

Mitigating the Partner Uncertainty for Venture Firms in Cross-border Corporate Venture Capital Investment

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Despite the growing importance of corporate venture capital (CVC) in the venture capital market, little scholarly attention has been devoted to cross-border CVC investment. Venture firms perceive higher risks of technology leakage in cross-border CVC investment than they do in domestic CVC investment due to geographical and cultural disparity. Given that venture firms would not receive CVC investment in the presence of the partner uncertainty, we argue that the likelihood of cross-border CVC investment increases with the strength of intellectual property protection (IPP) regime, the investment timing (i.e. funding round number), and the industry unrelatedness with the corporate investor. Additionally, we investigate how the venture firm's complementary resource need interact with the partner uncertainty in decisions for cross-border CVC investment. By examining 2,873 CVC investment transactions in the period 1994-2009, we found supporting evidence for the strength of IPP regime and the industry unrelatedness in mitigating the partner uncertainty of foreign corporate investors. However, the effectiveness of these factors is moderated by the type of resources that the venture firms need from the foreign corporate investors.

Keywords : *Corporate Venture Capital, Cross-Border Investment, Partner Uncertainty, Resource Dependence*

I. Introduction

Corporate venture capital (CVC) refers to the capital raised by established firms to acquire minority equity stakes in privately held venture firms for strategic purposes (Gompers and Lerner, 1998). Recently, CVC has become a prominent source of funding for venture firms (Dushnitsky, 2012), constituting more than 15 percent of the U.S.

venture capital market in 2013, according to the National Venture Capital Association (Figure 1). Corporate investors are particularly important to entrepreneurs for they provide complementary resources on top of financial support and managerial advices, accelerating the commercialization of the technological invention of venture firms (Basu, Phelps, and Kotha, 2011; Ferrary, 2010; Katila,

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Rosenberger, and Eisenhardt, 2008; Park and Steensma, 2012). In particular, cross-border CVC investments help venture firms to grow and internationalize (Devigne, Vanacker, Manigart, and Paeleman, 2013; Mäkelä and Maula, 2005). For instance, Skype received

CVC investment from Itochu Technology Ventures (the CVC arm of Itochu) in 2009, in order to penetrate the Japanese market. Moreover, cross-border CVC has accounted for about 18%, on average, of all CVC deals in the U.S. since 1994 (Figure 2).

Figure 1
Number and Percentage of Deals with CVC Involvement in U.S. (CVC vs. total VC)

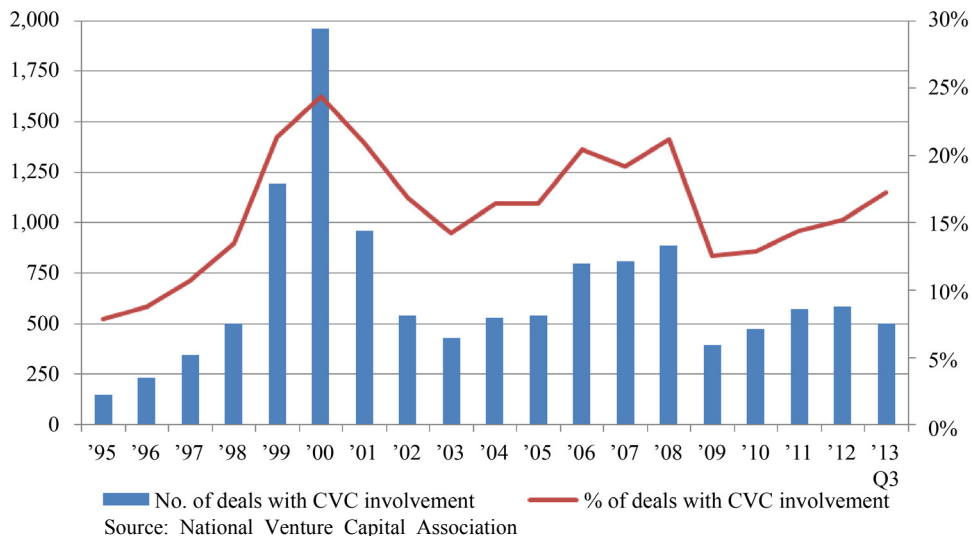
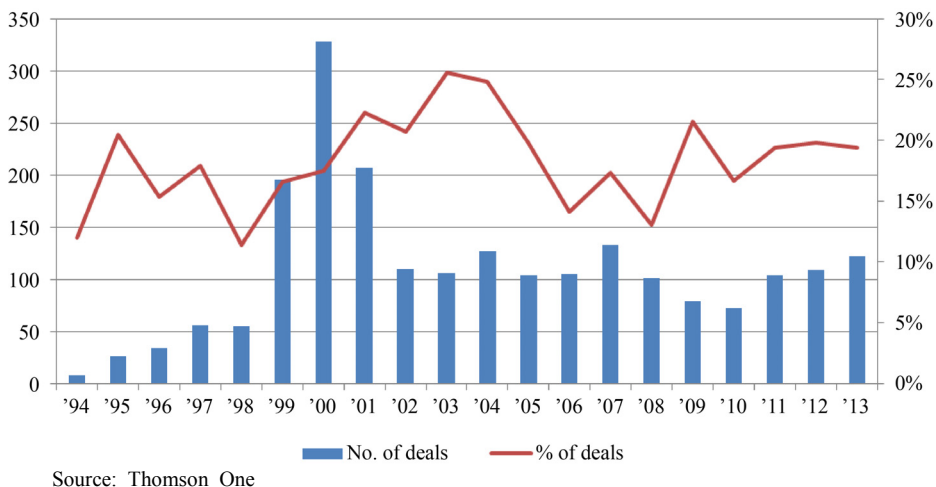


Figure 2
Number and Percentage of Deals with Cross-Border CVC Involvement in U.S.(cross-border CVC vs. total CVC)



Despite the increasing importance of cross-border CVC investments for venture firms, prior research has mostly focused on the remedies for overcoming the liabilities associated with the foreignness of investors, paying considerably less attention on the venture firm's perspective. A corporate investor is more likely to internationalize its VC program when the entrepreneurial and innovative environments in the parent company's home country offer poor investment opportunities (Da Gbadji, Gailly, and Schwienbacher, 2014). However, a wide range of societal and institutional disparities between countries create liability of foreignness for investors (Bell, Filatotchev, and Rasheed, 2012) and decrease the level of investment flow between distant countries (Moore, Payne, Bell, and Davis, 2015). The internationalization of VC firms is facilitated by the amount of local knowledge on host countries and international experience (Guler and Guillén, 2010b). Therefore, investors' network (Guler and Guillén, 2010a; Madhavan and Iriyama, 2009) and hiring local executives (Pruthi, Wright, and Meyer, 2009) are critical in mitigating the information asymmetry caused by the foreignness.

