Journal of Business Research 95 (2019) 242–252

Contents lists available at ScienceDirect

Journal of Business Research

journal homepage: www.elsevier.com/locate/jbusres

Partner-selection effects on venture capital investment performance with uncertainties

Chun-Yun Cheng[a,*], Ming-Je Tang[b]

[a] Business Administration, SooChow University, Taipei, Taiwan, ROC
[b] International Business, National Taiwan University, Taipei, Taiwan, ROC

ARTICLE INFO

Keywords:
Partner selection
Uncertainty
Venture capital investment
Syndication network
Performance

ABSTRACT

This paper intends to complement the existing literature on the performance of venture capital (VC) investments by presenting a multiple principal-agent framework for examining partner selection strategies aimed at mitigating uncertainties and their effects on investment performance and boundary conditions. Using a dataset of VC investments from 1980 and 2008 in the U.S., we found evidence that the existence of industrial and geographic uncertainties negatively affects the performance of independent VC (IVC) investments. The empirical results show that the strategy of partner selection has no effect on IVC performance. However, from the homophily and resource perspectives, if various VC-specific uncertainties are considered as contextual factors, one would expect CVC firms to be selected as partners by IVC firms as a way to increase the probability of success.

1. Introduction

The venture capital (VC) industry is increasingly regarded as an important component of the U.S. economic landscape. Many successful new companies over past decades-including Apple, Google, Amazon, Federal Express, Intel, Microsoft and eBay-have been backed by VC funds (Gompers & Lerner, 2004). Although VC firms finance only 1 to 2% of all new businesses in the U.S., the proportion of initial public offerings backed by VCs increased from around 10% in 1980 to over 50% in 2000 (Braunerhjelm & Parker, 2010). This growth has increased the amount of attention paid to the VC industry by the popular press and academics.

The research generally concludes that VC and entrepreneurial factors play important roles in explaining the performance of VC investments. Specific VC factors, including, for example, the level to which VC firms are involved in their investments (MacMillan & Kulow Roubina, 1989), allocation of attention paid to portfolio companies (Jaaskelainen, Maula, & Seppa, 2006), and the VC firms' characteristics and managerial strategies (Gompers, Kovner, & Lerner, 2009; Jain, 2001) have a significant impact on performance. Venture-specific factors (e.g., industries and structure) (Fitza, Matusik, & Mosakowski, 2009; Jain, 2001) and the heterogeneous distribution of critical resources among start-up firms (Fitza et al., 2009) influence the outcome of VC investments with respect to the success of their portfolio companies. Some scholars combined the above two arguments, estimating that venture-specific and VC factors account for significant variability (26.3% and 11.2%, respectively) in performance (Fitza et al., 2009).

VCs typically finance specific ventures under multiple uncertainties since only scant public information is available. This paper begins by describing VC specific uncertainties (i.e. industrial and geographic uncertainties) present in the relationships between VCs and start-ups. These uncertainties lead to information asymmetries and agency problems, which negatively affect investment performance, as entrepreneurs have private information about their businesses and tend to overstate future profitability to secure the supply of financial capital from the VCs. We explore the relationship between different types of VC uncertainties inspired by Sorenson and Stuart (2001) involving VC investments and performance at the project level, using the VC-venture dyad as the unit of analysis.

The emergence of syndication networks, a new organizational form among VC firms, is increasingly acknowledged as one way to address these uncertainties. Syndication networks are a kind of inter-firm alliance in which two or more VC firms co-invest in a start-up firm and share a joint payoff (Wright & Lockett, 2003). Sorenson and Stuart (2001) showed that inter-firm relationships in the VC community effectively reduce uncertainties by facilitating the transmission of useful information across syndication networks. Although the syndication network is a significant part of the VC industry, there has been little research on how VC firms structure syndication deals, select their partners to cope effectively with environmental uncertainties, or how

* Corresponding author.
E-mail address: chunyunc@scu.edu.tw (C.-Y. Cheng).

https://doi.org/10.1016/j.jbusres.2018.10.002
Received 21 June 2017; Received in revised form 28 September 2018; Accepted 1 October 2018
Available online 24 October 2018
0148-2963/ © 2018 Elsevier Inc. All rights reserved.

these choices affect investment performance.

We attempt to complement the existing research on the performance of VC investments by developing a multiple principal-agent framework to examine partner selection strategies and the framework's boundary conditions. Our research questions are: How do VC uncertainties and partner selection effects influence the performance of VC investments? Do the aforementioned partner selection decisions have boundary conditions? If so, will they vary in predicting superior performance when they interact with VC uncertainties? Traditional agency theory has been adopted to prescribe actions that focus on the protection of the investment of the principals (VCs) against the harmful behavior of the agents (entrepreneurs). Our core argument is that the existence of industrial and geographic uncertainties in the relationships between VC firms and start-ups makes the agency problem worse by making it more difficult to reduce asymmetric information. Consequently, we posit a negative relationship between VC uncertainties and the performance of investments. Inter-firm collaborations have proven to be an effective remedy for this agency problem because the necessary resources and capabilities are shared among the partners. The emergence of syndication networks and the involvement of multiple parties in VC investing motivated us to extend the principal-agent analysis to a multiple principal-agent framework to help us understand how VC investments are organized and the consequences of this organizational structure on performance. The specific uncertainties in the VC industry, referred to as VC uncertainties in this paper, serve as a contextual factor that moderates the relationship between partner selection and investment performance.

The VC industry is an appropriate setting for studying the effects of organizational structure on performance under conditions of uncertainty for two reasons. First, there is considerable variability in how VC investments are structured. The VC industry consists of two types of organizations: the independent VC (IVC) firm and the corporate VC (CVC) firm. The majority of firms in the VC industry are so-called IVC firms, which are formed by individuals through limited partnerships that pool and manage money from entities such as pension funds and wealthy individuals. For example, 94% of the sample of this study is IVC investment. Thus, our main arguments and hypotheses are constructed as viewed through the lens of IVC investments.

IVCs pursue high financial returns by funding growth-oriented start-ups from which they later exit via an initial public offering (IPO) or an acquisition (Gompers & Lerner, 2000). They manage all aspects of the investment: opportunity identification, diligence processing, post investment monitoring and also offer value-added services to portfolio companies (Dushnitsky & Shapira, 2010; Sapienza, 1992; Sapienza, Manigart, & Vermeir, 1996). CVCs are the second most common group in the market for entrepreneurial financing. Although the first wave of CVC investments dates back to the 1960s, CVC units entered the VC sector at an unprecedented pace during the 1990s and 2000s. CVC is defined here as equity or equity-linked investments in young, privately held companies, where the investor is a financial intermediary of a nonfinancial corporation (Keil, Maula, & Wilson, 2010). During the 1990s, large corporations in a wide variety of industries set up corporate venturing units. To sum up, IVC firms focus on financial returns while CVC firms focus on strategic goals; the IVC-CVC dichotomy clearly represents a distinguishing attribute of VC firms. It facilitates empirical research on how VC firms structure investments in terms of what kind of partners they should select to cope with uncertainties and increase the probability of investment success. A second reason to study investments in the VC-industry environment is that it can give us detailed information on specific investments at the project level, allowing us to measure the behavior of VC firms more precisely than prior studies.

This paper is organized as follows: In the next section, after reviewing the literature, we develop hypotheses specifying the conditions under which a VC investment is most likely to yield better performance at the project level. The hypotheses are focused on the careful selection of partners to cope with specific uncertainties and the attendant boundary conditions. This discussion is followed by an operationalization of the measures and statistical analyses of the data. We then present our empirical results on determinants of the performance of VC investments. A discussion of the results and their implications concludes the paper.

2. Theoretical background and hypotheses

2.1. VC uncertainties and performance

Agency theory has emerged in the entrepreneurship literature as one of the dominant frameworks for analyzing the relationship between VCs and start-ups (Amit, Glosten, & Muller, 1990; Sahlman, 1990; Sapienza & Gupta, 1994). Venture capitalists occupy an intermediary role between investors and start-up companies that need financial capital. After raising capital from their investors, VC firms must identify prospective start-ups that they may want to finance. An agency problem occurs when an entrepreneur (agent) and a VC (principal) have incongruent goals and different risk preferences. VCs typically finance specific ventures. In doing so, they confront many uncertainties resulting from the fact that public information is rarely available. These uncertainties often lead to information asymmetries because entrepreneurs have confidential information about their businesses and often overstate the future profitability of the businesses to secure financial capital from the VCs. Agency costs increase sharply if entrepreneurs are spatially distant from the VCs.

Economic sociologists believe that the likelihood of forming a social relationship declines as a function of distance in social space (Blau, 1977; Lazarsfeld & Merton, 1954). This is because the costs of interaction, which include finding and screening exchange partners and maintaining relationships, increase with distance (Zipf, 1949). A few researchers who have examined how location affects the functioning of markets and the organization of economic activity have uncovered strong spatial effects. For example, research on the interlocking of corporate boards created by overlapping membership shows that spatially proximate companies are more likely than other companies to share directors (Kono, Palmer, Friedland, & Zafonte, 1998).

