They Are Not Mistaken! Why Passive Investments Matter

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This paper is devoted to the explanation of the large share of passive investments in companies' portfolios and their relationship with environmental factors. We utilized duality framework to explain underlined processes of corporate venture capital (CVC) investments, such as learning and stabilization. Statistical analysis of venture capitalists over a four-year period showed evidence of significant association between the share of passive CVC investments and company syndication centrality depending on the level of industry concentration. Post-hoc analysis provides an additional support to the duality-view on CVC investments by suggesting that diversified portfolios of passive investments are positively associated with the company's innovativeness.

INTRODUCTION

In this paper we explain why companies actively pursue passive corporate venture capital (CVC) investments. We apply the duality framework and argue that passive CVC investments are capable of providing indirect benefits to the company that includes intensive learning and stabilization of the portfolio. We suggest that experienced companies tend to invest in large number of passive CVC investments in order to strengthen the learning process. We also argue that syndicated companies tend to protect their core competencies by not revealing them via CVC investments that are congruent with their current core capabilities, especially in the fragmented markets.

Our longitudinal analysis of corporate venture capitalists suggests that syndicated central companies tend to make more passive CVC deals in the low concentration markets and less passive investments under the high concentrated markets. We also found that the strength of the appropriability regime is positively associated with the number of passive CVC deals. Our post-hoc analysis provides additional support to the application of the duality framework to the CVC investments context by indicating significant and positive association between the share of passive CVC investments in the company's portfolio and its innovativeness. Moreover, this relationship is further strengthened by the moderation effect between the share of passive CVC deals and the incumbent's R&D intensity.

We show that passive CVC investments are not necessarily a result of mistake as suggested by the existing literature, and that they bring indirect benefits. We demonstrate a successful application of the duality framework and explain how passive investments provide such benefits. Passive CVC deals provide extensive learning to the company, while not disclosing company's core capabilities to fellow-syndicate members and other market players. We also suggest several guidelines to companies that should be concerned with: the industry dynamics, specifications of knowledge flow, and allocation in the marketplace.

The paper proceeds as follows. We begin by describing existing CVC literature and the duality framework. We continue by demonstrating the application of the duality framework to the CVC investments, and then develop our hypotheses by showing how the level of experience, degree of centrality, appropriability regime, and industry concentration are interrelated and associated with the number of passive CVC investments. Following this, we describe our data, method of analysis, tests of hypotheses, and present the results. The last section concludes our study and discusses our results along with their implications for both theory and practice while addressing the limitations.

LITERATURE REVIEW

Overview of CVC – Dualism Perspective

Turbulent environments require companies to correspond to fast-changing technologies and consumer demands. The need of acquiring new information and know-how arises continuously. Under these dynamic conditions, companies realized that additional knowledge can be obtained from external sources through CVC activities. Indeed, there are numerous evidences that CVC programs grant vast variety of benefits to CVC investors that include but are not limited to obtaining a window of technology and innovations, strengthening the demand of companies' offerings, improving the efficiency of company's operations, obtaining financial gains (Anokhin, Örtqvist, Thorgren & Wincent, 2011; Dushnitsky & Lennox, 2005), developing new capabilities (Basu Phelps, & Kotha, 2011), and creating value for shareholders (Dushnitsky & Lenox, 2006). Over the last two decades companies have invested billions of dollars in entrepreneurial start-ups in order to obtain financial or strategic benefits, and this market still continues to grow (Park & Steensma, 2012).

We define CVC investment as an investment of corporate funds directly in external start-up companies (Chesbrough, 2002). This definition does not include any investments in internal or company-owned start-up, or investments which are undertaken through a third party. Therefore, we consider only company-initiated investments that serve the internal purposes of that company. In this paper, we utilize a two-dimensional construct of CVC proposed by Chesbrough (2002). The first dimension identifies the purpose of CVC investment. Usually, companies indicate several goals of their CVC programs, but aggregately they can be classified as either strategic or financial. Strategic CVC is aimed at augmenting company's market position by creating some sort of synergy between CVC investor and a new start-up (Chesbrough, 2002). Such benefit may come in form of window of technology, stimulation of the demand of company's offerings, supporting their complements, etc. (Anokhin et al., 2011, Dushnitsky & Lennox, 2005, Chesbrough, 2002). the main purpose of strategically-oriented CVC is to obtain external knowledge and capabilities, which include innovations, know-how, more efficient business practices, technologies, etc. (Chesbrough, 2002, Dushnitsky & Lenox, 2005, Basu, et al, 2011).

Companies undertake financial CVC in order to achieve financial benefits. Scholars claim that financial CVC is similar to independent VC, and is not aimed at achieving strategic benefits, but rather at obtaining high returns on investments (Chesbrough, 2002). Thus, the first dimension of CVC construct represents companies' determination for change and improvements (Chesbrough, 2002). The second dimension of CVC reflects the strength of the link between CVC and the company's current operations (Chesbrough, 2002). In cases when CVC portfolio is congruent with company's capabilities, a CVC investor is either looking to improve or exchange its resources or processes – whichever will allow to company to directly benefit from the CVC. On the other hand, there is evidence that when companies invest in start-ups that do not have strong operational link with investor's capabilities. In a case of low

congruency, CVC investor utilizes the notion of complementarity: investor tries either to support the compliment to its offerings or to obtain any improvement of its existing business processes. Therefore, the second dimension of CVC represents the level of support for stability and continuous development of the company's current capabilities. Thus, such support may be direct and high if the CVC is congruent with company's operations and indirect if CVC is incongruent.