Yet, cultural and geographical distances raise not only the information asymmetry for corporate investors but also the partner uncertainty for venture firms (Oxley, 1999; Oxley and Sampson, 2004) because the distances increase the costs of interaction and communication (Bell et al., 2012; Reus and Lamont, 2009), thereby hampering trust building in the relationship (Guiso, Sapienza, and Zingales, 2009). Venture firms are not passive actors in decisions for venture capital investment (Katila et al., 2008; Santos and Eisenhardt, 2009). Therefore, in this study, we propose to investigate how venture firms mitigate the partner uncertainty caused by cultural and geographical disparity associated with cross-border CVC investment.

Given that corporate investors are interested in expropriating the intellectual property of venture firms (Dushnitsky and Lenox, 2005; Dushnitsky and Shaver, 2009; Katila

et al., 2008), we argue that the partner uncertainty for a venture firm in cross-border CVC investment is mitigated when the intellectual property can be protected. In this aspect, a venture firm is more likely to receive investment from foreign CVCs when the intellectual property protection regime of the venture firm's industry is strong, when the venture firm has internally accumulated sufficient tacit knowledge, and when the foreign corporate investor is not a potential threat to the venture firm. However, since venture firms compare their resource need with this inherent partner uncertainty before forming CVC investment ties (Dushnitsky and Shaver, 2009; Katila et al., 2008), we additionally investigate how venture firms' resource need interact with the partner uncertainty in cross-border CVC investment. The hypotheses are tested using 2,873 CVC transactions in the period 1994-2009.

This study extends the literature on CVC investment into the cross-border context. Prior work disregarded the differences associated with the national background of corporate investors and implicitly omitted foreign corporate investors from the sample. Moreover, this study contributes to the resource dependence theory by showing that venture firms anticipate not only the resource need that they face but also the partner uncertainty associated with CVC investment. Further, given that CVC investment is a bilateral negotiation, corporate investors who wish to internationalize their investment portfolios need to understand the factors that mitigate the appropriation concerns of entrepreneurs in the host countries. Therefore, this study presents the venture firm's perspective on CVC investment.

The rest of this paper is structured as follows. In the second section, we briefly review the extant literature on the benefits and liabilities of CVC investment for venture firms, and explore why cross-border CVC investment is associated with higher partner uncertainty compared to domestic CVC investment. Subsequently, we present hypotheses related to the mitigation of part-

ner uncertainty in cross-border CVC investment. The methodology and the results of our hypotheses testing follow in the third and fourth sections, respectively. We conclude the paper with a discussion of the implications of these findings.

II. Literature Review

2.1 Benefits and Liabilities of CVC Investment for Venture Firms

Venture firms engage in investment relationships with corporate investors in order to access necessary resources and to reduce resource uncertainty (Katila et al., 2008; Park and Steensma, 2012; Zahra and Allen, 2007). Venture firms view a corporate investor as a combination of a typical venture capitalist, who provides financial support and advice, and an alliance partner, from whom they expect strategic returns (Kann, 2000). From the perspective of venture firms, corporate investors are invaluable for two reasons. First, CVC investments are rich sources of capital (Katila et al., 2008). Unlike independent venture capital (IVC) investments, CVC investments are not governed by the external portfolio pressure of maximizing overall financial returns. Thus, they can provide “outsized cash infusions from a single source, without the venture having to court and coordinate a large syndicate of investors” (Katila et al., 2008: 301). Second, established firms have various complementary resources that new venture firms require in order to develop and commercialize their technological inventions, such as resources related to manufacturing, legal, marketing, distribution, sales, customer services, and product development (Teece, 1986).

In particular, venture firms form inter-firm relationships with foreign corporations for various strategic reasons (Glaister and Buckley, 1996) via CVC investment. For instance, in 2009, Skype received CVC investment from Itochu Technology Ventures, a CVC arm of Itochu, in order to penetrate Japanese market. Skype generates revenue by selling Skype credit, generally paid by

credit cards, on the web site. Yet, Skype had been troubled by the low credit card usage in Japan. By forming a CVC investment tie with Itochu, Skype could sell Skype credits in a voucher form through the distribution network of convenient stores, Family Mart, owned by Itochu. Moreover, in high-tech sectors, cross-border CVC investment is inevitable for venture firms. For instance, Swype Inc., a virtual keyboard developer for touchscreen smartphones in the U.S., received CVC investment in 2009 from Samsung Electronics and Nokia, the largest smartphone manufacturers at the time, to pre-load the application on smartphones. Hence, cross-border CVC investment helps venture firms to grow and internationalize (Devigne et al., 2013; Mäkelä and Maula, 2005) by providing knowledge about external markets and complementary assets such as supplier and buyer network, legitimacy in international markets (LiPuma, 2006; Zahra, Ireland, and Hitt, 2000).

However, the benefits of CVC investment come at a price. Corporate investors may be more interested in expropriating the intellectual property of venture firms than in delivering complementary resources (Dushnitsky and Shaver, 2009; Katila et al., 2008). One of the motivations for established firms to strategically invest in venture firms is the opportunity to acquire new emerging technological knowledge (Basu et al., 2011; Dushnitsky and Lenox, 2005; Wadhwa and Kotha, 2006). For instance, Intel Capital’s investment in Berkeley Networks (BN) (a manufacturer of switches for computer networking) in 1997 was primarily motivated by Intel’s desire to learn BN’s architecture for Intel’s internal switching projects, while BN wanted Intel’s help to gain access to Microsoft (Chesbrough and Lane, 2000). If corporate investors succeed in acquiring the venture firms’ technology, they may no longer be motivated to maintain the relationship with the venture firms and may even try to exit the relationship (Zahra and Allen, 2007), in which case the venture firms would no longer have access to the complementary resources that they need.

2.2 Increase in Partner Uncertainty with the Foreignness of Corporate Investor

The partner uncertainty in CVC investment is likely to increase with the foreignness of corporate investors due to the cultural and geographical disparity. Cultural distance—the extent to which shared values, beliefs, and attitudes differ between countries (Hofstede, 2001)—influences individual perceptions and behaviors, thereby affecting the level of trust in economic exchange (Guiso et al., 2009). For instance, cultural distance impedes understanding and communication between two parties (Bell et al., 2012; Reus and Lamont, 2009). Moreover, Luo (2002) confirmed that cultural distance is not a moderator but a determinant of trust in an inter-firm relationship. The lack of trust or of “positive expectations regarding another’s goodwill” (Das and Teng, 2001: p. 255), has been found to increase the perceived likelihood of a partner’s opportunistic behavior (John, 1984; Nooteboom, 1996) and the transaction cost between them (Williamson, 1985). Trust is particularly critical in equity-based inter-firm relationships (Casciaro, 2003) because equity investment increases the cost of exiting the relationship, and the focal firm is more vulnerable to the partners’ undesirable behavior (Bensaou and Anderson, 1999), unlike in non-equity inter-firm relationships such as the simple contractual agreements in marketing or R&D. Lastly, geographical distance increases costs for travel, transportation, and coordination (Zaheer, 1995), thus raising the costs of collecting information and monitoring the investors’ opportunistic behavior.