In one of the seminal studies on the VC industry, Sorenson and Stuart (2001) demonstrated the prevalence of localized exchange by showing that the likelihood of a VC firm investing in a new venture declines sharply with the increase in spatial distance between the VC firm and the target. In this paper, by “VC uncertainties” we mean the uncertainties that occur in the VC industry because of the industrial and geographic distance between an entrepreneur (agent) and a VC (principal). VC firms play two roles as they broker economic activities in the entrepreneurial financing market: pre-investment opportunity identification and post-investment monitoring (e.g., Gupta & Sapienza, 1992; Sorenson & Stuart, 2001). These tasks become increasingly difficult at a distance and thus create higher uncertainties.

To enact the first role, VC firms must acquire information about the existence and characteristics of investment opportunities and assess their quality (Gupta & Sapienza, 1992). Entrepreneurs in start-ups usually have superior information regarding the quality of the companies and their innovations. Yet, without a mechanism to send a credible signal to VC firms, entrepreneurs have the incentive to misrepresent the true value of their innovations. The social space argument suggests that a VC firm's prior experience in a particular industry or geographic area should affect the extensiveness of its personal contact networks of the entrepreneurs as well as other investors in the given industry or geographic area (Sorenson & Stuart, 2001). Having ample contacts in turn facilitates the identification of new investment opportunities and provides better access to accurate information about the quality of the investment targets. Thus, experience in an industry or in a geographic area may lead to specialization among venture capitalists along these dimensions.

To perform the second role, VC firms actively monitor their investments by organizing their contracts as staged financing (Amit et al., 1990; Bergemann & Hege, 1998; Gompers, 1995), allocating control rights (Hellmann, 1998) and providing value-added services and advice (Bygrave & Timmons, 1992). VC firms frequently pay visits to start-ups to assess their operations. Because increased time spent in transit reduces the number of portfolio companies that an individual can monitor, geographic proximity reduces the costs of monitoring (Sorenson & Stuart, 2001). As a result, VC investments tend to be highly localized in terms of physical space (Gupta & Sapienza, 1992; Norton & Tenenbaum, 1993).

Additionally, a few studies have examined the relationship between the success of VC funds and the strategy of specialization in terms of spatial proximity at the industry level (Gompers et al., 2009; Norton & Tenenbaum, 1993). In agreement with Bygrave (1987, 1988) and other financial intermediation theorists, Gompers et al. (2009) argued that maintaining a high degree of specialization is useful for controlling risk as well as gaining access to networks, information and deal-flow from other VC firms. Using data from the Dow Jones Venture Source (formerly Venture One), they found a strong positive relationship between the degree of specialization by individual venture capitalists at a firm and the firm's success.

We began our study by developing hypotheses on the causal relationship between the existence of IVC uncertainties and the performance of investments. The greater the geographic and industrial uncertainty in the relationship between IVC firms and the companies they invest in, the greater the information asymmetries that the IVC firms confront. Thus, we argue that the presence of industrial and geographic uncertainties aggravate the agency problem by making it more difficult for fund managers in IVC firms to decrease information asymmetries. Consequently, these IVC uncertainties at both the industrial and geographic levels have negative effects on investment performance.

H1. Geographic uncertainties in the relationship between an IVC firm and its start-up is negatively related to the probability of success of the start-up.

H2. Industrial uncertainties in the relationship between an IVC firm and its start-up is negatively related to the probability of success of the start-up.

2.2. Partner selection and IVC performance

The relationship between IVC uncertainties and the performance of IVC investments occurs because of the need to protect the investment of the principal (i.e., IVC firm) against harmful behavior by the agent (entrepreneur) as predicted by traditional agency theory. In addition to this, we propose a multiple principal-agent framework. Traditional agency theory is concerned with conflicts of interests between a principal and an agent, whereas a multiple principal-agent framework explores conflicts of interests among multiple agents, at least one of whom is associated with a different principal (Arthurs, Hoskisson, Busenitz, & Johnson, 2008). This framework delineates the sophisticated nature of a VC investment by incorporating three elements that affect the strategy of partner selection and VC performance in Fig. 1: VC-VC (the horizontal relationship between two VC firms), VC-investor (the vertical relationship between a VC firm and its investors) and VC-E (the vertical relationship between a VC firm and an entrepreneur).

2.2.1. VC-VC (the horizontal relationship between two VC firms)

First, the emergence of syndication networks, defined as two or more VC firms co-investing in a start-up firm and sharing the joint payoff (Wright & Lockett, 2003), is increasingly acknowledged as one way to address uncertainties. Sorenson and Stuart (2001) showed that inter-firm relationships in the IVC community effectively reduce uncertainties and decrease space-based constraints by facilitating the transmission of useful information across syndication networks as well as geographic and industrial space. A syndication network includes multiple principals (i.e., lead and non-lead investors) who are mutually interdependent. Horizontal intra-stakeholder agency costs raise issues of inter-firm governance (Meuleman, Lockett, Manigart, & Wright, 2010). De Clercq and Dimov (2008) argued that reduced commitment and free riding on the efforts of other partners create horizontal agency costs, and may influence investment performance. Although inter-firm cooperation is beneficial to IVC firms because partners share the necessary resources and capabilities, coordination costs are unavoidable. In this paper, we evaluate the costs and benefits of the formation of syndication networks and the strategy of partner selection, which are ways in which VC firms organize the structure of their investments and alleviate uncertainties. We maintain that these practices influence investment outcomes. Focusing strictly on the horizontal relationships among VCs, we argue that congruent goals boost cooperation among IVC firms and increase the probability for success of their investments. Whereas the quality of an IVC firm is determined by its ability to make sound investment decisions and reap financial returns for its investors, a CVC firm focuses on strategic goals and is likely to follow the strategy dictated by its corporate parent, such as familiarizing itself with a pioneering technology (Dushnitsky & Lenox, 2005; Dushnitsky & Lenox, 2006) or quickly establishing alliances in product markets (Dushnitsky & Lavie, 2010). We argue that an IVC firm has a tendency to select other IVC firms with similar investment motives with respect to financial gains. This strategy facilitates the alignment of goals among various partners and mitigates potential uncertainties (Fig. 2).

2.2.2. VC-investor (the vertical relationship between a VC firm and its investors)

Second, concentrating on the relationship between VC firms and their investors, we observe that VCs are agents, even though they are also principals to entrepreneurs. In other words, as noted by Arthurs et al. (2008), the role of the VC firm is characterized by a dual identity (principal and agent). Typical IVC funds are sponsored by institutional investors and wealthy individuals. IVC firms have a substantial performance-pay component. They receive “carried interest,” which amounts to about 20% of the profit the fund generates (Dushnitsky & Shapira, 2010; Gompers & Lerner, 1999; Lerner, 1994a; Sahlman, 1990). As for CVC funds, the corporation usually serves as the sole sponsor either by acting as the only limited partner in managing a dedicated fund or by organizing the investment activities of a fully-owned subsidiary (Keil et al., 2010). CVC firms do not provide the same high-powered incentives that IVC firms do. The most common compensation among managers in CVC programs is a fixed salary (Block & Ornati, 1987; McNally, 1997).

Agency theory assumes that both the agent and the principal are self-interested and boundedly rational (Eisenhardt, 1989). Consequently, utility-maximizing behavior by the agent (the VC) is likely to emerge by applying to them appropriate incentives and controls that align the goals of the VC with those of the investors. In an IVC setting, investors reward fund managers by giving them attractive performance-based incentives. These high-powered incentives closely align the IVC managers' behavior with the investors' interests. We infer that the agency costs shared by IVC firms and their investors are less than those shared by CVCs and corporations. Thus, we argue that cooperation among IVC firms can mitigate coordinating costs within syndication networks, because these firms share consistent goals of financial gains. Other things being equal, these syndication networks are likely to achieve superior investment performance if IVC firms cooperate with one another.

2.2.3. VC-E (the vertical relationship between a VC firm and an entrepreneur)

Finally, entrepreneurs also assume a dual role, as agents (to the VC firm) and as principals to their own firm, because they simultaneously

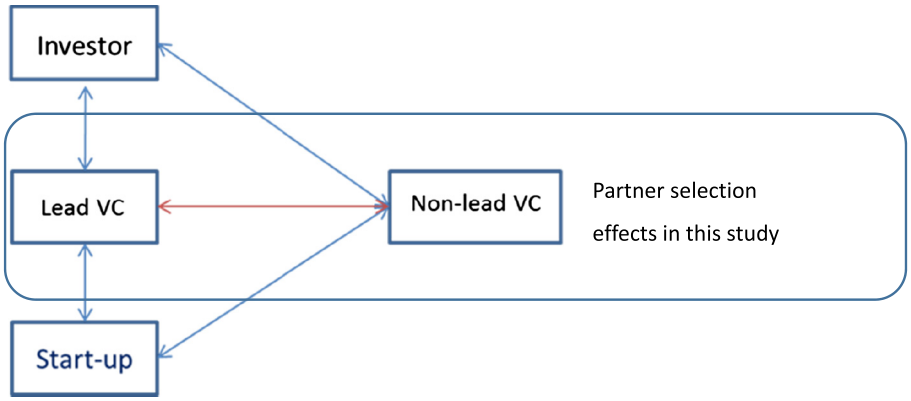

Fig. 1. A multiple principal-agency framework.