The CVC literature has demonstrated a significant amount of evidence of benefits of strategic CVC investments, since it provides innovative benefits to the company and allows for either the improvement of existing capabilities or the acquiring of disruptive technologies (Chesbrough, 2002). Scholars claimed that the greatest value for the investor is created when CVC is strategically oriented (Dushnitsky & Lenox, 2005) and congruent with company's current capabilities (Chesbrough, 2002), e.g. when company undertakes so-called driving CVC investments. This type of invested is initiated by "strategic rationale" to develop the key strategic areas of the company. The classic example of such CVC investment would be Microsoft Corporation, who invested about $1 billion into the start-ups that support the ".Net" online architecture which enables Microsoft to provide different online services. By supporting start-ups that move .Net forward, Microsoft increases consumers demand for its platform, and promote it over other major competitors (such as IBM). On the other hand, if strategic CVC investment is not tightly linked with the company's current capabilities, the company is focused on acquiring the disruptive technology (For example, Intel invested in semiconductor industry start-ups) (Bent, 2012). By similar logic, research has shown that the smallest value is created by passive CVC investments, e.g. when CVC does not specifically focus on obtaining innovation advantages and is incongruent with the company's capabilities (Chesbrough, 2002). Even though well-established firms are capable of gaining highly attractive financial returns on their CVC investments, researchers claimed that even very high margins create much lesser value for the company compared to strategic benefits (Dushnitsky & Lenox, 2005).

Existing research argues that companies must balance their CVC portfolio with both types of strategic CVC investments, tightly and loosely coupled (Chesbrough, 2002; Maula, Autio & Murray, 2009). This kind of portfolio will benefit the company by granting access to new technologies and business practices, along with continuous improvements of existing capabilities. It is so argued that such a portfolio provides both change and stability. However, it is important to note that change and stability are managed and obtained by different types of investments in Chesbrough's (2002) framework – this indicates the dualistic point of view (Farjoun, 2010).

The major issue with such a view of CVC is the discrepancy between theoretical conclusions and practical evidence: Companies' portfolios consist primarily of passive investments. A high proportion of passive CVC investments contradicts existing literature that states that the greatest value from CVC investments can be obtained through strategic CVCs. CVC literature provides the single explanation of why passive investments dominate CVC portfolios: Companies cannot identify the strategically beneficial investments due to the information overload (O'Reilly III, 1980), information asymmetry (Cuervo-Cazurra & Annique Un, 2010), and the level of uncertainty (Chesbrough, 2002). As a result, the goal of passive investments is learning in a trial and error manner (Axelrod & Cohen, 2000). By investing in ventures that are not congruent with the current operations, companies intensify their learning process (Stinchcombe, 1974; March, 1991). However, Yang (2009) showed that the intensity and diversity of CVC investments are positively associated with company's CVC selection and valuation capabilities. Therefore, according to the existing research on financial CVC investments, companies should decrease the portion of passive investments due to the learning process and increase the portion of strategic CVCs in order to achieve better outcomes. However the statistics show that this does not happen.

The Novel View on CVC Investment: Duality Perspective

In order to explain companies' tendency to undertake passive investments, we utilize the duality framework developed by Farjoun (2010). The major difference between duality and dualism is the relationship link between stability and change: stability and change are not separate and mutually exclusive, but in fact are interdependent and mutually enabling. Change represents new capabilities and innovation, and reflects dynamics of the company variation. Stability, on the other hand, represents

efficiency and standardization, as well as static efficiency. At first glance, it does not seem to be logical, but the underlined processes, such as learning and establishment of reliability, make it a very solid argument. We further argue that the duality framework should be applied to CVC investments by showing how two dimensions of CVC represent the company's need for change and stability.

Two Dimensions of CVC

As we discussed earlier, the first dimension of CVC represents the purpose of the CVC investment: strategic or financial. Existing research provided numerous evidences that strategic investments provide companies with new ideas, innovations, technologies, etc. Such views clearly state that strategic investments are undertaken in order to support changes within the company and/or its offerings. Such changes are crucial for the companies due to the dynamics of the product categories – companies just have to keep up with technological progress and changing consumer needs. When the company adjusts itself according to market and technology trends, it enables itself to become stable enough to provide its offerings to satisfy the market: basically, the company becomes more reliable when it changes itself according to the market trends. Thus, the company supports its stability in the marketplace through change and variation.

On the other side of the first dimension is non-strategic type of CVC investments. Existing research argues that the purpose of such CVC investments is to get high return on investment, e.g. to get financial surplus (Chesbrough, 2002). It provides companies with additional funds that can be used to implement the company's strategy or to accumulate a slack. Financial capabilities of the company, including slack, enable it to operate and develop further (Nohria & Gulati, 1996; Voss, Sirdeshmukh, & Voss, 2008). Due to the level of uncertainty and information asymmetry, companies cannot be confident in all of their investments. In this case, stability can be achieved through redundancy: the company expands its portfolio to make a system reliable "even when each part may be unreliable" (Farjoun, 2010; Wildavsky, 1991). The company invests in several loosely connected ventures to get financial returns, and if disturbance occurs, it does not harm the entire portfolio. Therefore, we conclude that non-strategic CVC investments are aimed primarily at supporting the stability and reliability of the company. Moreover, financial resources are needed to implement any innovative changes and improvements, so the abundance of the non-strategic investments ensures that the company will be capable of implementing necessary changes.

The second dimension of CVC investments represents the level of congruency between the company's current capabilities and CVC investment. When the company invests in tightly-related CVC, it tries to achieve some sort of synergy between its current business practices and CVC. Such kinds of investment are closely related to stability. Existing research refers to such practice as "routinizing the nonroutine" (Farjoun, 2010; Shumpeter, 1942). Continuous improvement of current business practices enables companies to deal with market shocks and other unexpected problems (Farjoun, 2010, Bigley & Roberts, 2001) and makes the company more stable and flexible. Moreover, constant improvement in the same direction fosters the company's adaptation and helps to systematize and implement their innovations.

If the company invests in loosely-linked CVC, the company tries to find the radical change for existing capabilities or obtain completely new ones. Low congruent CVC investments, similar to the strategic CVCs, are closely related to change – the company is searching for innovation. However, CVC literature argues that low-congruent CVC may not create a high value for the company, because synergy between the parent company and CVC may not be achieved (Dushnitsky & Lenox, 2005).