III. Hypothesis

3.1 Mitigating Partner Uncertainty in Cross-border CVC Investment

Given that venture firms are active decision makers that choose which corporations to invite as potential investors (Tyebee and Bruno, 1984), entrepreneurs would not en-

gage into cross-border CVC investment unless the partner uncertainty is alleviated.

3.1.1 Intellectual Property Protection (IPP) Regime

We propose that a venture firm is more likely to receive CVC investment from a foreign corporate investor when the intellectual property protection (IPP) regime of the venture firm’s sector is strong. We consider that a venture firm is under a strong IPP regime when the legal mechanisms such as patents and trade secrets are effective in protecting the intellectual property of the focal venture firm. Entrepreneurs are more likely to perceive higher risks of technology leakage in cross-border CVC investment compared to domestic CVC investment because cultural and geographical distances hinder trust building in the relationship (Guiso et al., 2009) and increase the costs of monitoring the opportunistic behavior (Bell et al., 2012) in the former type of CVC investment. In such situations, legal instruments may relieve the concerns of venture firms (Katila et al., 2008). Some examples are patents and trade secrets (Anton and Yao, 2004; Katila and Mang, 2003). A patent provides the patent holder the right to exclude others from using the same technology (Walker, 1995) and allows the patent holder to prosecute those who infringe the patent. Trade secrets protect the intellectual property that cannot be patented (Epstein, 2004), such as know-how and customer lists. Improperly discovering and using improperly discovered trade secrets are illegal, and such actions could result in litigation. Since the ability to protect intellectual property by these mechanisms varies across industries (Arora, 1995; Cohen, Nelson, and Walsh, 2000; Levin et al., 1987; Ziedonis, 2004), we expect more cross-border CVC investment for venture firms under industries of a strong IPP regime.

Hypothesis 1. Venture firms under a strong IPP regime are more likely to engage into cross-border CVC investment.

3.1.2 Investment Timing (Funding Round)

Venture firms may also protect their intellectual property more broadly by timing their investment relationship with a foreign corporate investor at later funding rounds. The timing of an investment round tracks the progressive maturation of the focal venture firm, since venture firms need additional cash infusion as their development process progresses (Sahlman, 1990). As the development progresses, a venture firm's technology becomes more incorporated into the product or service, thus enhancing the causal ambiguity of its technology (Rumelt, 1984) and making it more difficult for foreign corporate investors to expropriate its intellectual property (Alvarez and Barney, 2001; Lerner and Merges, 1998). Moreover, at later funding rounds, corporate investors are less likely to influence the product portfolio and strategic agendas of the venture firms. Additionally, the venture firms' request to corporate investors becomes clearer at later funding rounds (Vohora, Wright, and Lockett, 2004). Hence, venture firms are less likely to experience friction and misunderstanding with foreign investors caused by cultural and geographical distances (Dai, Jo, and Kassicieh, 2012), which would undermine the effectiveness of the value-adding activities of foreign investors (Devigne et al., 2013). Based on these factors, we posit the following hypothesis:

Hypothesis 2. Venture firms are more likely to engage into cross-border CVC investment at later funding rounds.

3.1.3 Industry Unrelatedness

Selecting a corporate investor with fewer conflicts of interests is critical for the growth of venture firms (Khanin and Turel, 2014). Entrepreneurs need to pay close attention to the incentives and the ability of corporate investors to expropriate the intellectual property of venture firms (Diestre and Rajago-

palan, 2012). Foreign corporate investors have lower trustworthiness related to the intention of their investment compared to domestic corporate investors (Guiso et al., 2009; Luo, 2002). In this regard, we suggest that venture firms would avoid corporate investors from closely related industries in cross-border CVC investment. The incentives and abilities of a corporate investor to expropriate the intellectual property of its investee firm are stronger when the focal venture firm is more closely related to the corporate investor. First, when both the investor and the investee operate in related industries, the level of bilateral competition—"the extent to which partners can be considered competitors of the focal firm" (Lavie, 2007: p. 1194)—is raised. When the focal venture firm is considered as a potential competitor, the investor has more incentives to direct its effort toward value appropriation instead of value creation (Diestre and Rajagopalan, 2012; Dushnitsky and Shaver, 2009; Lavie, 2007), which could lead to the unintended leakage of resources (Lavie, 2006). Second, industry relatedness enhances the absorptive capacity of a corporate investor, exacerbating the risks of resource misappropriation in CVC investment. Absorptive capacity is the ability to recognize, assimilate, and apply external knowledge for innovation (Cohen and Levinthal, 1990). Industry relatedness facilitates technical communication and learning since both parties have common skills, shared languages, and similar cognitive structures (Grant, 1996; Kogut and Zander, 1992; Lane and Lubatkin, 1998), thereby increasing the possibility of technology leakage to corporate investors. Hence, we hypothesize the following:

Hypothesis 3. Venture firms are more likely to engage into cross-border CVC investment when the industries of corporate investors and venture firms are unrelated.

3.2 Moderating Effects of Complementary Resource Need of Venture Firms

As was mentioned in the previous section, the primary purpose for which venture firms seek CVC investment is to access complementary resources of corporate investors (Basu et al., 2011; Katila et al., 2008; Park and Steensma, 2012). Thus, we propose that the level of complementary resource need of a venture firm would moderate its proclivity for cross-border CVC investment in the presence of the partner uncertainty. If venture firms have sufficient complementary resources, they would use complex criteria while searching for and screening corporate investors, and they would select investors with less potential for opportunistic behavior (Zahra and Allen, 2007). However, if venture firms are short of necessary resources, gaining access to the complementary resources of established firms may outrank concerns about the opportunistic behavior of corporate investors (Kaplan, 1994; Smith, 2001). In such situations, venture firms would be more likely to accept investments from investors with large partner uncertainty. Xia (2011) argued that an alliance relationship would last longer without the adoption of safeguards against the partner's opportunistic behavior when the

resource need of the focal firm is large, because accessing the partner's resources is more important than constraining the partner's opportunistic behavior in this context. Therefore, the resource need of venture firms would reduce the importance of mitigating the partner uncertainty in cross-border CVC investment, leading to the following hypotheses:

