechanisms rooted in RDT and differences in power relationships between investors and ventures that extend prior results primarily focused on imprinting effects in early-stage ventures. Early investments may be less conducive to commercial outcomes due to their increased impact on innovation outcomes, which creates a lasting imprinting effect (Kim & Park, 2017). However, while imprinting may explain early-stage effects, imprinting effects disperse over time (De Cuyper et al., 2020) and cannot explain direct changes in ventures' networks, such as the portfolio of corporate investors. We offer such explanations by showing shifts in venture-investor power dynamics and their associated performance outcomes.

Finally, we provide further evidence in the debate on venture age's influence on the propensity to receive CVC. From a venture's perspective, early-stage ventures may be more resource dependent than late-stage ventures, as their resource pools are less developed (Park & Tzabbar, 2016). Ventures potentially postpone relationships with corporate partners and investors to counterbalance the potential misappropriation of their IPs (Katila et al., 2008). While CVCs may misappropriate ventures' knowledge in certain situations, preventing the formation of other investment ties (Dushnitsky & Shaver, 2009), ventures in general increasingly seek out CVC investments in earlier stages (Colombo & Shafi, 2016). This can be credited to early-stage ventures' high reliance on external resources and CVC's positive effects on venture innovation beyond IVC investment, as it is difficult to substitute CVC investors' resources with other types of partners (Uzuegbunam et al., 2019).

Studies of the differences in power balance between investors and ventures at different development stages examined timing as a defense against expropriation. These studies came to conflicting conclusions as to whether ventures defer investments to later development stages as a defense mechanism (Katila et al., 2008) or whether ventures' resource needs in early stages outweigh such considerations (Colombo & Shafi, 2016). This suggests that ventures might use timing as a defense against expropriation, but it seems more likely that investment timing is the result of a matching process between investors and investment seekers who are conscious of each other's resource needs and of the likely outcomes of different power relationships.

We offer an RDT-based theoretical explanation of why CVC investments are more likely in early- than late-stage ventures, extending knowledge about age as defense against expropriation. Given the resource needs of ventures and CVC investors, we can expect that the venture-investor power imbalance is higher for early-stage ventures than for late-stage ventures. Situations of high power

imbalance are unlikely to lead to full constraint absorption (i.e., M&A) (Casciaro & Piskorski, 2005). When full constraint absorption is unlikely, ventures can still partially absorb resource constraints through alliances and CVC (Diestre & Rajagopalan, 2012; Katila et al., 2008). In other words, as ventures cannot acquire incumbents' resources by other means, and as potential acquirers are less interested in early-stage ventures, contractual relationships such as CVC become the most viable option for ventures to access incumbents' resource pools.

Limitations

Our study faces limitations. First, we do not consider an ultimate outcome of knowledge-generating activities, such as patenting or developed products. While studying such outcomes would have proven useful as an extension, not all ventures in our sample patent equally across industries. As a result, we chose to focus on ventures' commercial performance, which should ultimately reflect the effect of knowledge-generating activities within the venture. While we control for knowledge generating inputs, such as venture assets and investor R&D intensity we cannot control for innovation outcomes due to lacking data availability. Second, our sample size of 294 ventures is quite small, yet comparable to prior studies (e.g., Alvarez-Garrido & Dushnitsky, 2016; Benson & Ziedonis, 2009). We are relying on this small sample of Norwegian ventures to access detailed financial data of private ventures, detailed information on board seats, and detailed information of individual investments and divestments. Whereas larger samples of US ventures might offer larger samples, similar data on private firms are not available. Third, while the Norwegian context is similar to other high-income OECD countries, scholars should study further whether its special social security system and labor laws influence the study's results. While prior studies on entrepreneurship in Norway seem to be generalizable beyond the European context (e.g.,

Hvide & Møen, 2010; Luzzi & Sasson, 2016), we do not know enough about CVC in various institutional environments (Colombo & Shafi, 2016).

Conclusion

In summary, studying the timing of CVC investments and its associated outcomes is of high theoretical and practical relevance. While investors may come to different conclusions about how they should stage their venture investments and how much oversight is needed, ventures should also evaluate the purpose of potential collaboration with corporate investors. Given our findings, early-stage ventures in particular may wish to reconsider an investment for commercial gains in early stages. Such ventures should pay attention to the benefits and costs of board seats for corporate investors, as granting control rights to any single investor influences future collaboration with CVC investors. With our study, we aim to inspire others to conduct research on the timing-based heterogeneity of CVC investment outcomes. Future studies could assess whether performance and learning outcomes differ based on investor profiles or whether other means of resource constraint absorption by ventures, such as alliances or M&A, provide different outcomes due to their timing.