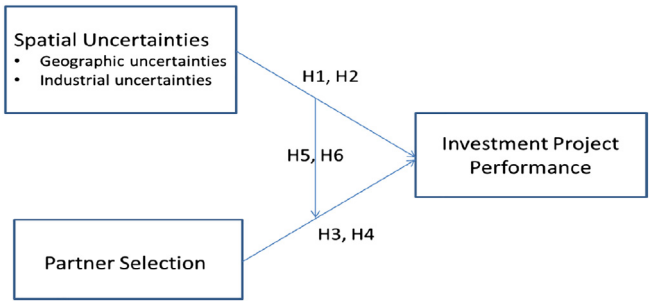

Fig. 2. Research framework.

hold significant equity stakes in the start-up but receive capital from the VC firm (Bruton, Filatotchev, Chahine, & Wright, 2010). This dual role can create the replacement of the traditional principal-agent problem between the VC firm and the entrepreneur with a multiple principal-agent problem arising from incongruence between the principal-principal goals when the dominant owner disregards the interests of minority owners (Bruton et al., 2010; Dharwadkar, George, & Brandes, 2000; Douma, George, Kabir, and Center for Economic Research, 2006; Young, Peng, Ahlstrom, Bruton, & Jiang, 2008).

IVC firms may collaborate with other IVC firms to reduce the costs of "the paradox of disclosure" in which entrepreneurs can reveal technical details to mitigate agency problems, but often opt not to do so to avoid being taken advantage of or even being mimicked (Anton & Yao, 1994, 2002; Bhattacharya & Ritter, 1983). Dushnitsky and Shaver (2009) argued that when an entrepreneurial invention targets the same industry as a corporate product, a CVC firm has both the ability and the inclination to copy the invention. Under this condition, an entrepreneur is less likely to disclose information to a CVC firm, preferring instead to seek financing from an IVC firm (Dushnitsky & Shaver, 2009). In summary, we argue that to increase the probability of investment success, IVC firms tend to select other IVC firms rather than CVC firms as partners in syndication networks. Selecting similar partners for the purpose of facilitating goal alignment thus improves the prospect of financial gains. The success of an investment is determined largely by smart partner selection on the part of VC firms, and this selection is asymmetric between IVCs and CVCs. That is, decent performance is determined disproportionately by the strong preference for IVCs to select other IVCs as partners.

H3. Controlling for availability, the tendency of an IVC firm to select another IVC partner is positively related to the probability of its investment success.

2.3. Interaction between VC uncertainties and partner selection

Applying the aforementioned argument from agency theory and the multiple principal-agent framework to the topic of VC investments is important to our understanding of how both VC uncertainties and partner selection strategies influence investment performance. This raises an intriguing question: If VC firms' incentives affect their risk attitudes and behavior patterns, and in turn, IVC firms tend to syndicate with other IVC firms to achieve superior performance, how do CVC firms become a part of syndication networks and thus influence investment performance? We argue that the various sources of uncertainties motivate differences in networking behavior with CVCs that influence these outcomes. In an effort to complement the argument from agency theory, we sought in this study to answer the above question considering various uncertainties in the VC industry to be contextual factors from the perspectives of homophily and the available resources. Whereas agency theory stresses the costs arising from the misaligned goals of partners (Eisenhardt, 1989), homophily theory and the resource-based view (RBV) highlight the role of inter-organizational relationships in mitigating the uncertainties associated with agency costs.

Homophily, the proposal from network theory that similarity breeds connection (Homans, 1950), may explain why IVCs cooperate with each other to mitigate geographic uncertainties. Homophily is the strongest single predictor of the quality of various types of interpersonal relationships ranging from marriages and friendships to work advice (McPherson, Smith-Lovin, & Cook, 2001). As a general rule, people are most likely to interact with others who are similar to themselves in such respects as race, gender, education, social status, and beliefs (Homans, 1950; Lazarsfeld & Merton, 1954).

Previous research suggests that at the organizational level, other dimensions of homophily, such as similarity of resource profiles, facilitate inter-firm collaboration (Ahuja, Polidoro, & Mitchell, 2009; Lane, Salk, & Lyles, 2001; Mowery, Oxley, & Silverman, 1996). According to the relevant literature, firms establish linkages with other firms in an attempt to control uncertainties (Burt, 1983; Salancik & Pfeffer, 1978; Thompson, 1967). Focusing on embedded relationships, an organization's decision makers can mitigate these uncertainties by choosing the appropriate collaborative partners (Chung, Singh, & Lee, 2000; Gulati & Gargiulo, 1999; Li & Rowley, 2002; Meuleman et al., 2010; Uzzi, 1996). The strength of homophilous ties varies as a function of context. In high-uncertainty settings, actors exhibit strong preferences for interacting with certain proximate others (Sorenson & Stuart, 2008). Organizations revert to the comfort of relationally familiar or similar partners whenever significant uncertainties exist (Beckman, Haunschild, & Phillips, 2004; Galaskiewicz & Shatin, 1981; Podolny, 1994). Additionally, sources of uncertainties may affect which network partners are selected. When uncertainties are outside a firm's control and are

shared with other firms, the firm reduces these uncertainties by interacting with others that are similar to itself (Beckman et al., 2004).

Although there is much evidence about the effects of homophilous tendencies on the formation of ties, less is known about the effects of such tendencies on the outcomes associated with uncertainties. Because transferring knowledge between firms incurs costs (Hansen, 1999; Reagans & McEvily, 2003), firms seeking to economize are likely to be more inclined to undertake such transfers for similar others under an uncertain environment. Homophilous ties are relatively easy to form even in the presence of uncertainties and can facilitate the transfer of knowledge and information, which has a positive effect on firm investment performance.

To overcome information asymmetries arising from geographic uncertainties between themselves and the target companies they are evaluating, IVC firms are likely to select local rather than distant partners to facilitate physical interactions with entrepreneurs and subsequent monitoring activities. Other possible catalysts for tie formation, in addition to similarity between the two firms' knowledge bases and organizational structures, are similarities in their dominant logic and organizational culture (Meirovich, 2010). As opposed to an IVC firm paired with a different type of firm (i.e. CVC), two IVC firms are more likely to understand each other's know-how as well as their operating routines and managerial practices, thereby minimizing coordination costs. It's also easier for firms of the same type to coordinate the tasks of evaluating and monitoring start-ups as a way to mitigate information asymmetries geographically. IVC firms tend to select IVC partners because it requires less effort to interact with them than with CVC firms. This is because IVC firms interacting with other IVC firms can communicate and achieve consensus on the basis of a shared common code. To economize on communicative costs, IVC firms cooperate with other IVC firms to mitigate the agency problems arising from geographic uncertainties, which in turn increase the probability of investment success.

H4. The tendency of an IVC firm to select another IVC partner to increase its probability of success is moderated by geographic uncertainties. If such uncertainties exist, the tendency to select similar partners increases the probability of success.

However, seeking similar partners to control uncertainties isn't without cost. Firms may face a trade-off between the benefits of homophily in terms of greater accessibility to the partner on the one hand and the costs that arise from compromising the partner's abilities on the other. We argue that, whereas homophily might make it easier for VCs firm to request and obtain knowledge from their similar partners, it might also prompt them to seek redundant resources. This resource limitation approach may interfere with accomplishing their identifying and monitoring tasks in an uncertain environment and thus affect investment outcome. Although prior research has shown that VC syndication networks effectively reduce VC uncertainties by facilitating the diffusion of information across spatial boundaries (Sorenson & Stuart, 2001), this line of research does not tease out the specific characteristics of partners that may affect investment outcomes. Specifically, CVC firms have distinctive resources and capabilities that allow them to overcome industrial uncertainties arising from information asymmetries between VC firms and the companies they invest in.