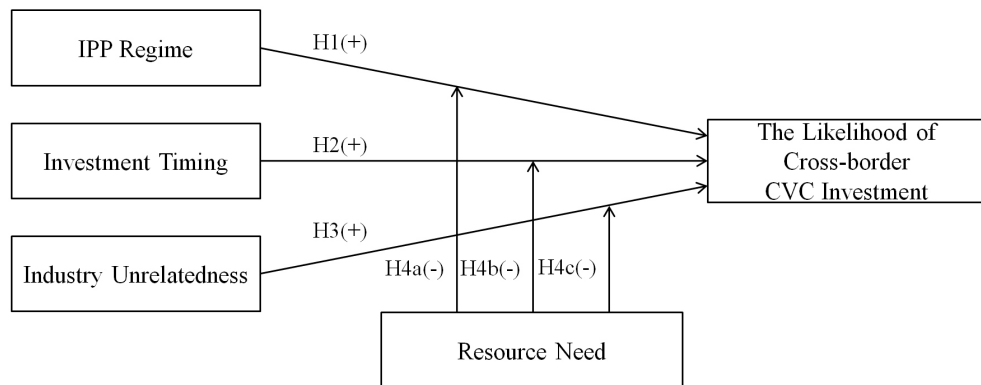
Hypothesis 4a. The positive relationship between the strength of IPP regime and the likelihood of cross-border CVC investment is negatively moderated by the resource need of the focal venture firm.

Hypothesis 4b. The positive relationship between the funding round and the likelihood of cross-border CVC investment is negatively moderated by the resource need of the focal venture firm.

Hypothesis 4c. The positive relationship between the industry unrelatedness and the likelihood of cross-border CVC investment is negatively moderated by the resource need of the focal venture firm.

The theoretical framework of this study is summarized in Figure 3.

Figure 3
Theoretical Framework



IV. Methodology

4.1 Data and Sample

In this study, we attempt to analyze whether the strength of IPP regime of the focal venture firm, deferring the investment timing to later funding rounds and the selection of an unrelated corporate investor by the venture firm reduce the partner uncertainty for the venture firm in cross-border CVC investment. To achieve this goal, we collected the CVC transactions that U.S.-based venture firms engaged with various foreign (i.e. non-U.S.) and domestic (i.e. U.S.) corporate investors, and empirically compared whether the level of the aforementioned factors are more prominent in cross-border CVC transactions than domestic counterparts. Therefore, the unit of analysis is a CVC investment transaction.

We used the Thomson ONE database, which provides comprehensive data about venture capital investors and their portfolio companies (i.e. venture firms). To identify CVC investment transactions, we first collected all investment transactions that came from “Corporate PE” funds as categorized by the Thomson ONE database. However, “Corporate PE” fund in Thomson ONE database does not conform to the notion of CVC in this research. The corporate PEs in the database consist of not only those with strategic objectives but also those that have only financial objectives, similar to IVCs. Such financially driven corporate PEs generally do not provide complementary resources to venture firms and are not subject to the resource misappropriation hazards. Thus, to determine whether the owner of the fund had strategic purposes, we manually searched the parent firm of each fund in Google, using the fund names as the search keyword. Subsequently, we excluded VC investments from financial corporations (for example, Royal Bank of Canada, AIG Private Equity) or non-profit corporations (for example, Kaiser Permanete). We assumed the rest of the investors in the

sample had strategic objectives.

In this study, we restricted the analysis to the initial CVC investments in U.S.-based high technology venture firms (VEIC¹) 1000s to 5000s) that had their first round of funding after January 1st 1994 and completed the fund-raising process before December 31st 2010. We excluded follow-on investments in the analysis. We also carved out venture firms in non-high-technology industries because high-technology venture firms are the primary target of corporate investors (Dushnitsky and Lenox, 2005). We chose 1994 as the starting year since CVC investments began to surge after that year. We set the period of study as 16 years in order to include two cycles of venture capital funds, as the lifetime of a venture capital fund generally lasts about eight years (Gompers and Lerner, 2004). Moreover, we fixed the geographic location of venture firms to the United States for several reasons. First, many non-U.S. corporations are attracted to innovation clusters such as the Silicon Valley in order to gain access to advanced technologies (Chesbrough and Tachau, 2002; Hasegawa, 2011). Second, the U.S. venture capital market is the most developed market globally, with the highest penetration of CVC investment (Da Gbadji et al., 2014). Third, unlike the case in other regions in the world, U.S. venture capital investments are thoroughly tracked by the Thomson ONE database, which offers a good ground for empirical studies (Maats, Metrick, Yasuda, Hinkes, and Vershovski, 2011). Thus, cross-border CVC investment transactions in this study are those made by non-U.S. corporate investors in U.S.-based venture firms. After omitting data with missing values, the final sample consisted

1) Thomson ONE reports the Venture Economics Industry Codes (VEIC) for venture firms. VEIC 1000s represent the communication industry, VEIC 2000s the computer-related industry, VEIC 3000s the semiconductor and other electronics industries, VEIC 4000s the biotechnology industry, and VEIC 5000s the medical and health industries. VEIC 6000s and above represent the non-high-technology industries.

of 2,873 initial CVC investment transactions between 1,829 venture firms and 535 established firms.

Additionally, we used the Lexis-Nexis and COMPUSTAT Global and North America databases to track information about parent firms such as location, business domains, and various industry-level data, and the Business R&D and Innovation Survey by U.S. Census Bureau to operationalize the strength of IP protection.

4.2 Variable Description

4.2.1 Dependent Variable

The dependent variable, *Cross-border CVC Investment*, is a dummy variable. It represents the likelihood that the corporate investor of the focal transaction is a foreigner. Hence, we coded 1 if the corporate investor's parent firm is a non-U.S. corporation; and 0 if it is a U.S. corporation (i.e. domestic CVC). To determine whether the parent firm is a foreigner or a local, we first identified the location of the headquarters in COMPUSTAT Global and North America databases. For those firms that were not tracked by the databases, we used the Lexis-Nexis. We classified a corporation as "foreign" if it was headquartered outside the United States. Cross-border CVC investments account for 28 percent of all the CVC investment transactions in the sample.

4.2.2 Explanatory Variables

IPP Regime variable is measured using the survey data from the Business R&D and Innovation Survey (BRDIS) conducted by the U.S. Census Bureau. The survey reports the importance of each intellectual property protection instrument in each industry (in North America Industry Code, NAIC). The protection instruments that have been surveyed include utility patents, design patents, trademarks, copyrights, trade secrets, and mask works.²⁾ We summed up all the percentage scores for the "very important" ranking for each protection mechanism and

constructed industry-level data. Hence, the higher the total score is, the stronger the IPP regime of the industry is. Practically, we are assuming that the degree of importance of a protection mechanism in each industry shows the effectiveness of that particular protection mechanism. Since the survey was carried out in 2008 and 2009, we averaged the two years' scores. We consider this measure to be more sophisticated than that of the Carnegie Mellon Survey (CMS) (Cohen et al., 2000) since the CMS covers manufacturing firms only, ignoring the service sector. The BRDIS covers more industries such as the telecommunications, media, and healthcare sectors. Although the intellectual property protection regime is regarded to be time-invariant, the CMS survey (which was conducted in 1994) is rather outdated.