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TABLES

Table 1: Summary of the Theoretical Framework

DV: Comm. Performance	**H1:** CVC investment	**H2:** CVC investment, no board seat	**H2:** CVC investment, board seat
Early stage	**o**	**o**	**o**
Late stage	**+**	**+**	**o**

Note: **o** represents the baseline effect, whereas + represents a positive increase from the baseline

Table 2: Descriptive Statistics

	Variable	(1) N	(2) Mean	(3) SD	(4) Min	(5) Max
1	Commercial performance	1,601	5.158	3.935	0	12.84
2	Venture stage (cat)	1,729	3.002	2.226	1	7
3	CVC investment (binary)	1,729	0.135	0.342	0	1
4	CVC board (binary)	1,729	0.056	0.229	0	1
5	CVC no board (binary)	1,729	0.081	0.271	0	1
6	CVC accessibility	1,729	0.299	0.441	0	1
7	Years CVC investment (ln)	1,729	0.433	0.671	0	2.303
8	Num. CVC investors	1,729	0.887	1.910	0	22
9	CVC interindustry	1,729	0.273	0.428	0	1
10	CVC investor R&D intensity	1,729	0.004	0.028	0	0.488
11	CVC investor revenue (ln)	1,729	4.098	11.04	0	128.6
12	Years VC investment (ln)	1,729	0.683	0.700	0	2.303
13	Total VC equity	1,729	0.124	0.175	0	1
14	VC board seats	1,729	0.255	0.513	0	3
15	Board size	1,729	3.492	1.457	0	10
16	Employees (ln)	1,729	1.954	1.052	0	6.933
17	Total assets (ln)	1,601	14.67	2.807	0	21.59
18	Employee equity	1,729	0.586	0.310	0	1
19	Employee education	1,729	2.478	1.372	0	7.699
20	Venture industry (1-dig)	1,729	5.770	2.113	0	8
21	Year	1,729	2,011	2.842	2,004	2,015
22	Venture region	1,729	2.370	1.346	1	5
23	Investor accessibility	1,729	0.409	0.354	0	1
24	CVC availability	1,729	0.499	0.162	0.313	0.864
25	First stage residuals	1,729	0.083	0.184	0.000	0.978

