Venture Capital Syndicate Diversity: Three Types and their Effects on Performance[*]

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This study investigates the relationship between venture capital (hereafter, VC) syndicate diversity and the IPO performance of an entrepreneurial company backed by the syndicate. Specifically, focusing on three types of diversity within a VC syndicate, which are aligned with Harrison and Klein's seminal categorization in 2007 (i.e., separation, variety, and disparity), this study suggests their distinct effects on performance. Two stage least square analyses with 1,127 VC syndicate investments made by 6,268 VC firms strongly supported the hypotheses. The results showed that that capacity diversity decreases the performance and that expertise diversity and network diversity increase it.

Keywords : *Venture Capital Syndication, Diversity, IPO*

Ⅰ. Introduction

Determinants of entrepreneurial performance have been of interest to entrepreneurship researchers. They have analyzed internal determinants such as entrepreneurs (Gimeno, Folta, Cooper, and Woo, 1997) and an entrepreneurial firm (Covin and Slevin, 1991; Beckman and Burton, 2008) and external determinants including the personal network of an entrepreneur (Hansen, 1995), the interorganizational network of an entrepreneurial firm (Aldrich and Zimmer, 1986; Stuart, Hoang, and Hybels, 1999), and the environments (Kirzner, 1979; Baumol, 1990). This study looks into the interorganizational link-

age of an entrepreneurial firm, specifically, the venture capital (hereafter, VC) syndicate. Recently, researchers have begun to show more interest in VC syndication, not only because it is a major form of VC investment (Jääskeläinen, Maula, and Seppä, 2006), but also because it provides a rich empirical setting for investigating interorganizational ties (e.g. Podolny, 2001; Echols and Tsai, 2005). However, the characteristics of individual VC firms (hereafter, VCFs) within a syndicate have received only limited attention (Jääskeläinen, 2012). In particular, the diversity of a VC syndicate has been largely overlooked as a determinant of performance, al-

though it is well established that the diversity of a group composed of multiple organizations critically determines the group's performance (Powell, Koput, and Smith-Doerr, 1996).

Researchers have also shown conflicting results about the relationship between diversity and performance. For example, at the organizational level, diversity has been found to affect performance positively (Powell et al., 1996), negatively (Darr and Kurtzberg, 2000; Goerzen and Beamish, 2005), and in both directions (Zahra, Ireland, and Hitt, 2000; Koka and Prescott, 2002). These results imply that more comprehensive examinations need to be conducted by management researchers, to solve this inconsistency. This study addresses this inconsistency by focusing on different types of diversity among organizations in the context of VC syndication, as Harrison and Klein (2007) did with diversity among individuals. Following their influential categorization of diversity (i.e., separation, variety, and disparity), this study suggests capacity diversity, expertise diversity, and network diversity for each category. First, in line with separation, capacity diversity is about horizontal difference along the continuum of capacity, including size and experience, forming organizational perspectives. Second, variety is associated with expertise diversity. This diversity represents differences of organizations in terms of kind, source or category, which can be related to distinct knowledge and information. A composition of specializations in industry and investment stage among organizations is regarded as expertise diversity. Finally, network diversity is aligned with disparity. As socially-valued assets and resources, a composition of network positions among organizations refers to network diversity. This study proposes distinct effects of three diversity types on performance. Then, the hypotheses are tested by conducting 2 stage least square analysis with 1,127 VC syndicate investments by 6,268 VCFs from 1990 to 2000. The analysis predicts whether the venture company supported by a focal VC syndicate made IPO from 1990 to 2010or not. The analysis results strongly confirms the hypotheses. Capacity diversity is shown to decrease performance, while expertise diversity and network diversity are demonstrated to increase it.