Passive Investments

With respect to any interrelation between dimensions of CVC investments discussed above, we propose that the major reason for companies to make a large number of passive investments is to increase learning and achieve stability. Companies have to account for uncertainty and information asymmetry when making their strategic decisions. If the company decides to develop a single direction for its development, it exposes itself to the risks that may result from the potential shocks and failures (Perrow, 1999). However, when a company diversifies its portfolio with a large number of passive investments, it

creates redundancy and a loose coupling system. These kinds of systems provide the company with a stable cash flow, on the one hand, and stability on the other. When the loosely coupled system is exposed to a shock or any other disturbance, it will have enough time to respond accordingly and be able to stabilize itself in an efficient manner (Glassman, 1973; Simon, 1996). In addition to these direct benefits, stability also enables innovation and adaptability (Farjoun, 2010): by making more CVC investments, the company becomes exposed to a greater variety of information. Therefore, the company systematically absorbs information that may or may not be congruent with company's current operation, but will enable the company to stay updated with current trends. In addition to intangible benefits, a greater number of passive investments may accumulate some slack for the company that can provide it with more opportunities in the future (Voss, et al., 2008). Thus, experienced companies would diversify their portfolios in order achieve stability in cash and information inflows. Therefore, we hypothesize:

Hypothesis 1: There is a positive association between the level of the company's experience and the share of passive CVC investments in its portfolio

Syndicated CVC Investments

CVC investments became popular way of obtaining a window of technology, innovations, an increase in the demand for the company's offerings, financial benefits, etc. Just like any other type of investment, CVC involves some degree of uncertainty and financial expenses at initial stages. Naturally, companies try to minimize their expenses and uncertainties in order to ensure the positive outcome. The most common way to do that is to syndicate CVC investments. In order to decrease risk and to increase the output of CVC programs, companies syndicate their deals with the incumbents (Brander, Amit, & Antweiler, 2002). Syndication provides numerous benefits to the companies in addition to obtaining a window of technology and know-how from new ventures, such as learning capabilities, technologies, and investment techniques from fellow CVC investors, etc. (Wincent et al., 2010). The access to these flows of information and resources is dependent on the number of companies CVC investor is connected to: the more connections the CVC investor has, the more central they are in the network, and the more access they have to syndication benefits (Irwin & Hughes, 1992). Since syndication usually involves large numbers of companies, the majority of investments are likely to be incongruent to the company's current capabilities.

Moreover, Wincent et al. (2010) provided evidence that the syndication strategy may provide a drawback for the CVC investor due to information sharing. The company does not only enjoy the sharing of resources and risks, but they also must share the know-how with other syndicate members. If the syndicated company invests directly to congruent start-up with strategic intentions, the company risks losing its competitive knowledge/technology by making it available to other companies. More central companies are more exposed in front of other players due to the number of connections they have. Therefore, any central company should try to avoid any sort of disclosure of their core competencies. As a result, central companies are left with the option to invest in passive CVC investments in order to intensify their learning and cash flows with smaller costs due to the syndication. Therefore, we hypothesize:

Hypothesis 2: There is a positive association between the degree of the company's centrality and the share of passive CVC investments in its portfolio

INDUSTRY CHARACTERISTICS

Appropriability Regime

When considering new strategic investments, companies should always be concerned with the future possibility of appropriating the benefits of their investments. Such an ability to commercialize the outcome of know-how or technology is defined by the appropriability regime of the industry, sometimes also referred as IP regime (Cohen, Nelson, & Walsh, 2001). Under the conditions of a weak

appropriability regime, companies struggle to appropriate the returns of their work, because other industry players may access that information and diminish the returns of the innovator. The strength of the appropriability regime influences the likelihood of imitation opportunities (Hill, 1992). Under weak appropriability regime, even patents do not provide full protection and guarantee of appropriating returns (Cohen et al., 2001; Dushnitsky & Lenox, 2005). By the same token, under a weak appropriability regime start-ups will not be able to protect their strategic knowledge from CVC investors. Contrary to start-ups, CVC investors are the most likely to obtain desired strategic benefits from start-ups if the last one operates under the weak appropriability regime (Cohen et al., 2001; Dushnitsky & Lenox, 2005). Since the stronger appropriability regime increases the payoff for start-ups, it should also decrease the output for investors because disclosed information is better protected (Dushnitsky & Shaver, 2009).

Thus, if both CVC investor and potential start-up operate in the same industry (e.g. CVC is congruent with company's current operations) under a strong appropriability regime, the CVC investor may not be capable of benefiting strategically from this particular CVC. Moreover, if the start-up is tightly related to the company's current capabilities, the CVC investor risks supporting its potential competitor. Therefore, the CVC investor will most likely seek for learning options in less congruent industries in order to appropriate the returns from its investments. Therefore, we hypothesize:

Hypothesis 3: There is a positive association between the strength of appropriability regime in the product category and the share of passive CVC investments in its portfolio

Industry Concentration

It is well-documented in associated CVC literature that companies should account for not only industry specifications when making their decisions, but also for industry structure. The degree of industry concentration influences the amount of opportunities within that industry – the higher the industry concentration, the lesser the opportunities, knowledge, and resources that are distributed to all industry players, and instead are kept in possession of industry leaders (Malerba & Orsenigo, 1996). In highly concentrated industries, the largest companies possess significantly larger amounts of knowledge and resources. Therefore, instead of "learning by doing something else" (Schilling, Vidal, Ployhart, & Marangoni, 2003), leading companies in concentrated industries are capable of sustaining their market positions and making strategic investments that provide to the development of the company's market potential, or the so-called driving investments (Ramaswamy, Gatignon, & Reibstein, 1994). In contrast, some industries can be characterized by large numbers of market players, high entrepreneurial dynamics, and virtually free information and resource flows. Such industries are referred to as low-concentrated ones, since there is no monopolistic company that tries to protect and maintain its industry control (Anokhin et al., 2011, Geithman et al., 1981). Such industries are very volatile and dynamic, so companies should keep updated with current trends in order to correspond to existing and potential competitors. As discussed above, we argue that the large number of passive investments provides an opportunity to stay updated with current industry trends and create a stable loosely-coupled system that can protect from unexpected shocks. Therefore, in low concentrated industries, experienced companies will have to create a balanced and diversified portfolio in order to obtain stability. Therefore, we hypothesize:

Hypothesis 4a: The level of industry concentration positively moderates the association between the level of the company's experience and the share of passive CVC investments in its portfolio.