Table 3: Correlation Matrix

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1 Commercial performance	1																							
2 Venture stage (cat)	0.13	1																						
3 CVC investment (binary)	-0.03	-0.08	1																					
4 CVC board (binary)	0.01	-0.07	0.62	1																				
5 CVC no board (binary)	-0.04	-0.05	0.74	-0.07	1																			
6 CVC accessibility	-0.02	0.12	0.4	0.28	0.28	1																		
7 Years CVC investment	0	0.24	0.32	0.19	0.24	0.74	1																	
8 Num. CVC investors	-0.05	0.1	0.48	0.17	0.46	0.48	0.59	1																
9 CVC interindustry	-0.04	0.11	0.42	0.24	0.34	0.74	0.73	0.55	1															
10 CVC investor R&D intensity	0.04	-0.03	0.12	0.09	0.07	0.16	0.14	0.15	0.09	1														
11 CVC investor revenue	0	0.06	0.39	0.16	0.35	0.38	0.47	0.84	0.45	0.21	1													
12 Years VC investment	0.07	0.27	0.02	-0.02	0.04	0.09	0.2	0.1	0.11	-0.03	0.04	1												
13 Total VC equity	0.08	0.03	-0.05	-0.01	-0.05	-0.08	-0.04	-0.09	-0.05	-0.03	-0.09	0.56	1											
14 VC board seats	-0.04	0.03	-0.04	0	-0.05	0.05	0.01	-0.07	0.03	-0.03	-0.03	0.32	0.35	1										
15 Board size	0.2	0.07	0.16	0.14	0.08	0.2	0.22	0.16	0.21	0.07	0.2	0.19	0.11	0.12	1									
16 Employees (ln)	0.2	0.15	0.2	0.01	0.25	0.18	0.31	0.34	0.28	-0.04	0.21	0.14	-0.09	-0.15	0.24	1								
17 Total assets (ln)	0.35	0.05	0.13	0.06	0.11	0.01	0.07	0.11	0.04	-0.01	0.03	0.16	0.09	0.01	0.27	0.33	1							
18 Employee equity	-0.04	-0.03	-0.19	-0.17	-0.09	-0.3	-0.3	-0.24	-0.27	-0.14	-0.22	-0.33	-0.45	-0.16	-0.27	0.18	-0.14	1						
19 Employee education	0.19	0.13	0.18	0.03	0.2	0.18	0.28	0.27	0.23	-0.02	0.14	0.14	-0.04	-0.15	0.21	0.82	0.3	0.07	1					
20 Venture industry (1-dig)	-0.02	-0.01	0	-0.01	0.01	-0.06	-0.04	0	-0.01	-0.05	0.03	0.04	0.07	0.01	0.04	-0.02	-0.1	-0.03	0.05	1				
21 Year	0.08	0.46	-0.09	-0.09	-0.03	0.1	0.16	0.06	0.04	-0.05	0.03	0.22	0.06	0.07	-0.03	0.04	-0.02	-0.06	0.02	-0.02	1			
22 Venture region	0.04	0.03	0.04	0.06	-0.01	0.04	0.1	0.09	0.09	0.05	0.16	0.02	0.09	0.08	0.19	-0.13	0.1	-0.15	-0.2	-0.23	-0.04	1		
23 Investor accessibility	0.01	0.14	0.29	0.18	0.21	0.73	0.52	0.33	0.5	0.06	0.25	0.49	0.27	0.28	0.26	0.1	0.05	-0.41	0.11	0.01	0.18	0	1	
24 CVC availability	-0.04	-0.27	0.1	0.09	0.04	-0.05	-0.1	-0.05	-0.03	0.01	-0.01	-0.15	-0.07	-0.03	0	-0.05	0	0.07	-0.03	-0.02	-0.48	0.01	-0.13	1
25 First stage residuals	-0.02	-0.03	0.68	0.46	0.47	0.47	0.41	0.38	0.43	0.07	0.26	0.04	-0.03	-0.01	0.12	0.17	0.09	-0.2	0.17	-0.02	-0.01	0.03	0.33	0.01

Table 4: First Stage Longitudinal Probit Regression with Venture Stage as Predictor of CVC Investment and Relative CVC Availability as Instrument

DV: CVC investment	**(1) Probit**
Venture stage (cat)	-0.138
	(0.031)
	[0.000]
Employees (ln)	0.152
	(0.122)
	[0.212]
Employee equity	-0.661
	(0.238)
	[0.005]
Employee education	0.084
	(0.085)
	[0.321]
Investor accessibility	1.111
	(0.233)
	[0.000]
CVC interindustry	1.271
	(0.180)
	[0.000]
CVC investor R&D intensity	1.579
	(1.550)
	[0.309]
CVC investor revenue	0.026
	(0.005)
	[0.000]
CVC availability	3.822
	(1.611)
	[0.018]
Constant	-4.480
	(0.926)
	[0.000]
Industry, Region and Year Dummies	Yes
Observations	1,729
Number of Ventures	294
chi2	233.606
loglikelihood	-440.499

Robust s.e. clustered at venture level in parentheses. P-values in brackets
Similar results have been achieved with age as continuous variable

Table 5: CVC Investment and Venture Stage as Predictor of Venture Performance (main)

DV: Commercial performance	(1) OLS	(2) OLS
CVC investment (t-1)	0.156	-0.228
	(0.208)	(0.280)
	[0.454]	[0.417]
Venture stage 4-6 (t-1)	0.301	0.260
	(0.189)	(0.189)
	[0.113]	[0.170]
Venture stage 7-9 (t-1)	0.353	0.338
	(0.298)	(0.297)
	[0.236]	[0.256]
CVC investment x Venture stage 4-6 (t-1)		0.877
		(0.469)
		[0.062]
CVC investment x Venture stage 7-9 (t-1)		1.401
		(0.517)
		[0.007]
First stage residuals	0.520	0.578
	(0.341)	(0.337)
	[0.129]	[0.087]
CVC accessibility (t-1)	-0.268	-0.181
	(0.332)	(0.308)
	[0.419]	[0.558]
Years CVC investment (t-1)	0.126	-0.004
	(0.266)	(0.261)
	[0.637]	[0.987]
Num. CVC investors (t-1)	0.017	-0.021
	(0.130)	(0.126)
	[0.896]	[0.868]
CVC interindustry (t-1)	0.250	0.333
	(0.323)	(0.334)
	[0.440]	[0.319]
CVC investor R&D intensity (t-1)	1.614	1.821
	(1.768)	(1.862)
	[0.362]	[0.329]
CVC investor revenue (t-1)	0.010	0.010
	(0.025)	(0.024)
	[0.688]	[0.692]
Years VC investment (t-1)	-0.196	-0.222
	(0.180)	(0.177)
	[0.277]	[0.211]
Total VC equity (t-1)	-0.009	0.047
	(0.708)	(0.697)
	[0.990]	[0.947]
VC board seats (t-1)	0.275	0.280
	(0.166)	(0.167)
	[0.099]	[0.095]
Board size (t-1)	0.017	0.041
	(0.103)	(0.101)
	[0.870]	[0.683]
Employees (ln) (t-1)	0.656	0.627
	(0.343)	(0.341)
	[0.057]	[0.067]
Total assets (ln) (t-1)	0.159	0.155
	(0.054)	(0.054)
	[0.003]	[0.004]
Employee equity *(t-1)*	-0.438	-0.482
	(0.538)	(0.529)