Investment Timing variable represents the funding round number of the focal CVC investment transaction. The round number is provided by Thomson ONE and we logged the number to reduce skewness. At later funding rounds, it is easier for venture firms to protect themselves from expropriation by foreign corporate investors because their technology is more mature (Lerner and Merges, 1998), thereby enhancing causal ambiguity (Rumelt, 1984). Thus, foreign corporate investors may not be able to influence the venture firms' strategic direction.

Industry Unrelatedness is the reverse of industry relatedness. Following Schildt, Maula, and Keil (2005), the four-digit Standard Industrial Classification (SIC) codes of corporate investors and venture firms were used to construct the variable. The SIC codes of venture firms were obtained from the Thomson ONE database, and we used the company database in Lexis-Nexis to identify the four-digit SIC codes of the business domains of corporate investors. Since the investors are generally large corporations that operate across multiple business sectors, it would not be appropriate to use only the primary business domain information provided by COMPUSTAT. The variable was

2) copyright protection for semiconductor products

assigned a value of -1 if the four-digit SIC code of the focal venture firm matched that of any of the business domains of a corporate investor; -0.75 if the first three digits of the SIC code matched any business domain; -0.5 if the first two digits matched; -0.25 if the first digit matched; and 0 if none of the digits matched. Thus, the variable has the value -1 if the industries of the corporate investor and the venture firm in the focal CVC investment are an exact match, and 0 if they are completely unrelated.

4.2.3 Moderating Variables.

The degree of venture firm's resource need is closely associated with the amount of complementary resources needed for commercialization. Although constructing a firm-level variable would have been more desirable for our analysis, it was not quite possible since the venture firms in the sample are private companies. Thus, as in prior research (Katila et al., 2008; Park and Steensma, 2012), we constructed two industry-level variables to represent the levels of manufacturing and marketing resource need.

First, we operationalized the Manufacturing Resource Need variable as the industry (four-digit SIC) average ratio of fixed assets to sales in the investment year. To measure this variable, the yearly industry value of the "Property, Plant and Equipment" (PPENT) and "Revenue" (REVT) items were drawn from the COMPUSTAT North America database. Subsequently, $\frac{\sum PPENT_{SIC_i, t_{INV}}}{\sum REVT_{SIC_i, t_{INV}}}$ was calculated, where SIC_i is the industry (four-digit SIC) in which venture firm i operates, and t_{INV} is the year of the focal CVC investment.

We measured the *Marketing Resource Need* variable similarly. Collecting the "Selling, General and Administrative Expense" (XSGA) and "Revenue" (REVT) items from the COMPUSTAT North America database, we calculated $\frac{\sum XSGA_{SIC_i, t_{INV}}}{\sum REVT_{SIC_i, t_{INV}}}$. We used selling expenses instead of advertising expenses for two reasons. First, the advertising expenses had more missing values compared to the XSGA item. Second, we

think the XSGA item better expresses the notion of marketing than the advertising expenses item does, as marketing involves advertising as well as the management of sales operations.

4.2.4 Control Variables

Prior research suggests that investor characteristics are related to the venture firms' fund-raising decisions (Dushnitsky and Shaver, 2009). Therefore, we first measured *Experience of CVC Investor*, which is the number of months that passed between the corporate investor's first investment and the focal investment. Second, we measured *Fund Size of CVC Investor*, which is the fund size category of the corporate investor in the focal investment transaction. We assigned values to the fund size category provided by Thomson ONE: 0~25 million USD (1); 25~50 million USD (2); 50~100 million USD (3); 100~250 million USD (4); 250~500 million USD (5); 500~1,000 million USD (6); and 1,000 million USD (7). Further, we included a variable that represented whether or not the program had an autonomous structure (Johnson, 2012). The CVC Structure variable was assigned the value 1 if the CVC program was operated by a unit outside the firm boundary (that is, if the investment program was operated by a wholly owned subsidiary, or if it was outsourced to an independent venture capitalist) and 0 if the CVC program was operated by an internal department or team.

The venture firms' engagement into CVC investment is also affected by environmental conditions (Park and Steensma, 2012). Therefore, we considered two environmental dimensions. First, we included the *Industry Size* variable, $\ln(IND_SIZE_{SIC_i, t_{INV}})$, where $IND_SIZE_{SIC_i, t_{INV}}$ refers to the total sales amount of the industry (four-digit SIC) within which venture firm i operates in the year of the focal investment, t_{INV} . Second, following Boyd (1990) and Dess, and Beard (1984), we calculated the *Industry Growth* variable, $IND_GRW_{SIC_i, t_{INV}}$ from the regression slope of industry sales over a 5-year period before t_{INV} .

We included the logged amount of total equity raised (*Equity Invested*) by the venture firm in the round that the focal CVC investment transaction occurred. If venture firms need more cash infusion, they may be more flexible with their preference of investors. Further, we controlled the location of the venture firm, *Venture Cluster Region*. If a venture firm is located in a cluster region, it is more likely to be noticed by foreign corporate investors, and the investors are less likely

to behave opportunistically in order to maintain their reputation as trustworthy partners (Hallen, Katila, and Rosenberger, 2013; Sorenson and Stuart, 2001). We assigned the value 1 if a venture firm is located in California, Massachusetts, or Texas, and 0 otherwise. Additionally, we included the year dummy (t_{INV}) and the industry dummy of venture firms to control time- and industry-related unknown effects. The summary of variables used in this study is presented in Table 1.

Table 1
Summary of Variables

Variables	Mean	Std. Dev.	Definition
<i>Dependent Variable</i>			
(1) Cross-border CVC Investment	0.279	0.449	1 if the corporate investor in the focal transaction is a foreigner, and 0 if a local
<i>Explanatory Variables</i>			
(2) IPP Regime	125.190	52.974	Sum of the percentage scores for the “very important” ranking in each industry
(3) Investment Timing (ln)	0.940	0.621	Funding round number of the focal transaction
(4) Industry Unrelatedness	-0.518	0.404	Values between 0 and -1 according to the number of digits of SIC codes matched
<i>Moderating Variables</i>			
(5) Manufacturing Resource Need	0.276	0.313	The ratio of fixed assets to sales of the industry at the investment date
(6) Marketing Resource Need	0.389	0.142	The ratio of sales & administrative expenditure to sales of the industry at the investment date
<i>Control Variables</i>			
(7) Industry Size (ln)	11.096	1.250	Total sales in million USD of all firms in each industry at the investment date
(8) Industry Growth	14.271	11.944	Regression slope of previous 5 years of industry sales
(9) Equity Invested (ln)	2.589	1.069	The equity amount of total fund raised by focal venture firm at the investment date
(10) Experience of CVC Investor	87.322	79.468	The number of months of focal CVC unit from its first investment till the investment date
(11) Fund Size of CVC Investor	1.661	1.375	The fund size of focal CVC unit, categorized 1 to 7 according to its fund size in mil USD
(12) CVC Structure	0.554	0.497	1 if the CVC program was operated by a unit outside the firm boundary, 0 otherwise
(13) Venture Cluster Region	0.680	0.467	1 if focal venture is located in “California”, “Massachusetts”, or “Texas”, 0 otherwise
(14) Industry Dummy			The industry category of focal venture
(15) Year Dummy			The year of the investment date