If a company syndicates its deals, the flow of knowledge and resources is influenced simultaneously by its syndicate position and industry concentration (Anokhin et al., 2011). In high concentrated industries, the leading companies try to protect their market share from imitation and possible market entry by creating a monopolistic market structure. They also control the distribution of the industry resources among the players. It is most likely that the leading companies in the concentrated industries are also the most central in the syndication network. Therefore, in addition to monopolistic advantages, these

companies control more resources and knowledge than less forward companies. As a result, leading central companies may create the entry barriers to the industry by high differentiation and specialization. In cases of such monopolistic advantages, central companies do not have to spread their CVC portfolio on learning because they control the substantial portion of the industry. Therefore, such central companies will try to create the tightly coupled system, e.g. create a congruent with current capabilities portfolio.

However, in low concentrated industries, central companies are exposed to potential issues with free information flow (Anokhin et al., 2011). Central companies in low concentrated industries will experience difficulties in appropriating strategic returns from CVC investments. Therefore, central companies will syndicate only those portions of their CVC portfolio that are not concerned with direct strategic benefits, e.g. that is not congruent with company' current capabilities.

We argue that central companies in highly concentrated industries will try to monopolize their market by creating highly congruent CVC investments instead of passive ones, while central companies in low concentrated industries will continue to invest in passive investments in order to keep their strategic investments away from syndicated information flow and share the risks and costs of passive investments with other syndicate members. Therefore, we hypothesize:

Hypothesis 4b: The level of industry concentration negatively moderates the association between the degree of the company's syndication centrality and the share of passive CVC investments in its portfolio.

When an appropriability regime is high in concentrated industries, companies will face double trouble: The influence of the leading companies that try to create monopolistic industry, and issues with obtaining strategic benefits from start-ups. In such a setup, companies will have to search for the indirect advantages of CVC investments, e.g. either learning from somewhere else or increasing the demand for their products by supporting its compliments. Both types of indirect benefits are obtained from incongruent CVC investments. By investing in other industries, companies will increase their chances of obtaining strategic benefits from CVCs. We hypothesize that incumbents of highly concentrated environments with strong appropriability regimes will tend to invest in other markets, seeking for synergies and outside learning.

Hypothesis 4c: The level of industry concentration positively moderates the association between the strength of an appropriability regime and the share of passive CVC investments in its portfolio

DATA AND METHOD

In order to test proposed hypotheses, the unique dataset was constructed by combining USPTO, VentureExpert, Corporate Venturing Directory & Yearbook, and COMPUSTAT. The data from COMPUSTAT is reported with respect to business cycles, but not calendar years. As such, we do not use the yearly aggregates provided by VentureExpert directly: we looked at the exact dates of particular deals to match them to appropriate financial years. All sources were widely used in the CVC literature, and we considered investments committed from 1998 until 2001. The U.S. Census Bureau's NAICS and the Bureau of Economic Analysis 1998-2001 Annual Input-Output tables were used to classify CVC investments into passive and other categories. The merger of VentureExpert, Corporate Venturing Directory & Yearbook, and COMPUSTAT provided us with a sample of 162 companies and their CVC activity during 1998-2001.

Dependent Variable

Our dependent variable represents the proportion of passive investments in the company's portfolio in the given year. Classification of the investments was done according to the Chesbrough's framework (2002) and approach taken by Dushnitsky and Lenox (2005): if the investment does not have an operational capability link or market development potential, it is classified as passive. The percentage of passive investments was then calculated by dividing the number of passive investments by the total

number of CVC deals in a given year. If a company made no CVC deals in a particular year, the observation was deleted from the analysis in order to prevent biased slope and coefficients.

Independent Variables

Experience

We obtained the measure of a company's experience in CVC programs by calculating the number of years it was engaged with CVC investments. The number of years was calculated beginning from the first year the company appeared in VentureExpert as an investor or co-investor. Companies with long records of participating in CVC investments are more likely to obtain unique knowledge and experience (Yang, Narayanan, & Zahra, 2009).

Centrality

This variable represents the company's centrality in the syndication network. The measure is obtained utilizing social network analysis as an average geodesic distance between the company and other incumbents (Anokhin et al., 2011). The distance between the companies was calculated: companies with shorter distances from one another are considered to be central companies, and those with longer distances are non-central.

IP Regime

The strength of the appropriability regime was obtained from the paper by Cohen et al. (2001). Cohen (2001) identified several measures of the strength of the IP regime. Among the proposed measures, we utilized the product lead time only due to the high and significant correlation among predictor variables. In this paper, we are primarily concerned with a company's ability to obtain knowledge from CVC.

Concentration Ratio

The industry concentration ratio represents the industry concentration via the 4 largest companies, and is measured by their market share. Concentration ratio takes values from 0 to 100 percent – low scores represent competitive environments, while high scores indicate concentrated oligopolistic markets (Hrazdil & Zhang, 2012)

Control Variables

Existing research demonstrated the importance of controlling in order to account for organizational slack, calculated by the current ratio of assets to liabilities (Voss, et al.,2008). As discussed above, organizational slack represents the amount of extra resources available to the company. Such resources may be invested into R&D or CVC, and therefore, company's activities may be caused by the extra resources instead of usually being allocated once.

The number of particular CVC investments is primarily influenced by CVC intensity (Dushnistky and Lenox, 2005). We measure CVC intensity by calculating the total number of distinct CVC deals. We do not utilize the CVC intensity operationalization by the dollar amount of CVC deals, because a company may receive indirect strategic benefits from each deal regardless the amount of money committed. Therefore, the greater exposure to the variety of CVC investment, the more extensive learning will occur (Yang, Narayanan, & Zahra, 2009)

Riyanto & Schwienbacher (2006) showed an importance of a company's willingness to take a risk in the CVC investments. We control for risky investments by including a dichotomized variable representing relatively risky investments(such as those made at early stages), and non-risky ones(such as those made during the later and balanced stages) (Yang, Narayanan, & Zahra, 2009).

We control for the industry's R&D intensity due to different dynamics across industries. R&D and CVC investments may compete for company's resources (Dushnitsky & Shapira, 2010). The measure of R&D was obtained directly from COMPUSTAT.

We also control for a company's size by sales, which were calculated by taking a natural log of company's sales and the industry membership in a year's time.