Scholars who advocate the RBV argue that value-maximizing choices are constrained by imperfect information and uncertainties about future outcomes in the presence of economic rationality (Lin, Yang, & Arya, 2009). They suggest that alliances are formed for the value-creation potential of pooling resources (Shah & Swaminathan, 2008). The resources of particular interest to alliances include financial capital, technical capabilities, managerial capabilities, and other relevant assets (Hitt, Dacin, Levitas, Arregle, & Borza, 2000). Accordingly, firms search for alliance partners that have resources they can leverage and integrate to create synergy (Das, Sen, & Sengupta, 1998; Lin, Haibin, & Demirkan, 2007; Lin et al., 2009). It can be argued that complementary skills and resources are required for all types of alliance projects and therefore are a minimum requirement for partnering success (Shah & Swaminathan, 2008). For example, Hitt et al. (2000) found complementary capabilities to be one of the most important criteria for selecting alliance partners. Harrison, Hitt, Hoskisson, and Ireland (1991) argued that firms acquiring other companies with highly similar resources do not perform as well as firms acquiring targets with dissimilar yet complementary resources. In practice, partners should be sufficiently differentiated to provide missing elements or complementary capabilities (De Leeuw, Lokshin, & Duysters, 2014; Lin et al., 2009; Osborn & Hagedoorn, 1997). A complementary partner selection strategy has other beneficial outcomes. When the partners have complementary skills and resources, coordination between them is facilitated (Achrol & Stern, 1988; Harrison, Hitt, Hoskisson, & Ireland, 2001; Larsson & Finkelstein, 1999; Moorman & Slotegraaf, 1999; Shah & Swaminathan, 2008). Madhok and Tallman (1998) argued that alliances in which the partners have the potential to create synergy by integrating complementary resources have the highest probability of producing value.

To mitigate the information asymmetries arising from the industrial uncertainties involving their relationship with their target companies, CVC firms strategically focus their investments on gaining exposure to new markets and technologies (Dushnitsky & Lenox, 2005; Dushnitsky & Lenox, 2006), identifying acquisition targets, creating new markets (Siegel, Siegel, & MacMillan, 1988; Sykes, 1990), and facilitating the transmission of knowledge from innovative start-ups to corporate investors (Wadhwa & Kotha, 2006). By pursuing these activities, CVC firms are likely to increase their technological competence and obtain information about parent corporations in related or complementary industries. This information broadens partner diversity in the syndication networks. CVC firms serve as distinctive partners (defined as partners that have idiosyncratic attributes relative to those of IVC firms) by providing resources and capabilities that are useful primarily because of their relevance to the parent corporations and start-ups. This information from related lines of business may help corporations select better ventures, or it may add value to IVC firms once the investments are made (Gompers & Lerner, 2004). The start-up could be a prospective supplier of the CVC firm's parent corporation or a cash-hungry firm that has the potential to penetrate new markets.

In summary, a CVC partner is most likely to increase an IVC firm's industry-related knowledge in the presence of information asymmetries arising from industrial uncertainties; in turn, this knowledge improves the IVC firm's portfolio selection, increases the value of the start-up and leads to superior performance.

H5. The tendency of an IVC firm to select a CVC partner to increase its probability of success is moderated by industrial uncertainties. If such uncertainties exist, the tendency to select dissimilar partners increases the probability of success.

3. Method

To test our hypotheses about the structures under which a VC investment is most likely to lead to optimal performance of a project, we adopted the VentureXpert categories suggested by Dushnitsky and Lenox (2005) to separate IVC and CVC firms into two different datasets. We concentrated solely on investments by U.S.-based VC funds and excluded those made by angels and buyout funds. We collected project-level data on the performance of the portfolios of company-VC pairs from 1980 to 2003. The performance of each investment was measured after the initial investment until 2008 within a 10-year time frame.

3.1. Model estimations

To optimally estimate the likelihood of success of a particular IVC investment, we used a logistic model, and organized the data in a panel

Table 1
The list of control variables.

Control variables	Definitions
Firm size	The total amount of committed capital to all portfolio companies by a VC firm (log transformed)
Firm age	The number of days between the VC firm's first investment and current investment divided by 365(log transformed)
Number of investors	The total number of VC firms invested in a specific portfolio company
Number of rounds	The total number of rounds invested in a specific portfolio company
Received capital	The total amount invested in a specific portfolio company (log transformed)
Industries categories	Ten categories: communications and media, computer hardware, semiconductor, biotechnology, health/medical, consumer-related business, internet specific business, computer software energy or industry business, and other business
Competitive conditions	The aggregate amount of capital raised by other VC funds in the focal/lead fund's vintage year (log transformed)
Lead	Identified a lead VC firm as largest cumulative investment to a specific portfolio company
Early stage preference	The categorization of stage preference for each VC from VentureXpert
Stake	The percentage of a VC investment in a portfolio company
Specialization	Herfindahl–Hirschman Index, the sum of the squares of the percentage of all previous investments in each industry
Indegree	Let $q_{ji} = 1$ if at least one syndication relationship exists in which VC $_j$ is the lead investor and VC i is a syndication member, and zero otherwise. VC i's indegree then equals $\Sigma_j\, q_{ji}$.
Cross-state investment	Coded them "1" if states of VC firms and their target companies were located in different states, "0" otherwise
Cross-industry investment	It was coded "1" if VC firms have never invested in portfolio companies' industries and "0" otherwise
Industry experience	The percentage of previous investments whose industry is identical to current VC investment
Geographic experience	The percentage of previous investments which is located in the same state as current VC investment
Numbers of last year investments in the industry	The numbers of investments in each industry one year before a VC investment (log transformed)

format. To account for the possibility that more than one investment could be made by an IVC firm in a given year, and thus for possible non-independence of observations within each year, we included year dummies as well as a robust estimation of the standard errors to adjust for possible clustering of VC firms. We also included industry dummies to control for ten common categories (biotechnology, consumer-related businesses, communications and media, computer hardware, computer software and services, energy or industrial businesses, health/medical, Internet-specific businesses, semiconductors, and other miscellaneous businesses) in the model. The variables, *firm size*, *firm age*, *received capital*, *competitive conditions*, and *numbers of investments in the industry last year*, have been log-transformed for logistic regression analysis, because they were highly skewed and kurtotic. Additionally, we concluded, based on the Hausman test, that a random effects model would be more appropriate for our dataset than a fixed effects model. Robustness checks using simple logit and random effect logit estimation yielded similar results.

3.2. Sample

The data for our analysis came from Thomson Financial's VentureXpert database, published by Venture Economics. Several considerations about the VC industry influenced sample construction. First, VC investments are typically made in different rounds, with the first round representing the initial infusion of capital by one or more VC firms and the follow-up rounds contingent on whether the start-up reaches certain developmental milestones (Gompers, 1995). Second, the follow-up rounds can include new investors who have not participated in the previous investment rounds. Because follow-up investment decisions are different in nature from initial investment decisions (Podolny, 2001), and the syndication of follow-up investments involves different motivations and strategies (Lerner, 1994b; Sorenson and Stuart, 2008), we focused on the initial investments made by each VC firm in each of its portfolio companies.

Our sample included 7437 observations from portfolio company-IVC pairs and 622 observations from portfolio company-CVC pairs at the project level from 1980 to 2003. After deleting observations with missing information, we ended up with 6081 observations for IVC investments and 376 for CVC investments.

3.3. Measures

3.3.1. Dependent variables

Because VC firms disclose their performance data only to their investors, investment returns are not available. We thus followed Hochberg, Ljungqvist, and Lu (2007) by using a proxy, represented by a dummy variable coded 1 if the start-up has a successful initial public offering (IPO) or sale to another company (merge and acquisition) and 0 otherwise.

3.3.2. Independent variables

3.3.2.1. Geographic uncertainties. This independent variable was constructed by checking the locations of the VC firms and their target companies. We coded them 1 if they were in different states and 0 otherwise.

3.3.2.2. Industrial uncertainties. It was coded 1 if VC firms had never invested in the start-up's industry and 0 otherwise.

3.3.2.3. Partner selection. To adjust for both the availability of different-sized IVC/CVC groups and individuals' choices, we adopted the homophily measurement of Ibarra (1992) as a proxy for the preference of a similar partner for VC investments. This measurement is time-variant. We corrected the homophily metric for availability bias by calculating the following values (from a to d) for each IVC investment in a specific year: (a) the number of investments IVCs syndicated with other IVCs, (b) the number of investments IVCs syndicated with CVCs, (c) the number of IVC investments the focal IVC could have syndicated but did not, and (d) the number of CVC investments the focal IVC could have syndicated but did not. Homophily measures were then derived by the following calculation, which adjusts for both the availability of different-sized IVC/CVC groups and individuals' choices. This calculation produces a measure ranging from - 1 to 1; positive values indicate a tendency for a VC to choose a partner of the same type; a value of 0 indicates a balanced mix of IVC and CVC choices, both given availability.

$$S_{14} = \sqrt{\left(\frac{a}{a+c} - \frac{b}{b+d}\right)\left(\frac{a}{a+b} - \frac{c}{c+d}\right)}$$

3.3.3. Control variables

The control variables are listed and defined in Table 1.

Table 2
Descriptive statistics for both IVC and CVC investments.