4.3 Econometric Approach

Instead of a conventional logistic regression, we used a Generalized Estimating Equations (GEE) logistic regression model to account for autocorrelation caused by the repeated observations (Liang and Zeger, 1986). 35 percent of venture firms in the sample received CVC investment from more than one corporate investor: 1.6 corporate investors on average; maximum of 13. Hence, the characteristics of these venture firms repeatedly appear in the sample, causing the autocorrelation problem. While performing the GEE logistic regression analysis by STATA, we applied binomial distribution, logit link function, and exchangeable correlation structure with the robust option in estimating the variance of the residuals.

V. Results

Table 2 presents the correlation matrix of the variables used in the study. As demonstrated in Table 2, the multicollinearity of the explanatory and moderating variables does not seem to be serious. Table 3 reports the results of the GEE logistic regression analysis to test the four hypotheses. Model 1 in Table 3 reports some interesting results regarding the control variables. The coefficient of the *Experience of CVC Investor* variable is negative and significant ($-0.004, p < 0.001$) and that of the *Fund Size of CVC Investor* variable is positive and significant ($0.100, p < 0.01$), indicating that foreign corporate investors in the U.S. venture capital market are generally less experienced but operate larger funds compared to domestic corporate investors. In addition, the fact that the *CVC Structure* variable is positive and significant ($0.304, p < 0.01$) represents that foreign CVC funds that have invested in the U.S. tend to be managed directly by a wholly owned subsidiary or to have outsourced the investment program to an independent venture capitalist instead of operating the investment unit internally. *Venture Cluster Region* is positive and significant ($0.359, p < 0.001$), showing that venture firms that are located in well-known cluster regions are more likely to receive cross-border CVC investments. Lastly, the coefficient of the

Equity Invested variable is negative and significant ($-0.113, p < 0.05$), indicating that venture firms tend to prefer domestic corporate investors more than foreign corporate investors when they raise larger amount of capital.

Model 1 also presents the results for the test of the hypotheses 1 to 3. In Hypothesis 1, we proposed that venture firms under industries of a strong IPP regime are more likely to receive cross-border CVC investment. The results show that the coefficient of the *IPP Regime* variable is positive and significant ($0.003, p < 0.001$) in Model 1, supporting Hypothesis 1. In Hypothesis 2, we suggested that the likelihood of cross-border CVC investment would increase for venture firms at later funding rounds. Although the coefficient of *Investment Timing* variable is positive (0.112), it is not significant; therefore, Hypothesis 2 is not supported. As per Hypothesis 3, we expected that venture firm is more likely to receive CVC investment from a foreign corporate investor whose business domain is unrelated to the industry of the venture firm. The positive and significant coefficient of *Industry Unrelatedness* ($0.946, p < 0.001$) in Model 1 shows that Hypothesis 3 is supported.

Hypotheses 4(a–c) proposed that venture firms with large resource need are likely to receive cross-border CVC investment even though the partner uncertainty is not dissipated by various defense mechanisms. Models 3 to 8 present the interaction terms to test the moderating effects of resource need. In contrast to Hypothesis 4a, the interaction term in Model 3 is unexpectedly positive and significant ($0.017, p < 0.01$). This shows that a venture firm with large manufacturing resource need is less likely to receive cross-border CVC investment when the venture firm's IPP regime is weak. Thus, the importance of IPP regime is not disappeared for venture firms with large manufacturing resource need. With regard to Hypothesis 4b, the interaction term *Investment Timing* \times *Marketing Resource Need* in Model 6 is negative and significant ($-1.407, p < 0.01$) as expected, supporting the hypothesis. This represents that venture firms with large marketing resource need are likely to engage CVC investment relationship with a foreign corporate investor at early funding rounds.

Table 2
Correlation Matrix of Variables with Descriptive Statistics

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Cross-border CVC Investment	1.000												
(2) IPP Regime	0.087***	1.000											
(3) Investment Timing (ln)	0.025	0.017	1.000										
(4) Industry Unrelatedness	0.138***	-0.006	-0.192***	1.000									
(5) Manufacturing Resource Need	0.017	0.008	-0.107***	0.367***	1.000								
(6) Marketing Resource Need	0.011	-0.006	0.122***	-0.556***	-0.293***	1.000							
(7) Industry Size (ln)	0.017	0.051**	0.115***	-0.258***	0.255***	0.076***	1.000						
(8) Industry Growth	-0.055**	-0.066***	-0.025	0.126***	0.020	0.007	-0.096***	1.000					
(9) Equity Invested (ln)	-0.078***	0.247***	-0.006	0.106***	-0.026	0.097***	0.057**	0.075**	1.000				
(10) Experience of CVC Investor	-0.084***	0.059**	0.030	-0.077***	-0.032†	-0.009	0.017	-0.143**	-0.053**	1.000			
(11) Fund Size of CVC Investor	0.066***	0.010	0.064***	0.029	0.036†	-0.015	-0.014	0.041†	-0.173***	0.088***	1.000		
(12) CVC Structure	0.104***	-0.010	-0.074***	-0.018	-0.009	0.051**	0.023	-0.066***	0.008	0.232***	-0.122***	1.000	
(13) Venture Cluster Region	0.063***	0.035†	0.034†	-0.071***	0.040*	-0.054**	0.020	-0.054**	-0.011	0.040*	-0.022	0.041†	1.000

N = 2,873 CVC investment transactions

† p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.