	[0.416]	[0.363]
Employee education *(t-1)*	-0.021	-0.027
	(0.221)	(0.217)
	[0.925]	[0.900]
Constant	0.646	0.666
	(1.098)	(1.072)
	[0.557]	[0.535]
Venture, Industry and Year FE	Yes	Yes
Observations/Ventures	1,298/294	1,298/294
Adjusted R2	0.088	0.095
F-stat	5.019	5.364
Prob > F	0.000	0.000

Robust s.e. clustered at venture level in parentheses. P-values in brackets

Table 6: CVC board seats and Venture Stage as Predictor of Venture Performance (main)

DV: Commercial performance	(1) OLS	(2) OLS
CVC no board (t-1)	-0.060	-0.506
	(0.297)	(0.368)
	[0.839]	[0.170]
CVC board (t-1)	0.396	0.080
	(0.266)	(0.410)
	[0.138]	[0.846]
Venture stage 4-6 (t-1)	0.291	0.247
	(0.190)	(0.190)
	[0.127]	[0.195]
Venture stage 7-9 (t-1)	0.323	0.314
	(0.301)	(0.299)
	[0.284]	[0.296]
CVC no board x Venture stage 4-6 (t-1)		1.114
		(0.619)
		[0.073]
CVC no board x Venture stage 7-9 (t-1)		1.224
		(0.464)
		[0.009]
CVC board x Venture stage 4-6 (t-1)		0.615
		(0.610)
		[0.314]
CVC board x Venture stage 7-9 (t-1)		1.480
		(0.870)
		[0.090]
First stage residuals	0.511	0.563
	(0.337)	(0.336)
	[0.130]	[0.095]
CVC accessibility (t-1)	-0.295	-0.210
	(0.329)	(0.298)
	[0.369]	[0.482]
Years CVC investment (t-1)	0.107	-0.025
	(0.268)	(0.261)
	[0.689]	[0.923]
Num. CVC investors (t-1)	0.041	-0.004
	(0.135)	(0.133)
	[0.763]	[0.975]
CVC interindustry (t-1)	0.272	0.377
	(0.325)	(0.335)
	[0.404]	[0.262]
CVC investor R&D intensity (t-1)	1.523	1.844
	(1.785)	(1.908)
	[0.394]	[0.335]
CVC investor revenue (t-1)	0.008	0.008
	(0.024)	(0.024)
	[0.756]	[0.741]
Years VC investment (t-1)	-0.184	-0.210
	(0.180)	(0.175)
	[0.306]	[0.230]
Total VC equity (t-1)	-0.058	0.009
	(0.707)	(0.694)
	[0.935]	[0.989]
VC board seats (t-1)	0.269	0.272
	(0.165)	(0.165)
	[0.104]	[0.100]
Board size (t-1)	0.014	0.041
	(0.104)	(0.100)

	[0.895]	[0.687]
Employees (ln) (t-1)	0.678	0.650
	(0.345)	(0.343)
	[0.050]	[0.059]
Total assets (ln) (t-1)	0.162	0.158
	(0.054)	(0.054)
	[0.003]	[0.004]
Employee equity *(t-1)*	-0.416	-0.447
	(0.536)	(0.529)
	[0.439]	[0.398]
Employee education *(t-1)*	-0.034	-0.043
	(0.222)	(0.218)
	[0.880]	[0.845]
Constant	0.545	0.567
	(1.089)	(1.058)
	[0.617]	[0.592]
Venture, Industry and Year FE	Yes	Yes
Observations/Ventures	1,298/294	1,298/294
Adjusted R2	0.089	0.095
F-stat	5.193	5.792
Prob > F	0.000	0.000