Variable	IVC					CVC				
	Obs	Mean	Std. dev.	Min	Max	Obs	Mean	Std. dev.	Min	Max
Successful exit	7437	0.35216	0.47768	0	1	622	0.36977	0.48313	0	1
Stake	7411	0.45162	0.35014	7.21E-06	1	613	0.3521	0.3412	0.0008	1
Stage preference	7437	0.46228	0.49861	0	1	622	0.22669	0.41903	0	1
Industrial experience	7044	0.13226	0.17512	0	1	488	0.16489	0.21722	0	1
Geographic experience	7044	0.5174	0.32386	0	1	488	0.69112	0.32737	0	1
Specialization	7437	0.29198	0.19537	0.1140741	1	622	0.45348	0.28762	0.136	1
California	7437	0.40473	0.49087	0	1	622	0.31833	0.4662	0	1
Firm size	7435	12.2088	1.83145	3.912023	15.1404	621	10.8768	2.10306	2.89037	14.4883
Firm age	7114	1.78363	1.29065	−5.900582	3.78363	519	1.13472	1.21287	−4.5143	3.48732
Lead	7437	0.49496	0.50001	0	1	622	0.38746	0.48756	0	1
Indegree	6300	0.23192	0.25848	0	2.213	454	0.19354	0.33492	0	1.409
Received capital	7437	10.4687	2.14007	0.0953102	16.0753	622	10.8508	1.93105	3.91202	16.0016
Number of investors	7437	5.25481	4.27259	1	35	622	5.73955	4.84441	1	32
Number of rounds	7437	3.71131	2.71972	1	27	622	3.63023	2.76071	1	22
Competitive conditions	7386	2.65466	1.38944	−1.005029	4.53929	611	2.73149	1.59539	−0.9958	4.53929
Numbers of last year investments	7358	3.73589	0.98497	0	5.53733	610	3.95897	0.93287	0.69315	5.53733
Partner selection	7012	0.01559	0.01774	0	0.20471	563	0.01933	0.02296	0	0.13318
Industrial distance	6772	0.83092	0.37485	0	1	479	0.7286	0.44515	0	1
Geographic distance	7437	0.4916	0.49996	0	1	622	0.67363	0.46926	0	1

4. Results

Table 2 reports descriptive statistics for both the IVC and CVC investments. The average stake for an IVC investment project in our sample is 45%, which is much higher than the 35% for CVC investments. Tables 3 and 4 present the correlations for all the variables of interest for both the IVC and CVC investments.

4.1. Results for IVC investments

Table 5 shows the results of the random effects logistic estimation for IVC investment projects. Model 1 contains only the control variables; Model 2 adds the main effects of partner selection; Models 3 and 4 add the main effects of industrial uncertainties and geographic uncertainties; Models 5 and 6 add respectively the interaction effects of industrial uncertainties and geographic uncertainties with partner selection.

Model 1 presents a baseline containing the control variables used in the study. In contrast to the existing literature linking specialization to performance, the results show that specialization at the VC firm level has no effect on investment performance. Models 3 and 4 examine H1 and H2 respectively, by which we tested the relationship of VC uncertainties and likelihood of investment success. The significant negative correlations show that industrial and geographic uncertainties lead to inferior performance of IVC investments. Thus, both H1 and H2 are supported.

H3 states that the preference for similar partners has a positive impact on the performance of IVC investments. We used Model 2, which reflects H3, to test the significance of the dependent variables mentioned above. The nonsignificant correlation from testing Model 2 reveals no relationship between the strategy of partner selection and the performance of IVC investments.

H4 examines the interaction of geographic uncertainties and the propensity to select IVC partners on the performance of IVC investments. The insignificant correlations from the test of Model 5 reveal that when there are geographic uncertainties IVC firms' preference for partners with similar characteristics (other IVC firms) doesn't moderate the performance of their investments. This finding does not support H4.

H5 predicts that a possible positive relationship between the propensity to select similar partners and IVC investment performance is negatively moderated by the existence of industrial uncertainties. Fig. 3 shows the interaction effect of partner selection and industrial uncertainties for IVC investment projects on performance. The slope of partner selection on performance becomes negative when there were industrial uncertainties. In Model 6, the significant negative correlation reveals that the preference of IVC firms for similar (IVC) partners when there are industrial uncertainties harms investments. On the contrary, selecting CVC partners overcomes the problems created by industrial uncertainties, which in turn, leads to superior performance of IVC investment projects. We have shown that there is a significant moderation effect, but the relationship between the independent and dependent variables was not shown to be a precondition for moderation. This finding is consistent with the prediction of H5.

5. Discussion and conclusions

This study contributes toward providing insights to VC practitioners and complements the existing literature by shedding light on a multiple principal-agency framework by examining empirically the factors that affect the performance of IVC investments in the U.S. Agency costs increase when there are industrial and geographic uncertainties in the relationships between IVC firms and start-ups. These uncertainties in turn have a negative effect on investment performance. The existing literature suggests that inter-firm relationships in the IVC community effectively reduce spatial limitations on the flow of information (Sorenson & Stuart, 2001). We further argue that partner selection strategies affect performance outcomes for VC firms. The results of our empirical analysis in syndication networks suggest that, other things being equal, there is no relationship between the strategy of partner selection and the performance of IVC investments (Table 6).

Nevertheless, under specific conditions, a CVC could be a part of a syndication network. That possibility suggests that it would be useful to explore the boundary conditions of our multiple principal-agent analysis from other theoretical perspectives. Whereas agency theory emphasizes the ex ante incentive structure created by cooperating partners to prevent misaligned goals (Eisenhardt, 1989), the RBV highlights the role inter-organizational relationships play in reducing agency costs in the face of uncertainties. We argue that the outcome of a cost-benefit analysis of the RBV depends upon the context – specifically, the different sources of VC uncertainties in the research setting. Our empirical results show that to attain superior investment performance in the presence of industrial uncertainties, IVC firms should syndicate with CVC firms to access their corporation-specific complementary resources and capabilities.

Table 3
Correlations for IVC investments.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Successful exit	1.00																		
Stake	−0.19	1.00																	
Stage preference	−0.01	−0.03	1.00																
Industrial experience	0.02	0.00	0.06	1.00															
Geographic experience	−0.02	0.09	−0.22	−0.09	1.00														
Specialization	−0.01	−0.03	0.03	0.37	−0.04	1.00													
California	0.08	−0.12	0.10	0.07	−0.62	−0.01	1.00												
Firm size	0.11	0.03	0.05	−0.02	0.08	−0.39	0.17	1.00											
Firm age	0.06	0.01	−0.06	−0.10	0.10	−0.50	0.05	0.59	1.00										
Lead	−0.12	0.69	0.00	0.00	0.07	−0.05	−0.08	0.10	0.05	1.00									
Indegree	0.15	−0.11	0.07	−0.02	0.00	−0.32	0.20	0.60	0.46	−0.05	1.00								
Received capital	0.25	−0.69	0.04	0.04	−0.04	−0.03	0.16	0.27	0.13	−0.44	0.25	1.00							
Number of investors	0.21	−0.62	0.03	−0.02	−0.04	−0.03	0.13	0.14	0.08	−0.40	0.21	0.77	1.00						
Number of rounds	0.16	−0.34	−0.01	−0.07	0.02	−0.08	0.06	0.11	0.07	−0.20	0.16	0.46	0.53	1.00					
Competitive conditions	−0.13	0.04	0.11	0.15	−0.05	0.10	−0.02	−0.07	−0.11	0.03	−0.16	0.13	−0.15	−0.38	1.00				
Numbers of last year investments	−0.14	0.05	0.08	0.24	−0.04	0.09	−0.04	−0.10	−0.15	0.05	−0.25	0.04	−0.13	−0.30	0.74	1.00			
Partner selection	0.11	−0.40	0.00	−0.05	−0.04	−0.02	0.09	0.04	0.03	−0.28	0.08	0.31	0.38	0.21	−0.24	−0.15	1.00		
Industrial distance	0.02	0.00	0.03	0.31	0.02	−0.15	0.07	0.36	0.38	0.03	0.25	0.10	0.05	0.02	−0.01	0.04	0.01	1.00	
Geographic distance	−0.03	0.03	−0.12	−0.08	0.51	0.00	−0.38	0.02	0.02	0.01	−0.02	−0.01	−0.01	0.02	−0.03	−0.01	−0.01	−0.01	1.00

To the best of our knowledge, our study is the first to focus on how the strategy of partner selection and its interaction with environmental factors jointly affect the success of IVC investments. Our paper extends the basic principal-agent analysis to a multiple principal-agent framework and integrates the literature of partner selection and its boundary conditions with various theoretical insights about VC investments in the U.S.

Our study has significant theoretical implications and the empirical data point to promising areas for future research. For example, relational network theory has emerged as an important theoretical lens through which one can disentangle the formation of syndication networks and the investment performance of the VC industry. Most research has drawn on social embeddedness theory (Granovetter, 1985) to shed light on the informational and relational benefits of syndication networks, but relatively few studies have identified the limits of the relational network approach. A recent noteworthy example is the work of Meuleman et al. (2010). By synthesizing insights from agency theory with network theory, these authors identify the limitations of the embeddedness approach in addressing the role of partner selection decisions in inter-firm collaborations. They show that relational embeddedness is less important for selecting partners when agency risks are low and that reputational capital may act as a partial substitute for relational embeddedness. Likewise, our results indicate that partner selection is contingent on the conditions that increase or decrease the risk of horizontal agency problems between partner firms. We go a step further by examining the performance consequences of selecting partners with different governance structures and resource bases.