This study makes two primary contributions. First, this study extends the understanding of VC by suggesting significant determinants of VC syndicate performance. More specifically, diversity of VCFs within a syndicate is demonstrated as determinants of the performance. Second, it represents a step forward in research on diversity by demonstrating three types of diversity among organizations and their distinct effects on performance. More specifically, the analysis results confirm that separation decreases performance in the VC syndicate context, while variety and disparity increase it. This study is organized as follows. First, the author reviews relevant literature related to venture capital syndication, and diversity, and then, develops the hypotheses. In the next, the author describes the methodology of this study including sample, data, variables, and statistical analysis. Finally, the study presents analysis results and conclusions.

II. Literature Review and Hypotheses

2.1 Venture Capital Syndication

VC supports venture companies (Stuart and Sorenson, 2007). In particular, VC facilitates their growth by providing financial and-non-financial resources. VC Researchers have identified the contribution of the VCF to a venture company: providing financial resources (Gompers and Lerner, 2004), signaling the company's quality to potential investors (Stuart et al., 1999; Kim and Wagman, 2016), sharing collective knowledge (Ferrary and Granovetter, 2009), and embedding the company in entrepreneurial networks including other investors and professional agencies (Hsu, 2006). Financial contribution to a venture company is a fundamental role of

VCF which regards it as a part of contract (Burchardt, Hommel, Kamuriwo, and Billitteri, 2016). However, non-financial contribution is as essential as financial one as previous literature has shown (e.g., Ferrary and Granovetter, 2009). Through this contribution, a VCF's characteristics affect the venture company's performance the VCF supports and subsequently, the VCF's performance, itself.

A VCF forms links with other VCFs. Some of the links are developed into a temporary coalition of two or more than two VCFs, which is called as a VC syndicate (Bygrave, 1988). VC syndicate is a dominant form of VCF investment (Tian, 2012). One stream of VC syndicate researchers have shown the goals of VC syndication: increasing the amount of financial investment (Steier and Greenwood, 1995), decreasing risks by sharing (Lockett and Wright, 2001), and obtaining benefits such as future investment participation and affiliation with prestigious partners (Lerner, 1994). In addition, VCFs form a syndicate to learn other VCFs' knowledge and capabilities (Brander, Amit, and Antweiler, 2002). Another stream of VC syndicate research has focused on performance. Researchers have shown that factors including syndication itself (Das, Jo, and Kim, 2011; Tian, 2012), syndication size (Nahata, 2008), network centrality of syndication participants (Hochberg, Ljungqvist, and Lu, 2007), and prior experience (De Clercq, Sapienza, and Zaheer, 2008) affect performance. Recently, diversity has been addressed in a number of entrepreneurship research. For example, Gompers and his colleagues examined gender diversity and its effect on financial performance (Gompers and Wang, 2017) and team formation and performance (Gompers, Huang, and Wang, 2017). Also, diversity of a corporate venture capital portfolio was demonstrated to affect the performance of corporate investors (Wadhwa, Phelps, and Kotha, 2016; Belderbos, Jacob, and Lokshin, 2018). In addition, audience diversity of a venture company was presented to affect a judgment of the company's legitimacy

(Fisher, Kuratko, Bloodgood, and Hornsby, 2017). However, diversity of the VCFs within a syndicate and its influence on performance has still been insufficiently examined (Jääskeläinen, 2012). This study focuses on diversity as a determinant of VC syndicate performance.

2.2 Diversity and Performance

The performance consequences of diversity has been a key theme to management scholars (Williams and O'Reilly, 1998). In particular, at the individual level, how different a unit's individual members are has been extensively examined as an important determinant of the unit's performance. But, research on this relationship has shown mixed results, such as positive (e.g., Richard, 2000; Carpenter, 2002), negative (e.g., Jehn and Bezrukova, 2004; Putnam, 2007), and insignificant relationships (Webber and Donahue, 2001). At the organizational level, researchers also have investigated differences among organizations and the resulting influences. However, in line with the results at the individual level, researchers have found diverse results at this level, too. For instance, on one hand, various partners can increase performance by providing a wider range of learning (Powell et al., 1996). This positive relationship was also suggested to hold only if the partners are related to each other (Zhang, 2014). On the other hand, diverse partners can decrease performance through higher coordination cost (Goerzen and Beamish, 2005). Greater diversity is also associated with lower level of trust (Gulati, 1995). To solve this inconsistency, Sampson (2007) suggested a non-linear relationship between diversity and performance. As another explanation, diversity type and performance type can be considered as contingency factors. The effects of diversity on performance change according to these two types. More specifically, diversity makes dual effects on performance. Diversity decreases performance by increasing difficulty in coordination of diverse members. Simultaneously, diversity increases performance by increasing cre-