RESULTS

Descriptive statistics are shown in Table 1. Initial analysis shows that more than 50% of CVC investments are classified as passive. Such distribution is congruent with previous research provided by Dushnitsky and Lenox (2005) and suggested by Chesbrough (2002). The correlation coefficients do not exceed an absolute value of 0.5. The highest correlation of -0.49 is between control variables for organizational slack and sales.

TABLE 1
PAIRWISE CORRELATIONS

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	CVC Intensity (log)	1												
2	Risky Investments	-0.02	1											
3	Information Industry	-0.05	0.02	1										
4	Professional Industry	-0.03	-0.07†	-0.25***	1									
5	Other Industry	-0.03	-0.06†	-0.12**	-0.05	1								
6	Sales (log)	0.21***	0.02	-0.25***	-0.09*	0.05	1							
7	Organizational Slack	-0.04	0.00	-0.03	-0.08*	-0.07†	-0.49***	1						
8	R&D	-0.01	0.00	0.13**	-0.08†	-0.14***	-0.28***	-0.02	1					
9	Year 2000	0.16**	0.00	0.00	0.00	0.00	0.02	0.00	-0.10*	1				
10	IP Regime	0.05	-0.02	-0.35	-0.11	-0.05	0.02	0.27	0.12	0.00	1			
11	Experience	0.15***	-0.12**	-0.22***	-0.04	0.06	0.38***	-0.20***	-0.11*	0.04	0.02	1		
12	Centrality	0.16***	-0.04	0.03	0.00	0.07†	0.08*	-0.01	0.02	0.00	0.05	0.04	1	
13	CR	-0.10	-0.03	0.19***	0.36***	0.11***	-0.05	-0.04	-0.13**	-0.03	-0.37***	-0.07†	0.02	1

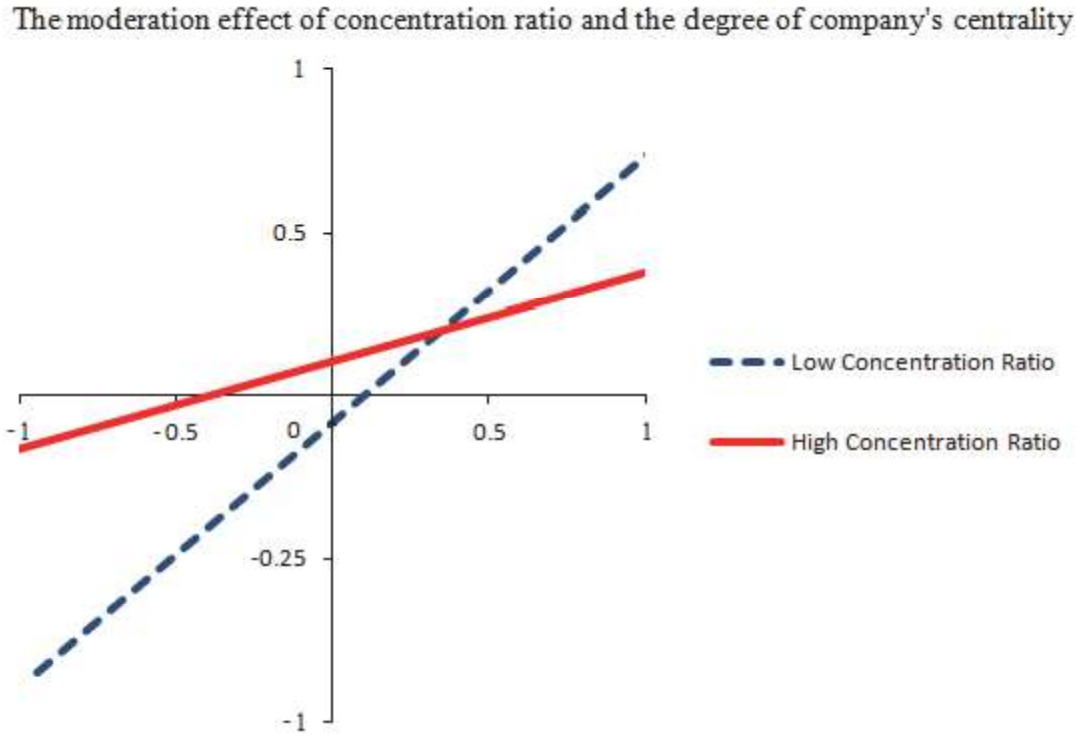
$^{\dagger}p<0.10, ^{*}p<0.05, ^{**}p<0.01, ^{***}p<.001$

We performed population-average linear model to test for proposed relationships. The utilization of linear model is justified by the continuous dependent variable representing the proportion of passive investments committed by each company per year. In order to justify the choice of population-averaged model we performed a Hausman test (χ^2=10.98, p = 0.0891) that failed to reject H_0 and demonstrated the possibility for using a population average option. Likelihood–Ratio tests were performed for each of the models described below. The results of LR–test indicated that the models are significantly different from pooled models.

Model 2 tests hypotheses 1, 2 and 3. The coefficient of company experience is positive but insignificant (β=0.005, p=0.726), e.g. the level of company's experience is not positively associated with the number of passive investments. Indeed, we failed to find the evidence demonstrating that more experienced with CVC activity companies tend to invest more in passive investments. Thus, we did not find support for hypothesis 1. The coefficient of the degree of company's centrality in the syndication network is significant and positive (β=0.083, p<0.001). It provides the evidence that more central companies tend to invest in passive investments and shows the support of hypothesis 2. The coefficient of the measure of the appropriability regime (β = 0.039, p<0.01) is also positive and significant. Therefore, the strength of the appropriability regime of the industry is positively associated with the number of passive investments committed by the companies. Thus, we found support for two out of three main effects hypotheses.

Model 3 tests hypotheses 3a, 3b, and 3c. The Interaction Model tests indicates moderation effect between industry concentration and company's experience is insignificant similarly to the hypothesis 1 (p=0.696). As a result, we did not find support for hypothesis 3a. The coefficient of moderation effect between the degree of company's centrality and industry concentration ratio is negative and marginally significant at 95% confidence level (β = -0.0423, p = 0.055). It indicates that central companies in concentrated industries tend to be more focused on congruent investments instead of passive ones. It is important to note that the main effect of centrality is still highly significant. Therefore, the moderation effect explained additional portion of the variable. However, we found only marginal support for hypothesis 3b. The coefficient for moderation effect between the strength of appropriability regime and industry concentration is insignificant (β = -0.0104, p = 0.684). We failed to find any support for hypothesis 3c.