Table 3
GEE Logistic Regression Analysis on the
Likelihood Cross-Border CVC Investment

Dependent Variable: Cross-border CVC Investment								
Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
IPP Regime	0.005 ^{***} (0.001)	0.004 ^{***} (0.001)	0.007 [*] (0.003)	0.001 (0.002)	0.004 ^{***} (0.001)	0.004 ^{***} (0.001)	0.004 ^{***} (0.001)	0.004 ^{***} (0.001)
Investment Timing (ln)	0.112 (0.080)	0.117 (0.080)	0.115 (0.080)	0.122 (0.081)	0.112 (0.109)	0.655 ^{**} (0.222)	0.123 (0.081)	0.126 (0.081)
Industry Unrelatedness	0.946 ^{***} (0.118)	0.937 ^{***} (0.119)	0.940 ^{***} (0.119)	0.971 ^{***} (0.120)	0.937 ^{***} (0.119)	0.936 ^{***} (0.119)	-0.605 ⁺ (0.311)	1.531 ^{***} (0.164)
Manufacturing Resource Need		0.218 (0.170)	0.201 (0.171)	-0.699 ⁺ (0.344)	0.203 (0.306)	0.230 (0.171)	0.199 (0.171)	-0.358 (0.219)
Marketing Resource Need		-0.343 (0.461)	0.486 (0.718)	0.169 (0.438)	-0.344 (0.461)	0.965 (0.657)	1.139 [*] (0.457)	-0.090 (0.454)
IPP Regime ×Manufacturing Resource Need			0.017 ^{**} (0.005)					
IPP Regime ×Marketing Resource Need				-0.008 (0.006)				
Investment Timing ×Manufacturing Resource Need					0.017 (0.281)			
Investment Timing ×Marketing Resource Need						-1.407 ^{**} (0.540)		
Industry Unrelatedness ×Manufacturing Resource Need							-2.086 ^{***} (0.392)	
Industry Unrelatedness ×Marketing Resource Need								3.930 ^{***} (0.766)
Industry Size (ln)	0.065 (0.041)	0.061 (0.041)	0.069 (0.042)	0.048 (0.041)	0.061 (0.041)	0.057 (0.041)	0.073 (0.041)	0.045 (0.041)
Industry Growth	-0.002 (0.004)	-0.002 (0.004)	-0.001 (0.004)	-0.002 (0.004)	-0.002 (0.004)	-0.002 (0.004)	0.000 (0.004)	-0.001 (0.004)
Equity Invested (ln)	-0.113 [*] (0.052)	-0.116 [*] (0.052)	-0.119 [*] (0.052)	-0.126 [*] (0.052)	-0.116 [*] (0.052)	-0.112 [*] (0.052)	-0.125 [*] (0.052)	-0.133 ^{**} (0.051)
Experience of CVC Investor	-0.004 ^{***} (0.001)	-0.004 ^{***} (0.001)	-0.004 ^{***} (0.001)	-0.004 ^{***} (0.001)	-0.004 ^{***} (0.001)	-0.004 ^{***} (0.001)	-0.004 ^{***} (0.001)	-0.004 ^{***} (0.001)
Fund Size of CVC Investor	0.100 ^{**} (0.032)	0.102 ^{**} (0.032)	0.103 ^{**} (0.032)	0.105 ^{**} (0.032)	0.102 ^{**} (0.032)	0.103 ^{**} (0.032)	0.119 ^{***} (0.032)	0.111 ^{***} (0.033)
CVC Structure	0.304 ^{**} (0.093)	0.298 ^{**} (0.093)	0.299 ^{**} (0.093)	0.299 ^{**} (0.094)	0.299 ^{**} (0.093)	0.307 ^{**} (0.093)	0.290 ^{**} (0.094)	0.283 ^{**} (0.094)
Venture Cluster Region	0.359 ^{***} (0.104)	0.361 ^{***} (0.104)	0.363 ^{***} (0.104)	0.342 ^{***} (0.104)	0.361 ^{***} (0.104)	0.368 ^{***} (0.104)	0.381 ^{***} (0.104)	0.389 ^{***} (0.105)
Constant	-9.688 ^{***} (2.675)	-9.773 ^{***} (2.221)	-9.984 ^{***} (2.117)	-10.002 ^{***} (2.013)	-9.775 ^{***} (2.226)	-10.095 ^{***} (1.943)	-11.095 ^{***} (3.369)	-9.489 ^{***} (1.955)
Industry Dummy								
Year Dummy								
Wald chi-square	221.75 ^{***}	227.21 ^{***}	228.94 ^{***}	236.5 ^{***}	227.43 ^{***}	235.35 ^{***}	231.92 ^{***}	261.43 ^{***}

N = 2,873 CVC investment transactions.

[†] p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001.

However, the interaction terms of *Industry Unrelatedness* in Model 7 and 8 show contrasting results. They are either negative (Model 7: -2.086, $p < 0.001$) or positive (Model 8: 3.930, $p < 0.001$) depending on the type of resources that the venture firms need. As shown in Model 8, when the manufacturing resource need of a venture firm is high, the venture firm receives cross-border CVC investments from more dangerous (that is, related) foreign corporations; thus Hypothesis 4c is supported. However, Model 8 shows that venture firms are more likely to engage into CVC investment relationship with an unrelated foreign corporate investor when the marketing resource need is high. We discuss these contrasting results in the discussion section.

VI. Discussion and Conclusion

Foreign corporate investors have become a prominent source of funding in the venture capital market. This trend is driven by the globalization of R&D and open innovation programs (Gassmann, Enkel, and Chesbrough, 2010; Gassmann and Von Zedtwitz, 1998), the diffusion of CVC investment practices among industrial firms (Gaba and Meyer, 2008; Noyes, Brush, Hatten, and Smith-Doerr, 2014), and the search for quality investment opportunities by foreign corporations (Da Gbadji et al., 2014). Cross-border CVC investments help venture firms internationalize and facilitate their growth (Devigne et al., 2013; Mäkelä and Maula, 2005).

However, entrepreneurs perceive greater risks of expropriation of their intellectual property by foreign corporate investors because of the cultural and geographical disparity. Thus, we expected that venture firms would accept cross-border CVC investment when the partner uncertainty is reduced. As expected, our results show that venture firms receive cross-border CVC investments when their IPP regime is strong, and when the parent firm of the foreign corporate investor is unrelated to the venture firms' business.

Contrary to our expectation, we found no evidence for the effectiveness of deferring

the investment timing to later funding rounds in mitigating the partner uncertainty of foreign corporate investors. This result is intriguing, especially considering the fact that foreign venture capitalists usually prefer financing in later rounds to reduce the inherent information asymmetry caused by cultural and geographical distances (Dai et al., 2012). We speculate that this finding is related to the efforts of foreign corporate investors to expand early-stage investment. Since established firms invest in venture firms as a real option for technology sourcing in future (Van de Vrande and Vanhaverbeke, 2013; Van de Vrande, Vanhaverbeke, and Duysters, 2011), investment in early-stage venture firms may increase the strategic value of the real option (McGrath, 1997; McGrath and Nerkar, 2004). For instance, SK Telecom, a telecommunication service company in Korea, opened an incubating center in 2014 in Sunnyvale, California, to attract early-stage venture firms.