Robust s.e. clustered at venture level in parentheses. P-values in brackets

Table 7: Board & Venture Stage as Predictor of New CVC investors & divestments (main)

	Δ Number of investors		New investor	Divestment
	(1) OLS	(2) OLS	(3) Probit	(4) Probit
CVC no board *(t-1)*	1.117	0.689	1.952	-2.917
	(0.306)	(0.140)	(0.301)	(0.672)
	[0.000]	[0.000]	[0.000]	[0.000]
CVC board *(t-1)*	0.332	0.364	1.671	-2.121
	(0.266)	(0.144)	(0.314)	(1.015)
	[0.212]	[0.012]	[0.000]	[0.037]
Venture stage 4-6 *(t-1)*	0.227	0.138	0.346	0.006
	(0.095)	(0.053)	(0.135)	(0.174)
	[0.018]	[0.010]	[0.011]	[0.973]
Venture stage 7-9 *(t-1)*	0.643	0.320	0.391	-0.169
	(0.250)	(0.122)	(0.173)	(0.277)
	[0.011]	[0.009]	[0.024]	[0.540]
CVC no board x Venture stage 4-6 *(t-1)*	0.108	0.038	-0.879	0.187
	(0.378)	(0.163)	(0.385)	(0.774)
	[0.775]	[0.817]	[0.022]	[0.809]
CVC no board x Venture stage 7-9 *(t-1)*	2.138	0.709	-0.636	-0.712
	(0.915)	(0.278)	(0.450)	(0.900)
	[0.020]	[0.011]	[0.157]	[0.429]
CVC board x Venture stage 4-6 *(t-1)*	0.542	0.324	-0.189	--
	(0.372)	(0.213)	(0.498)	
	[0.146]	[0.130]	[0.704]	
CVC board x Venture stage 7-9 *(t-1)*	1.398	0.248	-1.623	3.107
	(0.919)	(0.385)	(0.573)	(1.407)
	[0.130]	[0.520]	[0.005]	[0.027]
First stage residuals	0.251	0.382	1.827	-3.504
	(0.475)	(0.183)	(0.449)	(1.308)
	[0.598]	[0.037]	[0.000]	[0.007]
Full Controls	Yes	Yes	Yes	Yes
Venture, Industry and Year FE	Yes	Yes	No Ven. FE	No Ven. FE
Observations/Ventures	1,369/294	1,369/294	1,369/294	1,332/294
Adjusted R2	0.572	0.551		
F-stat	21.834	27.846	238.647	173.827
Prob > F	0.000	0.000	-442.877	-241.304

Robust s.e. clustered at venture level in parentheses. P-values in brackets
Board seat x Venture age 4-6 *(t-1)* predicts failure perfectly, 37 observations dropped in model 9

Table 8: Descriptive Statistics of New CVC investors and Divestment of CVC investors

		New investors post-investment			Divesting investors post-investment		
Variable	**Board (Y/N)**	**Age 1-3**	**Age 4-6**	**Age 7-9**	**Age 1-3**	**Age 4-6**	**Age 7-9**
Avg. Δ Investors	No board	+4.5	+3.6	+1.5	-1.9	-2.6	-3.5
	Board	+1.5	+2.0	+2.5	-1.0	-2.1	-1.0
Industry sub.*	No board	Med	Med	Med	Med	Med	Low
	Board	Med	Low	Low	Med	Med	Med
Avg. equity**	No board	+2.9%	+2.2%	+5.4%	-8.6%	-4.0%	-1.5%
	Board	+12.4%	+7.1%	+1.2%	-14.2%	-12.6%	-8.6%
Rel. equity***	No board	+0.2x	+0.4x	+0.5x	-0.7x	-0.8x	-0.1x
	Board	+0.6x	+0.7x	+0.1x	-0.7x	-1.2x	-0.7x

Note: * similarity between new/divesting and existing CVC investors; **average equity share of new investors / divesting investors; ***relative equity between the focal investing round and new/divesting investors

FIGURES

Figure 1: CVC and Venture Stage as Predictor of Performance (Marginal Effects)