GRAPH 1



Post Hoc

In order to further develop our theory, we built additional models to test the impact of the proportion of passive investments on company's innovativeness. Our dependent variable is the number of patent applications made by a company in a particular year (Dushnitsky and Lenox, 2005). According to Hagedoorn and Cloodt (2003), the number of patents applied by the company most fully represents the company's innovativeness. In this model, we test if our argument of applying duality framework is correct: e.g. if the proportion of passive investments is positively associated with the company's degree of innovativeness. The second issue that we address in this study is explaining what the relationship is among innovativeness, the proportion of passive investments, and R&D intensity.

In model 4 we utilize the proportion of passive investments as the independent variable while including the same control variables. Since the number of patent applications is count type variable, we applied negative-binomial population-averaged model. We also account for either over- or under-dispersion of the negative-binomial model by incorporating organizational slack, CVC-intensity, and total sales of the company. The coefficient of the proportion of random effects is positive and significant (β=0.430, $p<0.05$). Thus, we found the evidence that the proportion of passive investments is positively associated with the company's innovativeness.

In order to address the second issue, we estimated the model with interaction effect of the proportion of passive investments and company's R&D. The coefficient of interaction term is positive and significant (β=0.2112, $p<0.05$) – therefore, the proportion of passive investments positively moderates the positive association between company's innovativeness and R&D intensity.

TABLE 2
MODELS SUMMARY

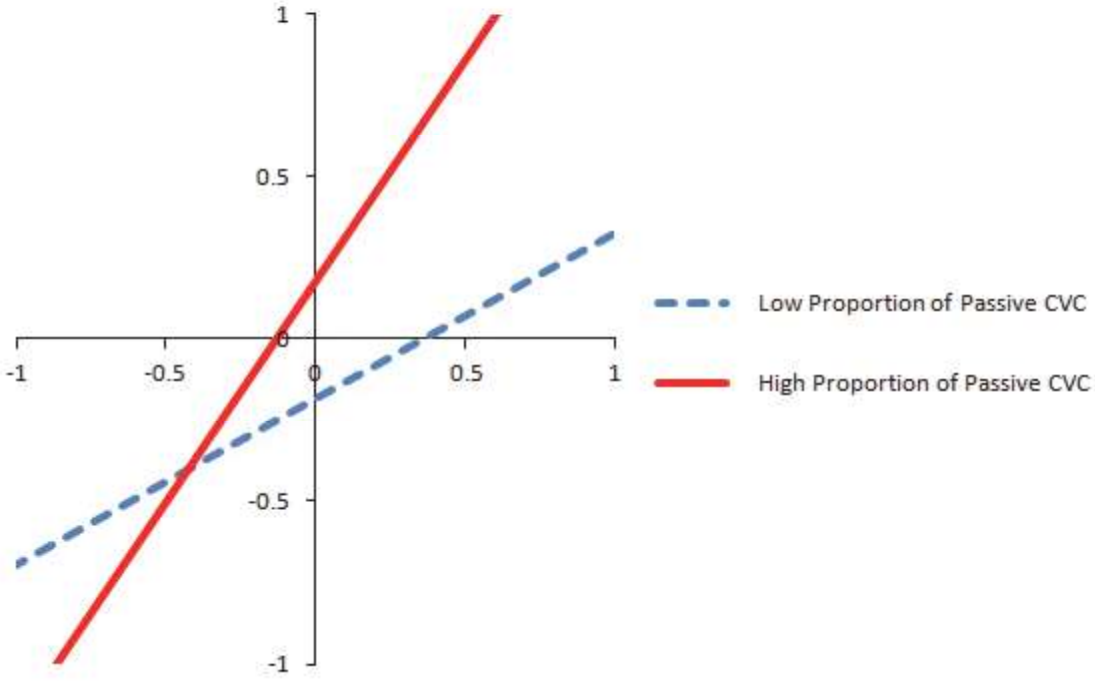
Dependent Variable	Proportion of Passive CVC (Passive)			Innovativeness	
Model #	Model 1	Model 2	Model 3	Model 4	Model 5
CVC Intercity (logged)	0.0011	-0.0255†	-0.0216	0.2518*	0.2331***
	(0.01)	*(0.02)*	*(-1.42)*	*(0.07)*	*(0.06)*
Risky Investments	-0.0453**	-0.0255†	-0.0237†	0.0902***	0.1184
	(0.01)	*(0.01)*	*(-1.64)*	*(0.10)*	*(0.10)*
Information Industry	-0.3944***	-0.3694***	-0.3817***	---	---
	(0.02)	*(0.02)*	*(-19.62)*		
Professional Industry	0.0053	0.0069	-0.0144	0.0526	0.0580
	(0.02)	*(0.02)*	*(-0.64)*	*(0.12)*	*(0.13)*
Other Industries	0.0182	0.0163	0.0178	-0.3402*	-0.2990†
	(0.02)	*(0.02)*	*(0.80)*	*(0.17)*	*(0.17)*
Sales (logged)	0.0094	0.0301	0.0272	1.3391***	1.3360***
	(0.02)	*(0.02)*	*(1.21)*	*(0.13)*	*(0.12)*
Organizational Slack	-0.0056	0.0023	0.0096	-0.2793**	-0.2794***
	(0.02)	*(0.02)*	*(0.47)*	*(0.09)*	*(0.09)*
R&D	-0.0215	-0.0444*	-0.0373†	0.4766***	0.4754***
	(0.02)	*(0.02)*	*(-1.88)*	*(0.11)*	*(0.11)*
Year 2000	0.0118	0.0141	0.0131	-0.0979**	-0.0925**
	(0.01)	*(0.01)*	*(1.20)*	*(0.04)*	*(0.03)*
IP Regime	---	0.0393**	0.0469*	0.3858†	0.183967†
		(0.01)	*(1.91)*	*(0.10)*	*(0.10)*
Experience	---	0.0051	0.0082	-0.1474***	0.388072***
		(0.01)	*(0.51)*	*(0.12)*	*(0.10)*
Centrality	---	0.0830***	0.0743	0.1767	-0.0967
		(0.02)	*(3.81)*	*(0.10)*	*(0.12)*
CR (Concentration Ratio)	---	---	0.0575*	---	---
			(2.55)		
Experience*CR	---	---	-0.0057	---	---
			(-0.39)		
Centrality*CR	---	---	-0.0423†	---	---
			(-1.92)		
IP Regime*CR	---	---	-0.0104	---	---
			(-0.41)		
Passive	---	---	---	0.1960*	0.1945*
				(0.10)	*(0.10)*
R&D*Passive	---	---	---	---	0.2112*
					(0.09)

†p<0.10, *p<0.05, **p<0.01, ***p<.001

Additional tables have been posted in the Appendix section.