Finally, this paper simplifies our understanding of the formation of syndication networks, which we describe as a combination of mutually independent strategic choices of partners at the dyadic level. Although the strategic alliance is a general type of inter-firm collaboration that is closely related to the structure of syndication, it is apt to be a multilevel framework influenced by both the firm itself and the group it belongs to. Syndication networks are analogous to multifirm alliances. Only a few studies have examined the influence of multifirm (group) alliances on performance at the group or firm level. In their study of IVC syndication, De Clercq, Sapienza, and Zaheer (2008) suggested that the level of involvement of individual firms in multifirm alliances depends on both the individual firm's self-interest and factors stemming from the firm's membership in the alliance. Thus, in the context of multi-firm alliances, inter-firm behavior is a product of both self-interest and group-driven motivations. Drawing on insights from De Clercq et al. (2008), we suggest that future research should add the group to the list of factors influencing partner selection behavior in a multi-level framework: The relative importance of firm-specific factors and group-specific factors, and their interaction, can affect the performance of VC investments.

As is the case with any empirical work, there are limitations to this study that provide opportunities for future research. The first concerns generalization of our results beyond VC firms. Although the strategic decision-making processes of VC firms share similarities with those of other industries, particularly the need to anticipate and respond to new technological trends and market developments, VC firms lack the structural complexity of more mainstream organizations. Second, the present analysis relies on logit regression with a binary dependent variable and the conventional reduced form. Thus, there is also an opportunity in future research to apply the statistical tools of survival analysis, as developed by population ecologists. Third, this paper does not fundamentally address the determinants of partner selection in forming a network organization. Future research should examine the antecedents of partner selection that may contribute to understanding the relation between network partner selection and outcome performance. Finally, if there are unobserved variables that influence partner selection and performance, a self-selection bias will be present, and normative implications drawn from these analyses might be incorrect (Heckman, 1979; Masten, 1993). Future research should examine the

Table 4
Correlations for CVC investments.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Successful exit	1.00																		
Stake	−0.10	1.00																	
Stage preference	−0.07	−0.01	1.00																
Industrial experience	0.07	−0.07	0.02	1.00															
Geographic experience	−0.01	0.04	−0.17	−0.13	1.00														
Specialization	0.08	−0.11	−0.03	0.40	−0.09	1.00													
California	0.00	−0.13	0.07	0.11	−0.75	0.01	1.00												
Firm size	0.07	−0.02	−0.01	0.00	−0.08	−0.40	0.17	1.00											
Firm age	−0.05	−0.04	−0.17	−0.07	0.07	−0.25	0.00	0.37	1.00										
Lead	−0.03	0.76	0.04	−0.08	0.14	−0.09	−0.24	−0.02	−0.06	1.00									
Indegree	0.07	−0.09	−0.19	−0.03	−0.25	−0.28	0.41	0.67	0.35	−0.15	1.00								
Received capital	0.15	−0.67	−0.02	0.10	0.07	0.05	−0.02	0.23	−0.02	−0.41	0.09	1.00							
Number of investors	0.13	−0.57	−0.06	0.09	0.05	0.08	−0.03	0.04	0.02	−0.37	0.04	0.75	1.00						
Number of rounds	0.09	−0.32	−0.11	−0.02	0.09	0.03	−0.12	−0.03	0.06	−0.18	−0.05	0.42	0.51	1.00					
Competitive conditions	−0.13	0.04	0.21	0.09	−0.07	−0.09	0.12	0.25	−0.11	−0.01	0.12	0.06	−0.17	−0.44	1.00				
Numbers of last year investments	−0.07	0.02	0.09	0.22	0.04	−0.10	0.05	0.14	−0.08	−0.05	0.08	0.01	−0.12	−0.33	0.70	1.00			
Partner selection	−0.01	−0.36	−0.07	0.05	0.04	0.05	−0.02	−0.06	0.06	−0.24	0.00	0.26	0.32	0.21	−0.25	−0.10	1.00		
Industrial distance	0.03	−0.03	−0.04	0.44	0.01	−0.06	0.09	0.35	0.38	−0.08	0.25	0.07	0.05	−0.03	0.07	0.20	0.05	1.00	
Geographic distance	−0.03	−0.06	−0.08	−0.01	0.48	0.05	−0.45	−0.04	0.04	0.00	−0.19	0.16	0.15	0.16	−0.08	0.03	0.12	0.03	1

Table 5
Random effect of logistic regression for determinants of the success of IVC investments.

	(1)	(2)	(3)	(4)	(5)	(6)
Stake	0.119	0.084	0.115	0.116	0.121	0.115
	(0.765)	(0.530)	(0.705)	(0.713)	(0.743)	(0.703)
Stage preference	−0.011	−0.022	−0.023	−0.024	−0.023	−0.025
	(−0.175)	(−0.337)	(−0.353)	(−0.372)	(−0.352)	(−0.390)
Industrial experience	−0.117	−0.136	0.034	0.019	0.020	0.011
	(−0.530)	(−0.608)	(0.142)	(0.077)	(0.082)	(0.044)
Geographic experience	−0.084	−0.064	−0.103	0.001	−0.001	−0.001
	(−0.830)	(−0.608)	(−0.999)	(0.006)	(−0.011)	(−0.010)
Specialization	0.202	0.254	0.224	0.236	0.235	0.243
	(0.711)	(0.872)	(0.772)	(0.812)	(0.810)	(0.835)
Firm size	0.013	0.013	0.011	0.011	0.011	0.013
	(0.440)	(0.421)	(0.367)	(0.373)	(0.375)	(0.420)
Firm age	−0.055	−0.046	−0.012	−0.013	−0.013	−0.015
	(−1.613)	(−1.281)	(−0.330)	(−0.363)	(−0.353)	(−0.418)
Lead	−0.025	−0.029	−0.033	−0.036	−0.037	−0.034
	(−0.323)	(−0.362)	(−0.408)	(−0.448)	(−0.461)	(−0.417)
Indegree	0.101	0.099	0.138	0.136	0.135	0.141
	(0.619)	(0.596)	(0.841)	(0.835)	(0.828)	(0.863)
Received capital	0.424***	0.442***	0.439***	0.440***	0.440***	0.439***
	(11.842)	(11.976)	(11.740)	(11.752)	(11.754)	(11.736)
Number of investors	−0.049***	−0.055***	−0.052***	−0.052***	−0.052***	−0.051***
	(−3.672)	(−4.060)	(−3.744)	(−3.748)	(−3.743)	(−3.709)
Number of rounds	−0.050***	−0.068***	−0.069***	−0.069***	−0.069***	−0.069***
	(−3.380)	(−4.371)	(−4.306)	(−4.299)	(−4.300)	(−4.322)
Competitive conditions	−0.207	−0.224*	−0.144	−0.153	−0.150	−0.155
	(−1.561)	(−1.675)	(−0.971)	(−1.031)	(−1.009)	(−1.044)
Numbers of investments last year	0.117	0.147*	0.141	0.145	0.143	0.141
	(1.344)	(1.663)	(1.559)	(1.604)	(1.586)	(1.567)
Partner selection		−0.003	−0.000	0.000	−0.014	0.084*
		(−0.151)	(−0.006)	(0.001)	(−0.539)	(1.770)
Industrial uncertainties			−0.231**	−0.228**	−0.228**	−0.065
			(−2.121)	(−2.097)	(−2.094)	(−0.475)
Geographic uncertainties				−0.129*	−0.181**	−0.130*
				(−1.853)	(−1.990)	(−1.864)
*Geographic uncertainties * Partner selection*					0.032	
					(0.883)	
*Industrial uncertainties * Partner selection*						−0.100**
						(−1.977)
N	6081	5834	5635	5635	5635	5635

t statistics in parentheses.
* p < 0.1.
** p < 0.05.
*** p < 0.01.