ativity brought by diverse members. Some diversity types and performance types are more related to difficulty in coordination than creativity. In this case, diversity decreases performance. Meanwhile, other types are mainly related to higher creativity. Then, diversity increases performance. In the context of VC syndication, this study adopts only one type of performance, which is a success in initial public offering (IPO) of a venture company a VCF supports. With one fixed type of performance, subsequently, this study focuses on diversity type as the determinant of direction of performance change.

2.3 Diversity Type

In their seminal study, Harrison and Klein (2007) suggested three distinct types of diversity within a unit such as a group or an organization (i.e., diversity at the individual level). They proposed a categorization of separation, variety, and disparity, and explained how these three concepts are distinguished. Separation refers to differences in lateral position or in opinion among unit members. This is about horizontal distance along a continuum such as value, belief, or attitude. Variety means differences in kind, source or category among unit members. Such variety can involve knowledge, information, or experience. It is not associated with any position in a lateral continuum or in a hierarchical column. Finally, disparity is about differences in the socially-valued assets or resources that the unit members hold. Disparity sometimes means social inequality among unit members, as it is derived from the vertical positions of a hierarchical column such as pay, status, and power. Although a number of research has adopted this distinction and expanded our understanding of diversity, the domain has been limited within a unit (i.e., research on diversity at the individual level). The author posits that their three types are still valid in the context of a syndication comprised of member organizations. As representative examples of the three diversity type constructs

(i.e., separation, variety, and disparity)at the organizational level, this study suggests capacity diversity, expertise diversity, and network characteristics diversity and examines their distinct effects on performance.

2.3.1 Diversity in Capacity

Diversity in capacity is matched to separation. In the context of VC syndication, VCFs' common goal is to obtain success in their investment. Thus, in their investment processes, values, beliefs or perspectives related to an investment play a more critical role in their coordination than others. Their capacity such as size and experience is one of those important attributes. The capacity decides the attitude to risk, which is related to a difficulty of coordination within the syndicate. So, as differences in individual members' values, beliefs, and attitudes belong to separation at the individual level, diversity in capacity of a VC syndicate is matched to separation at the organizational level. When considering its association with performance, diversity in capacity is more related to coordination than creativity and non-redundancy. Even though a VC syndicate is composed of diverse VCFs in capacity, they may possess similar sets of knowledge, technologies, resources, and capabilities. In this case, their contribution may be homogeneous and redundant despite their differences in size and experience. For example, some VCFs may be large and other VCFs may be small. But, their contributions can be redundant if both of them have obtained experiences in the same field. Likewise, some VCFs may have more experiences than others. But, their difference may not provide any novel ideas and perspectives if they come from the same field. Therefore, creativity, which brings a positive relationship between diversity and performance, does not play a critical role on the relationship between diversity in capacity and VC syndicate performance. Meanwhile, this type of diversity substantially affects coordination of members. If VCFs are diverse in size, each VCF's economies of scale will differ. Different economies

of scales will make each VCF's optimal investment strategies divergent. This divergence will increase the coordination cost and decrease the syndicate performance. If VCFs are diverse in degree of experience, the amounts of their knowledge accumulated from experiences will vary. Except for few cases, their various amounts of knowledge will lead them to keep different interpretations of the investment conditions. Then, conflicts may emerge among the VCFs and the syndicate performance decreases. Taken together, diversity in capacity increases difficulty in coordination and does not substantially affect creativity and non-redundancy within the syndicate. Then, increasing difficulty in coordination will reduce performance. Therefore, the author proposes the following.