GRAPH 2

Moderation Effect of Proportion of Passive CVC Investments and company's R&D



DISCUSSION

In this paper we provided an alternative approach to the issue of the large proportion of passive investments in companies' portfolios. We utilized the notion of duality which states that change and stability are mutually interdependent and enabling. We show that companies choose to invest in large number of passive investments, contrary to the existing theoretical logic.

We show that this large portion of passive investments provides indirect benefits, like increases in learning, stability, and innovativeness. Passive investments intensify the company's learning in a trial and error manner: the company spreads out its investment portfolio and systematically tries to extract know-hows and ideas from it. By creating a diversified portfolio, the company ensures its stability and opportunity to identify the window of technology and utilize it. Intensive and diversified learning, along with a loosely coupled system, also provides an opportunity to withstand any unexpected shocks: the company is up-to-date with market tendencies, and when shock damages the particular CVC, it does not spread to the whole portfolio.

In addition to the potential benefits, passive investments are sometimes the only reasonable investment available to companies. Companies that participate in syndicated networks should be concerned with information spillovers in order to keep their core competencies secret. Central companies are exposed in front of other syndicate members, which can observe and mimic the exposed central companies. Therefore, central companies should not engage in investing and revealing their strategic competencies.

We also show that the industry defines the processes of allocating and sharing information and resources within itself. In particular, high concentrated industries are controlled by leading companies that try to create an oligopolistic market and limit their competition. By the same token, low concentrated

industries are characterized by a free flow of information. Therefore, companies should tailor their portfolios in order to enable themselves to appropriate the outcomes of the CVC in the future.

However, this paper is limited due to the utilization of the secondary data, as indirect benefits, learning, and stability are very difficult to expose thusly. We believe that the marginal significance of some hypotheses is caused by the inability of the operationalized variables to fully explain the underlined duality process. Therefore, a study with primary data should be undertaken in the future in order to fully uncover all the benefits and drawbacks of the duality nature of CVC investments.

Taking all of the above into consideration, companies should consider diversification for their portfolios in order to obtain the previously discussed benefits. Managers should clearly understand the conditions under which they commit their resources to CVC programs, in order to appropriate positive outcomes in the future.

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APPENDIX

Control Model

```
. xtreg randompercent lncvc_num zrisky zinfo zprofess zotherind lnsales zslack1
zrnd_int zyr3, pa

GEE population-averaged model                   Number of obs      =       253
Group variable:                     corp_num    Number of groups   =        97
Link:                               identity    Obs per group: min =         1
Family:                             Gaussian                   avg =       2.6
Correlation:                    exchangeable                   max =         4
                                                Wald chi2(9)       =    693.26
Scale parameter:                    .0420303    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
randomperc~t |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lncvc_numf |   .0010647   .0137941     0.08   0.938    -.0259712    .0281007
      zrisky |  -.0452648   .0145416    -3.11   0.002    -.0737659   -.0167637
       zinfo |  -.3944381   .0175373   -22.49   0.000    -.4288106   -.3600655
    zprofess |   .0052949   .0185153     0.29   0.775    -.0309945    .0415843
   zotherind |   .0181963   .0249341     0.73   0.466    -.0306735    .0670662
     lnsales |   .0044881   .0106768     0.42   0.674     -.016438    .0254143
     zslack1 |  -.0055746   .0218085    -0.26   0.798    -.0483184    .0371692
    zrnd_int |  -.0214535   .0196331    -1.09   0.275    -.0599337    .0170267
        zyr3 |   .0118343   .0116763     1.01   0.311    -.0110508    .0347194
       _cons |   .4924141   .0839626     5.86   0.000     .3278504    .6569778
------------------------------------------------------------------------------
```

Main Effects Model

```
. xtreg randompercent lncvc_num zrisky zinfo zprofess zotherind lnsales zslack1
zrnd_int zyr3 zprod_lead zage zcloseness, pa

GEE population-averaged model                   Number of obs      =       213
Group variable:                     corp_num    Number of groups   =        94
Link:                               identity    Obs per group: min =         1
Family:                             Gaussian                   avg =       2.3
Correlation:                    exchangeable                   max =         3
                                                Wald chi2(12)      =    817.37
Scale parameter:                    .0345715    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
randomperc~t |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lncvc_numf |  -.0239415   .0143083    -1.67   0.094    -.0519852    .0041022
      zrisky |  -.0254919   .0141984    -1.80   0.073    -.0533202    .0023364
       zinfo |  -.3693575   .0181183   -20.39   0.000    -.4048688   -.3338462
    zprofess |   .0068916   .0179411     0.38   0.701    -.0282723    .0420555
   zotherind |   .0162544   .0226141     0.72   0.472    -.0280685    .0605772
     lnsales |   .0143522   .0105544     1.36   0.174    -.0063341    .0350384
     zslack1 |   .0022956   .0205276     0.11   0.911    -.0379377    .0425289
    zrnd_int |  -.0444086   .0198625    -2.24   0.025    -.0833384   -.0054787
        zyr3 |   .0141413   .0111693     1.27   0.205    -.0077501    .0360326
  zprod_lead |   .0393498    .014949     2.63   0.008     .0100503    .0686493
        zage |   .0050732   .0144621     0.35   0.726    -.0232721    .0334184
  zcloseness |   .0830145   .0195981     4.24   0.000      .044603     .121426
       _cons |   .4236075   .0807641     5.24   0.000     .2653127    .5819022
------------------------------------------------------------------------------
```