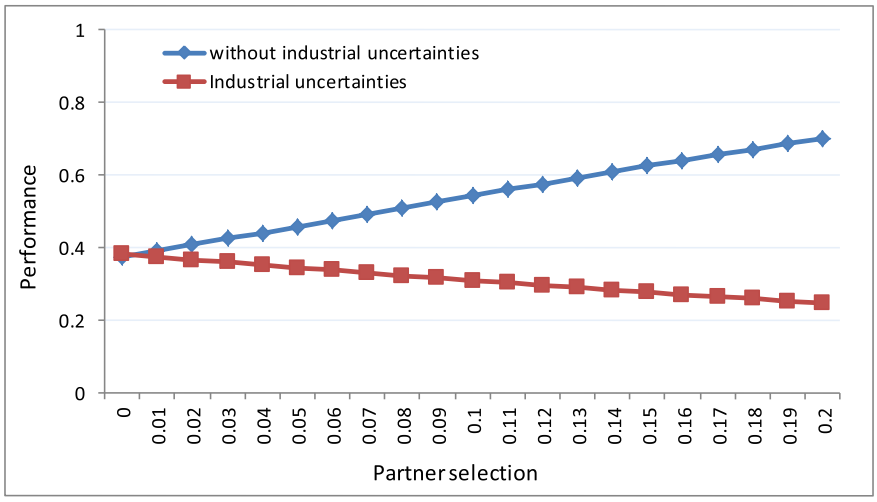

Fig. 3. Interaction effect of industrial uncertainties and partner selection on IVC investment performance.

Table 6
Comparison of differences between IVC and CVC.

	IVC	CVC
Goals	Financial returns	Exploit industry knowledge to develop products or services that can potentially provide competitive advantage for the parent corporations
Organizational structure	Limited partnerships	Individual units of parent corporations
Sponsors	Institutional investors and wealthy individuals	Parent corporate
Incentive of fund managers	Performance-based incentives, about 20% of the profit the fund generates	Fixed salary
Lifespan of an investment	Longer (up to ten years)	Shorter (terminates in four years)

performance implications of the firm across various industries or the degree of uncertainty about the alignment of firms' strategic choices with the degree of its contractual hazards using the Heckman two-stage model to adjust for sample selection biases.

Acknowledgements

The author disclosed receipt of the financial support for the research from the Ministry of Science and Technology of Taiwan, R.O.C., Project number: MOST 106-2410-H-031-054-MY2.

References

Achrol, R. S., & Stern, L. W. (1988). Environmental determinants of decision-making uncertainty in marketing channels. *Journal of Marketing Research, 25*(1), 36–50.
Ahuja, G., Polidoro, F., & Mitchell, W. (2009). Structural homophily or social asymmetry? The formation of alliances by poorly embedded firms. *Strategic Management Journal, 30*(9), 941–958.
Amit, R., Glosten, L., & Muller, E. (1990). Entrepreneurial ability, venture investments, and risk sharing. *Management Science, 36*(10), 1232–1245.
Anton, J. J., & Yao, D. A. (1994). Expropriation and inventions: Appropriable rents in the absence of property rights. *The American Economic Review, 84*(1), 190–209.
Anton, J. J., & Yao, D. A. (2002). The sale of ideas: Strategic disclosure, property rights, and contracting. *Review of Economic Studies, 69*(3), 513–531.
Arthurs, J. D., Hoskisson, R. E., Busenitz, L. W., & Johnson, R. A. (2008). Managerial agents watching other agents: Multiple agency conflicts regarding underpricing in IPO firms. *The Academy of Management Journal, 51*(2), 277–294.
Beckman, C. M., Haunschild, P. R., & Phillips, D. J. (2004). Friends or strangers? Firm-specific uncertainty, market uncertainty, and network partner selection. *Organization Science, 15*(3), 259–275. https://doi.org/10.1287/orsc.1040.0065.
Bergemann, D., & Hege, U. (1998). Venture capital financing, moral hazard, and learning. *Journal of Banking & Finance, 22*(6–8), 703–735.
Bhattacharya, S., & Ritter, J. R. (1983). Innovation and communication: Signalling with partial disclosure. *The Review of Economic Studies, 50*(2), 331.
Blau, P. M. (1977). *Inequality and heterogeneity*. Free Press.
Block, Z., & Ornati, O. A. (1987). Compensating corporate venture managers. *Journal of Business Venturing, 2*(1), 41–51.
Braunerhjelm, P., & Parker, S. C. (2010). Josh Lerner: recipient of the 2010 Global Award for Entrepreneurship Research. *Small Business Economics, 35*(3), 245–254.
Bruton, G. D., Filatotchev, I., Chahine, S., & Wright, M. (2010). Governance, ownership structure, and performance of IPO firms: The impact of different types of private equity investors and institutional environments. *Strategic Management Journal, 31*(5), 491–509. https://doi.org/10.1002/smj.822.
Burt, R. S. (1983). *Corporate profits and cooptation: Networks of market constraints and directorate ties in the American economy*. Academic Press.
Bygrave, W. D. (1987). Syndicated investments by venture capital firms: A networking perspective. *Journal of Business Venturing, 2*(2), 139–154.
Bygrave, W. D. (1988). The structure of the investment networks of venture capital firms. *Journal of Business Venturing, 3*(2), 137–157.
Bygrave, W. D., & Timmons, J. A. (1992). *Venture capital at the crossroads*. Harvard Business Press.
Chung, S. A., Singh, H., & Lee, K. (2000). Complementarity, status similarity and social capital as drivers of alliance formation. *Strategic Management Journal, 21*(1), 1–22.
Das, S., Sen, P. K., & Sengupta, S. (1998). Impact of strategic alliances on firm valuation. *The Academy of Management Journal, 41*(1), 27–41.
De Clercq, D., & Dimov, D. (2008). Internal knowledge development and external knowledge access in venture capital investment performance. *Journal of Management Studies, 45*(3), 585–612. https://doi.org/10.1111/j.1467-6486.2007.00747.x.
De Clercq, D., Sapienza, H. J., & Zaheer, A. (2008). Firm and group influences on venture capital firms' involvement in new ventures. *Journal of Management Studies, 45*(7), 1169–1194. https://doi.org/10.1111/j.1467-6486.2007.00764.x.
De Leeuw, T., Lokshin, B., & Duysters, G. (2014). Returns to alliance portfolio diversity: The relative effects of partner diversity on firm's innovative performance and productivity. *Journal of Business Research, 67*(9), 1839–1849.
Dharwadkar, R., George, G., & Brandes, P. (2000). Privatization in emerging economies: An agency theory perspective. *The Academy of Management Review, 25*(3), 650–669.
Douma, S., George, R., Kabir, R., & Center for Economic Research (2006). Foreign and domestic ownership, business groups, and firm performance: Evidence from a large emerging market. *Strategic Management Journal, 27*(7), 637.
Dushnitsky, G., & Lavie, D. (2010). How alliance formation shapes corporate venture capital investment in the software industry: a resource-based perspective. *Strategic Entrepreneurship Journal, 4*(1), 22–48.
Dushnitsky, G., & Lenox, M. J. (2005). When do firms undertake R&D by investing in new ventures? *Strategic Management Journal, 26*(10), 947–965. https://doi.org/10.1002/smj.488.
Dushnitsky, G., & Lenox, M. J. (2006). When does corporate venture capital investment create firm value? *Journal of Business Venturing, 21*(6), 753–772. https://doi.org/10.1016/j.jbusvent.2005.04.012.
Dushnitsky, G., & Shapira, Z. (2010). Entrepreneurial finance meets organizational reality: Comparing investment practices and performance of corporate and independent venture capitalists. *Strategic Management Journal, 31*(9), 990–1017. https://doi.org/10.1002/smj.851.
Dushnitsky, G., & Shaver, J. M. (2009). Limitations to interorganizational knowledge