> Hypothesis 1: VC syndicate diversity in capacity is negatively associated with syndicate performance.

2.3.2 Diversity in Expertise

Diversity in expertise is aligned to the second type of diversity (i.e., variety). As variety is about kind, source or category, which represents knowledge, information, or experience, among unit members, specialization of organizations within a syndicate can be matched to this construct. Within the context of the VC industry, each VCF can have expertise in a specific industry, if it has mostly invested in venture companies in the industry. For example, some VCFs specialize themselves in the bio technology industry, while others do so in the computer software industry. Second, VCFs can buildan expertise with regard to specific investment stage. For example, some VCFs may concentrate on investment at the early stage, while others do so at the expansion stage. Likewise, VCFs have different expertise in industry and investment stage and these differences provide distinct knowledge and information. So, diversity in expertise in a VC syndicate can be associated with variety at the organiza-

tional level. This type of diversity is distinguished from diversity in capacity with regard to its influences on coordination and creativity. First, VCFs' diversity in expertise significantly increases creativity of the syndicate. Expertise in another field can be something new in itself. Information, knowledge, perspectives, resources, and capabilities from a VCF whose expertise is in a distinct field can become creative, novel, and non-redundant to the syndicate. Thus, if VCFs are more diverse in expertise, they can make more creative contributions to the syndicate. And a venture company the syndicate supports is more likely to succeed in IPO performance. In addition, as suggested by Harrison and Klein (2007), variety tends to bring greater creativity, more flexibility, and-better decision quality and diversity in expertise will do so. Second, this type of diversity does not affect coordination as much as diversity in capacity. As information about previous performance of each member is shared within the syndicate, expertise of each VCF is known to one another. So, with regard to specific industry and particular investment stage, syndicate members tend to acknowledge the expertise other VCFs have. So, diverse VCFs in expertise can obtain agreements on investment decisions with less conflicts and the costs of coordination get mitigated. In line with this discussion, the author proposes the following.

> Hypothesis 2: VC syndicate diversity in expertise is positively associated with syndicate performance.

2.3.3 Diversity in Network Characteristics

Network characteristics of an actor have been a key theme in social network research. Examples include structural holes (Ahuja, 2000; Zaheer and Soda, 2009), density (Gargiulo and Benassi, 2000), centrality (Freeman, 1979), and embeddedness (Uzzi, 1997; Echols and Tsai, 2005). However, the composition of network characteristics of group members

(i.e., diversity in network characteristics) has been relatively underexplored in spite of its influences on the group. Among three types of diversity, diversity in network characteristics can be categorized as disparity. Disparity is constructed by socially-valued assets or resources (Harrison and Klein, 2007) and networkcharacteristics, particularly network position characteristics, is one of meaningful assets an organization has. One relevant research focused on network position diversity in the Hollywood film industry (Cattani and Ferriani, 2008). This study showed that a team composed of both core position members and periphery members tends to obtain higher performance than a homogeneous team. Members in a periphery position are more willing to adopt novel ideas from outside becausethey want to increase their status (Burt, 1980), while members in a core position can provide legitimacy to novel ideas which are difficult to spread without support (Cross and Cummings, 2004). So, both adopting novel ideas and supporting them are essential for enhancing performance.