Interaction Effects Model

```
. xtreg randompercent lncvc_num zrisky zinfo zprofess zotherind lnsales zslack1
zrnd_int zyr3 zcr4 zprod_lead zage zcloseness c.zage#c.zcr4 c.zcloseness#c.zcr4
c.zprod_lead#c.zcr4, pa

GEE population-averaged model                   Number of obs      =       213
Group variable:                     corp_num    Number of groups   =        94
Link:                               identity    Obs per group: min =         1
Family:                             Gaussian                   avg =       2.3
Correlation:                   exchangeable                    max =         3
                                               Wald chi2(16)      =    855.09
Scale parameter:                    .0331182    Prob > chi2        =    0.0000

------------------------------------------------------------------------------
randomperc~t |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  lncvc_numf |  -.0202146   .0142714    -1.42   0.157    -.0481861    .0077568
      zrisky |  -.0237065   .0144329    -1.64   0.100    -.0519945    .0045815
       zinfo |  -.3816945   .0194511   -19.62   0.000    -.4198179   -.3435712
    zprofess |  -.0143698    .022333    -0.64   0.520    -.0581416     .029402
   zotherind |   .0178103   .0222447     0.80   0.423    -.0257886    .0614091
     lnsales |   .0129504    .010691     1.21   0.226    -.0080035    .0339043
     zslack1 |   .0095725   .0203943     0.47   0.639    -.0303996    .0495445
    zrnd_int |  -.0372826   .0198767    -1.88   0.061    -.0762402     .001675
        zyr3 |   .0131017   .0109396     1.20   0.231    -.0083396     .034543
        zcr4 |   .0574862   .0225276     2.55   0.011     .0133329    .1016395
  zprod_lead |   .0469102   .0245696     1.91   0.056    -.0012453    .0950658
        zage |   .0081825   .0161484     0.51   0.612    -.0234679    .0398329
  zcloseness |   .0743165   .0195114     3.81   0.000     .0360749    .1125581
             |
      c.zage#|
      c.zcr4 |  -.0056642    .014497    -0.39   0.696    -.0340779    .0227495
             |
         c.  |
  zcloseness#|
      c.zcr4 |  -.0423141   .0220746    -1.92   0.055    -.0855795    .0009512
             |
         c.  |
  zprod_lead#|
      c.zcr4 |  -.0104368   .0256704    -0.41   0.684    -.0607499    .0398763
             |
       _cons |   .4251669   .0837398     5.08   0.000       .26104    .5892939
------------------------------------------------------------------------------
```

Second-order Model 1

```
Fixed-effects (within) regression               Number of obs      =       213
Group variable: corp_num                        Number of groups   =        94

R-sq:  within  = 0.1439                         Obs per group: min =         1
       between = 0.2134                                        avg =       2.3
       overall = 0.1758                                        max =         3

                                                F(7,112)           =      2.69
corr(u_i, Xb)  = -0.2223                        Prob > F           =    0.0130

------------------------------------------------------------------------------
         rnd |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
randomperc~t |   485.0523    200.361     2.42   0.017     88.06254     882.042
  lncvc_numf |  -31.77917    47.6384    -0.67   0.506    -126.1686    62.61021
      zrisky |  (omitted)
       zinfo |  (omitted)
    zprofess |  (omitted)
   zotherind |  (omitted)
     lnsales |   86.69468    116.958     0.74   0.460    -145.0427     318.432
     zslack1 |   9.461202   67.54137     0.14   0.889    -124.3634    143.2858
    zrnd_int |   3.085439   102.3951     0.03   0.976    -199.7973    205.9682
        zyr3 |   35.43682    23.3646     1.52   0.132    -10.85715    81.73079
        zage |   674.2127   225.2805     2.99   0.003     227.8482    1120.577
  zcloseness |  (omitted)
  zprod_lead |  (omitted)
       _cons |  -80.98159   955.9456    -0.08   0.933    -1975.065    1813.102
-------------+----------------------------------------------------------------
     sigma_u |  1255.2677
     sigma_e |  322.97855
         rho |   .9379081   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(93, 112) =    18.52             Prob > F = 0.0000
```

Second Order Model 2

```
. xtnbreg pat_0 randompercent lncvc_num zrisky zprofess zotherind lnsales zslack1
zrnd_int zyr3 zage zcloseness zprod_lead pat_1, pa

GEE population-averaged model                   Number of obs      =       213
Group variable:                     corp_num    Number of groups   =        94
Link:                                   log    Obs per group: min =         1
Family:              negative binomial(k=1)                  avg =       2.3
Correlation:                    exchangeable                  max =         3
                                              Wald chi2(13)      =    407.78
Scale parameter:                           1  Prob > chi2        =    0.0000

------------------------------------------------------------------------------
       pat_0 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
randomperc~t |   .3334594   .2212675     1.51   0.132     -.100217    .7671357
  lncvc_numf |   .1879821   .0653643     2.88   0.004     .0598705    .3160938
      zrisky |    .043298    .099274     0.44   0.663    -.1512755    .2378716
    zprofess |  -.1086049   .1294033    -0.84   0.401    -.3622308    .1450209
   zotherind |  -.2812271   .1711488    -1.64   0.100    -.6166725    .0542183
     lnsales |   .4221714   .0638911     6.61   0.000     .2969472    .5473957
     zslack1 |  -.2240685   .0925575    -2.42   0.015    -.4054778   -.0426592
    zrnd_int |   .4585251   .1099258     4.17   0.000     .2430745    .6739756
        zyr3 |  -.0813073   .0368778    -2.20   0.027    -.1535865   -.0090282
        zage |    .298269   .0988154     3.02   0.003     .1045944    .4919436
  zcloseness |  -.1373011   .1233845    -1.11   0.266    -.3791302     .104528
  zprod_lead |   .1317008   .1000614     1.32   0.188     -.064416    .3278175
       pat_1 |   .0015593    .000183     8.52   0.000     .0012007    .0019178
       _cons |  -.1253968   .4788262    -0.26   0.793    -1.063879    .8130854
------------------------------------------------------------------------------
```