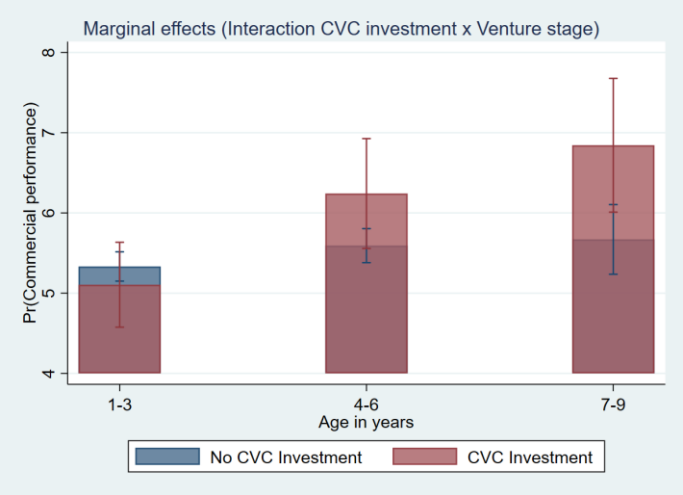
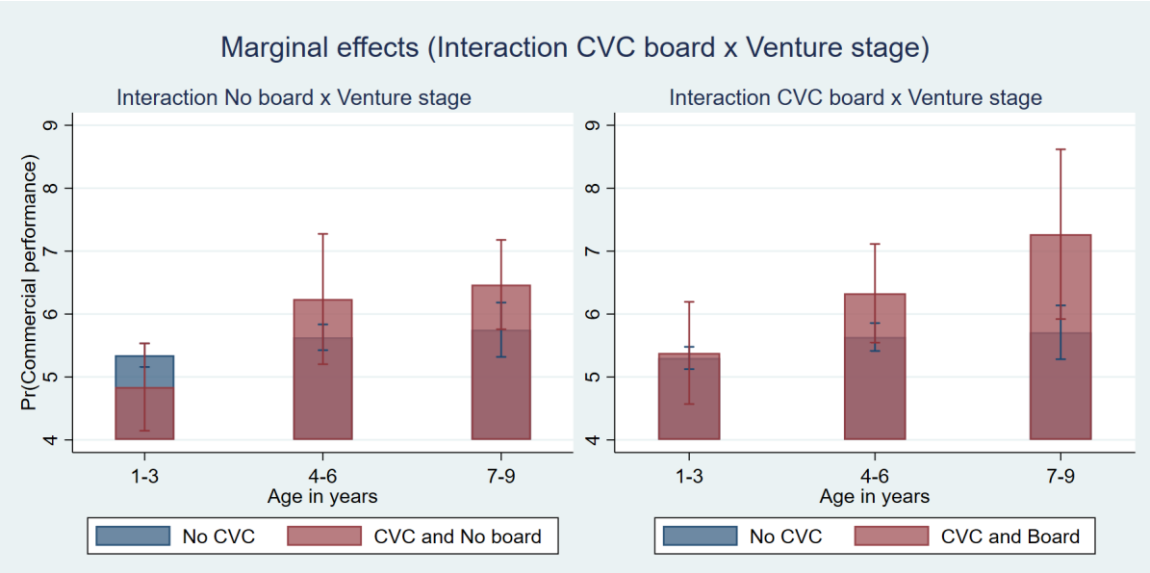


Figure 2: CVC Board and Venture Stage as Predictor of Performance (Marginal Effects)



APPENDIX

Appendix A: Detailed Distribution of Sample Ventures by NACE Industry

3-dig Code	Industry Name	Frequency	Percentage
620	Computer programming activities	65	0.22
711	Architectural and technical consulting activities	43	0.15
502	Sea and coastal freight water transport, incl. offshore services	33	0.11
829	Business outsourcing services not included elsewhere	33	0.11
721	Research and experimental development on biotechnology	12	0.04
631	Data processing, hosting and related activities	11	0.04
31	Marine fishing, incl. services and technology	10	0.03
773	Renting and leasing of intangible assets and specialized machinery	10	0.03
522	Other service activities related to sea and costal water transport	9	0.03
582	Publishing of computer games	8	0.03
731	Market research and advertising agencies	8	0.03
32	Marine aquaculture, incl. services and technology	6	0.02
749	Other professional, scientific & technical activities	6	0.02
91	Support activities for petroleum and natural gas extraction	6	0.02
741	Specialized design activities	5	0.02
611	Wired telecommunications activities	3	0.01
612	Wireless telecommunications activities	3	0.01
712	Technical testing and analysis	3	0.01
xxx	Other sub-industries	20	0.07
Total		**294**	**100%**