We postulated that venture firms with large complementary resource need would receive cross-border CVC investments without appropriate safeguards that could alleviate the partner uncertainty of foreign corporate investors. However, the results show that the direction of the moderating effect differs depending on the type of complementary resources that the venture firms need and the type of safeguards. The level of partner uncertainty of the corporate investor may vary according to the type of complementary resources that the investor provides. Access to the manufacturing resources of the corporate investor may be particularly risky for the venture firm because product development is often intertwined with the subsequent manufacturing process (Wasti and Liker, 1999), and the tacit knowledge associated with the core technology could be revealed during that process (Pisano and Teece, 1989). Consequently, venture firms would prefer more socially embedded local corporate investors for the access to manufacturing resources (Gulati and Gargiulo, 1999), and cross-border CVC investments are more likely only if appropriate safeguards

are in place. Yet, venture firms would prefer foreign corporate investors for the access to marketing resources as foreign corporate investors may help the venture firms to penetrate foreign markets (Mäkelä and Maula, 2005). Therefore, the endurance level of venture firms toward the partner uncertainty would be different according to the type of complementary resources.

As shown in Models 7 and 8 of Table 3, the effect of the industry unrelatedness is moderated by the type of resources that the venture firms access to. On the one hand, receiving CVC investment from a firm of related business increases the strategic value of the CVC investment for venture firms; on the other hand, it increases the partner uncertainty of the corporate investor (Dushnitsky and Shaver, 2009). However, the increase in strategic value is more dramatic in the case of manufacturing resources compared to marketing resources since manufacturing resources are intertwined with product development (Wasti and Liker, 1999). Therefore, for venture firms with large manufacturing resource need, receiving CVC investment from a foreign corporation of unrelated business provides insignificant strategic value.

The results of this study have managerial implications for corporate investors with plans to explore overseas investment. Venture firms tend to receive cross-border CVC investment when the partner uncertainty is mitigated by the strong IPP regime, deferring the investment timing to later rounds, and selecting a foreign corporate investor of unrelated business. Yet, the effectiveness of these factors differs according to the type of resources that a venture firm expects from its foreign corporate investor. Thus, if corporate investors want to engage in cross-border investment transactions in early-stage venture firms, they would need to provide their marketing resources in exchange for equity. Moreover, if venture firms have large manufacturing resource need, the investment of foreign corporate investors would be restricted to related business sectors of a strong IPP regime.

The main contribution of this study is that we extended the research on CVC investment into the cross-border context. Earlier, researchers focused on exploring why entrepreneurs select corporate investors instead of independent venture capitalists (for example, Park and Steensma, 2012; Katila et al., 2008; Hellmann, 2002). Moreover, foreign corporate investors have been implicitly omitted from the sample data of prior studies, which compiled their lists of corporate investors from Fortune 500 companies (for example, Basu et al., 2011), U.S. public firms (for example, Dushnitsky and Lenox, 2005; Sahaym, Steensma and Barden, 2010), or firms listed in the U.S. stock market (for example, Dushnitsky and Lavie, 2010; Dushnitsky and Shaver, 2009). In this study, we showed the difference between domestic and foreign corporate investors from the venture firms' perspective.

Additionally, this study contributes to the resource dependence theory. The extant theory mainly highlighted the collaborative side of inter-firm relationships, driven by the uncertainty of a firm in acquiring the resources required for its survival (Pfeffer and Salancik, 1978). However, researchers have overlooked the partner uncertainty that follows in such relationships (Gulati and Gargiulo, 1999; Katila et al., 2008). This study shows that venture firms anticipate the partner uncertainty that the relationship may generate and proactively attempt to reduce it.

This study has some limitations. First, we assumed that the investment pattern of foreign corporate investors is similar to that of domestic corporate investors. Since venture capital investment is a bilateral negotiation, the unique investment patterns of foreign corporate investors may have affected the results. For instance, foreign corporate investors may have deliberately invested in unrelated venture firms while domestic corporate investors may not have done so. Second, we did not include any effects of syndicate partners. Corporate investors syndicate with independent venture capitalists to enlarge the investment pool

and to enhance the evaluation and the value-adding activities (Dimov and Milanov, 2010; Ferrary, 2010; Manigart et al., 2006). The investment decision and performance of both corporate investors and entrepreneurs are likely to be influenced by the independent venture capitalists that bridge them (Hallen et al., 2013; Keil, Maula, and Wilson, 2010). Although we excluded independent venture capital (IVC) transactions on purpose in order to examine the differences among corporate investors, the indirect effects of IVCs should be considered in future research. Third, although we considered the level of trust between investors and investees as the key factor that affects the level of partner uncertainty, we did not measure it directly; instead, we assumed that trust in foreigners is generally inferior. Data that is not reported in this paper indicates that venture firms have more repetitive investment relationships with local investors than with foreigners. The number of repetitive investments (that is, redundant relationship formation) may reflect the level of trust between them.

We expect further research on cross-border CVC investment to be conducted in the future, particularly with regard to the direction of internationalization. In particular, it would be useful to examine whether venture firms in different countries would respond differently according to the nationality of the corporate investors. For instance, the investment activity of U.S. corporate investors in Asian venture firms may show different patterns than those identified in this study, since the venture firms from emerging economies are more willing to internationalize to developed countries than vice versa, especially for high-tech firms that target advanced markets. We recommend additional research on the performance consequences of cross-border CVC investments. Although CVC investments are considered beneficial in the commercialization of technology, cross-border CVC investments add other values for the internationalization of venture firms.

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국제 기업벤처캐피탈 투자에서 벤처기업의 파트너 불확실성 완화

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벤처캐피탈 시장에서 기업벤처캐피탈(CVC)의 중요성에도 불구하고 국제 CVC 투자에 대한 학술적 연구는 부족한 실정이다. 벤처기업은 국내 CVC 투자를 유치하는 경우보다 국제 CVC 투자를 유치하는 경우 지리적 및 문화적 거리로 인해 기술 유출의 위험을 더 크게 인식한다. 특히 벤처기업은 파트너 불확실성이 높은 CVC 투자를 받지 않으려는 성향을 보이기 때문에 본 연구는 국제 CVC 투자가 발생할 가능성은 후속라운드로 갈수록, 벤처기업이 속한 산업의 지적재산권 보호 수준이 높을수록, 그리고 기업투자자가 벤처기업의 잠재적 경쟁자가 아닐수록 증가할 것으로 예상된다. 추가적으로 본 연구는 벤처기업의 보완적 자원에 대한 필요성이 국제 CVC 투자에서 발생하는 파트너 불확실성에 어떤 영향을 미치는지 살펴보고자 한다. 이를 위해 1994년에서 2009년 사이 미국에서 발생한 2,873 건의 CVC 투자 건수를 분석하였다. 그 결과 벤처기업의 지적재산권 보호 수준과 기업투자자와의 산업 비관련성이 국제 CVC 투자에서의 파트너 불확실성을 감소시키는 영향이 있음을 확인하였다. 또한 이 요인들의 영향은 벤처기업이 어떤 보완적 자산을 필요로 하는지에 따라 강화되기도 혹은 약화되기도 함을 살펴볼 수 있었다.

주제어 : 기업벤처캐피탈, 국제 투자, 파트너 불확실성, 자원 의존성

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