acquisition: The paradox of corporate venture capital. *Strategic Management Journal, 30*(10), 1045–1064. https://doi.org/10.1002/smj.781.
Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *The Academy of Management Review, 14*(1), 57–74.
Fitza, M., Matusik, S. F., & Mosakowski, E. (2009). Do VCs matter? The importance of owners on performance variance in start-up firms. *Strategic Management Journal, 30*(4), 387–404. https://doi.org/10.1002/smj.748.
Galaskiewicz, J., & Shatin, D. (1981). Leadership and networking among neighborhood human service organizations. *Administrative Science Quarterly, 26*(3), 434–448.
Gompers, P., Kovner, A., & Lerner, J. (2009). Specialization and success: Evidence from venture capital. *Journal of Economics and Management Strategy, 18*(3), 817–844. https://doi.org/10.1111/j.1530-9134.2009.00230.x.
Gompers, P., & Lerner, J. (1999). An analysis of compensation in the US venture capital partnership. *Journal of Financial Economics, 51*(1), 3–44.
Gompers, P. A. (1995). Optimal investment, monitoring, and the staging of venture capital. *The Journal of Finance, 50*(5), 1461–1489.
Gompers, P. A., & Lerner, J. (2004). *The venture capital cycle.* The MIT Press.
Gompers, P., & Lerner, J. (2000). Money chasing deals? The impact of fund inflows on private equity valuation. *Journal of Financial Economics, 55*(2), 281–325. https://doi.org/10.1016/s0304-405x(99)00052-5.
Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology, 91*(3), 481–510.
Gulati, R., & Gargiulo, M. (1999). Where do interorganizational networks come from? *American Journal of Sociology, 104*(5), 1439–1493.
Gupta, A. K., & Sapienza, H. J. (1992). Determinants of venture capital firms' preferences regarding the industry diversity and geographic scope of their investments. *Journal of Business Venturing, 7*(5), 347–362.
Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly, 44*(1), 82–111.
Harrison, J. S., Hitt, M. A., Hoskisson, R. E., & Ireland, R. D. (1991). Synergies and post-acquisition performance: Differences versus similarities in resource allocations. *Journal of Management, 17*(1), 173.
Harrison, J. S., Hitt, M. A., Hoskisson, R. E., & Ireland, R. D. (2001). Resource complementarity in business combinations: Extending the logic to organizational alliances. *Journal of Management, 27*(6), 679.
Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica: Journal of the Econometric Society,* 153–161.
Hellmann, T. (1998). The allocation of control rights in venture capital contracts. *The Rand Journal of Economics, 29*(1), 57–76.
Hitt, M. A., Dacin, M. T., Levitas, E., Arregle, J.-L., & Borza, A. (2000). Partner selection in emerging and developed market contexts: Resource-based and organizational learning perspectives. *The Academy of Management Journal, 43*(3), 449–467.
Hochberg, Y. V., Ljungqvist, A., & Lu, Y. (2007). Whom you know matters: Venture capital networks and investment performance. *The Journal of Finance, 62*(1), 251–301.
Homans, G. C. (1950). *The human group.* New York: Har-court, Brace and World.
Ibarra, H. (1992). Homophily and differential returns: Sex differences in network structure and access in an advertising firm. *Administrative Science Quarterly, 37*(3), 422–447.
Jaaskelainen, M., Maula, M., & Seppa, T. (2006). Allocation of attention to portfolio companies and the performance of venture capital firms. *Entrepreneurship Theory and Practice, 30*(2), 185–206.
Jain, B. A. (2001). Predictors of performance of venture capitalist-backed organizations. *Journal of Business Research, 52*(3), 223–233.
Keil, T., Maula, M. V. J., & Wilson, C. (2010). Unique resources of corporate venture capitalists as a key to entry into rigid venture capital syndication networks. *Entrepreneurship Theory and Practice, 34*(1), 83–103. https://doi.org/10.1111/j.1540-6520.2009.00366.x.
Kono, C., Palmer, D., Friedland, R., & Zafonte, M. (1998). Lost in space: The geography of corporate interlocking directorates. *American Journal of Sociology, 103*(4), 863–911.
Lane, P. J., Salk, J. E., & Lyles, M. A. (2001). Absorptive capacity, learning, and performance in international joint ventures. *Strategic Management Journal, 22*(12), 1139–1161.
Larsson, R., & Finkelstein, S. (1999). Integrating strategic, organizational, and human resource perspectives on mergers and acquisitions: A case survey of synergy realization. *Organization Science, 10*(1), 1–26.
Lazarsfeld, P. F., & Merton, R. K. (1954). Friendship as a social process: A substantive and methodological analysis. *Freedom and Control in Modern Society, 18*(1), 18–66.
Lerner, J. (1994a). The syndication of venture capital investments. *Financial Management, 23*(3), 16–27.
Lerner, J. (1994b). Venture capitalists and the decision to go public. *Journal of Financial Economics, 35*(3), 293–316.
Li, S. X., & Rowley, T. J. (2002). Inertia and evaluation mechanisms in interorganizational partner selection: Syndicate formation among US investment banks. *Academy of Management Journal, 45*(6), 1104–1119.
Lin, Z., Haibin, Y., & Demirkan, I. (2007). The performance consequences of ambidexterity in strategic alliance formations: Empirical investigation and computational theorizing. *Management Science, 53*(10), 1645–1658.
Lin, Z., Yang, H., & Arya, B. (2009). Alliance partners and firm performance: Resource complementarity and status association. *Strategic Management Journal, 30*(9), 921–940. https://doi.org/10.1002/smj.773.
MacMillan, I. C., & Kulow Roubina, D. M. (1989). Venture capitalists' involvement in their investments: Extent and performance. *Journal of Business Venturing, 4*(1), 27–47.
Madhok, A., & Tallman, S. B. (1998). Resources, transactions and rents: Managing value through interfirm collaborative relationships. *Organization Science, 9*(3), 326–339.
Masten, S. E. (1993). Transaction costs, mistakes, and performance: Assessing the importance of governance. *Managerial and Decision Economics, 14*(2), 119–129.
McNally, K. (1997). *Corporate venture capital: Bridging the equity gap in the small business sector.* London, UK: Routledge.
McPherson, M., Smith-Lovin, L., & Cook, J. M. (2001). Birds of a feather: Homophily in social networks. *Annual Review of Sociology, 27*(1), 415–444.
Meirovich, G. (2010). The impact of cultural similarities and differences on performance in strategic partnerships: An integrative perspective. *Journal of Management & Organization, 16*(1), 127–139.
Meuleman, M., Lockett, A., Manigart, S., & Wright, M. (2010). Partner selection decisions in interfirm collaborations: The paradox of relational embeddedness. *Journal of Management Studies, 47*(6), 995–1019. https://doi.org/10.1111/j.1467-6486.2009.00897.x.
Moorman, C., & Slotegraaf, R. J. (1999). The contingency value of complementary capabilities in product development. *Journal of Marketing Research, 36*(2), 239–257.
Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1996). Strategic alliances and interfirm knowledge transfer. *Strategic Management Journal, 17*(S2), 77–91.
Norton, E., & Tenenbaum, B. H. (1993). Specialization versus diversification as a venture capital investment strategy. *Journal of Business Venturing, 8*(5), 431–442.
Osborn, R. N., & Hagedoorn, J. (1997). The institutionalization and evolutionary dynamics of interorganizational alliances and networks. *The Academy of Management Journal, 40*(2), 261–278.
Podolny, J. M. (1994). Market uncertainty and the social character of economic exchange. *Administrative Science Quarterly, 39*(3), 458–483.
Podolny, J. M. (2001). Networks as the pipes and prisms of the market. *American Journal of Sociology, 107*(1), 33–60.
Reagans, R., & McEvily, B. (2003). Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly, 48*(2), 240–267.
Sahlman, W. A. (1990). The structure and governance of venture-capital organizations. *Journal of Financial Economics, 27*(2), 473–521.
Salancik, G. R., & Pfeffer, J. (1978). *The external control of organizations: A resource dependence perspective.* Harper and Row.
Sapienza, H. J. (1992). When do venture capitalists add value? *Journal of Business Venturing, 7*(1), 9–27.
Sapienza, H. J., & Gupta, A. K. (1994). Impact of agency risks and task uncertainty on venture capitalist-CEO interaction. *The Academy of Management Journal, 37*(6), 1618–1632.
Sapienza, H. J., Manigart, S., & Vermeir, W. (1996). Venture capitalist governance and value added in four countries. *Journal of Business Venturing, 11*(6), 439–469.
Shah, R. H., & Swaminathan, V. (2008). Factors influencing partner selection in strategic alliances: The moderating role of alliance context. *Strategic Management Journal, 29*(5), 471–494. https://doi.org/10.1002/smj.656.
Siegel, R., Siegel, E., & MacMillan, I. C. (1988). Corporate venture capitalists: Autonomy, obstacles, and performance. *Journal of Business Venturing, 3*(3), 233–247.
Sorenson, O., & Stuart, T. E. (2001). Syndication networks and the spatial distribution of venture capital investments. *The American Journal of Sociology, 106*(6), 1546–1588.
Sorenson, O., & Stuart, T. E. (2008). Bringing the context back in: Settings and the search for syndicate partners in venture capital investment networks. *Administrative Science Quarterly, 53*(2), 266–294.
Sykes, H. B. (1990). Corporate venture capital: Strategies for success. *Journal of Business Venturing, 5*(1), 37–47.
Thompson, J. (1967). Organizations in action: Social science bases of administrative theory. *Classics in organization and management series.* Trans. Publishers.
Uzzi, B. (1996). The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review, 61*(4), 674–698.
Wadhwa, A., & Kotha, S. (2006). Knowledge creation through external venturing: Evidence from the telecommunications equipment manufacturing industry. *Academy of Management Journal, 49*(4), 819.
Wright, M., & Lockett, A. (2003). The structure and management of alliances: Syndication in the venture capital industry. *Journal of Management Studies, 40*(8), 2073–2102. https://doi.org/10.1046/j.1467-6486.2003.00412.x.
Young, M. N., Peng, M. W., Ahlstrom, D., Bruton, G. D., & Jiang, Y. (2008). Corporate governance in emerging economies: A review of the principal-principal perspective. *Journal of Management Studies, 45*(1), 196–220.
Zipf, G. K. (1949). *Human behavior and the principle of least effort.*

Chun-Yun Cheng is an Assistant Professor at the Department of Business Administration, SooChow University. Her research interests include strategic management and organizational theory.

Ming-Je Tang is a Professor at the Department of Business Administration, National Taiwan University. His research interests include strategic management and technology strategy.