In the VC context, a diverse syndicate with regard to its member's network characteristics canobtain higher performance. Periphery VCFs are more willing to receive new, creative, and non-redundant information from outside than core VCFs. However, this information is not easily accepted within the syndicate. Core VCFs can play a role in applying, implementing, and utilizing the information. A VC syndicate composed of only periphery VCFs will havea difficulty in transforming its creativity into performance. Meanwhile, a VC syndicate composed of only core VCFs will not be able to have sufficient creativity. Therefore, both core position VCFs and periphery position VCFs are essential and a diverse VC syndicate in terms of the members' network characteristics and positions obtain higher performance through taking advantage of high creativity. Meanwhile, in line with diversity in expertise, this diversity does not significantly affect coordination. Once diverse VCFs in terms of network position form

a syndicate, periphery VCFs (i.e., low status VCFs) tend to participate in collaboration more eagerly as they care about both the current syndicate performance and a future syndication chance with the core VCFs (i.e., high status VCFs). Thus, even if the syndicate have some conflicts between core and periphery VCFs, the coordination will not be substantially higher than a homogeneous syndicate. Taken together, diversity in network characteristics and positions increases creativity and does not substantially affect difficulty in coordination. In other words, less structural isomorphism within a syndicate brings higher performance to the syndicate. In line with this discussion, the author proposes the following.

> Hypothesis 3: VC syndicate diversity in network is positively associated with syndicate performance.

Ⅲ. Method

3.1 Sample and Data Collection

This study analyzed the VC syndicate investments from 1990 to 2000 and their IPO performance from 1990 to 2010. The time frame was adopted, because at least the 10-year period after the last investment round should be examined when evaluating a venture company's performance (Guler, 2007). Also, this time frame provides an appropriate setting for empirical analyses of IPO, as it includes an unprecedented period regarding the numbers of venture company foundation and IPO success (Ritter and Welch, 2002). The author collected data from the Venture Xpert database of SDC Thomson. The dataset provided 6,173 VC syndicate investments by 16,119 VCFs in the period from 1990 to 2000.[1] After excluding investments that have missing values, the final sample con-

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[1] Observations were collected only if both the investments' first and last rounds belong to the period from 1990 to 2000.

sisted of 1,127 VC syndicate investments by 6,268 VCFs.

3.2 Dependent Variable

A number of VC research has measured performance with non-financial indicators such as exit type of a VC syndicate and survival rate of a venture company and focused on what factors bring VC syndicates better outcomes. They demonstrated that syndication itself (Dimov and Milanov, 2010), size of syndication (Nahata, 2008), and higher centrality of VCFs (Hochberg et al., 2007) are positively associated with better outcomes. VCF's investment is typically regarded as a success when it exits through Initial Public Offering (hereafter, IPO), mergers and acquisitions, or stock buy backs (Guler, 2007). Among these successful exits, VCFs tend to obtain the highest returns when the venture company it supports does IPO (Gompers and Lerner, 2004). Seeking to contribute to this stream of research, this study adopted IPO exit as the dependent variable and this was measured as a dummy variable indicating IPO performance of a venture company backed by a syndicate. If a venture company supported by a VC syndicate succeeds in IPO from 1990 to 2010, the author assigned one to the VC syndicate investment. Otherwise, zero was assigned.

3.3 Independent Variables

With regard to VC syndicate diversity, this study investigated the following syndicate members' characteristics: size, investment experience, industry preference, stage preference, brokerage, density, degree centrality, betweenness centrality, and power centrality. Size was measured as the amount of the fund a VCF manages. The number of venture companies a VCF invested was assigned as the investment experience. Industry preference and investment stage preference of a VCF was measured as the values provided by Venture Xpert. With regard to the network values of a VCF, the author assumed that a tie was formed between two

VCFs if they belonged to the same VC syndicate at least once (Hochberg et al., 2007). Also, this study adopted the assumption that the network ties last for five years (Sorenson and Stuart, 2001). Through these steps, annual network matrices were created for each year from 1990 to 2000. The number of VCFs in annual networks ranged from 2,117 to 6,366. Five network variables were derivedfrom these matrices using UCINET 6 (Borgatti, Everett, and Freeman, 2002). Then, diversities of categorical variables (i.e., industry preference and stage preference) were measured following Blau's (1977) heterogeneity index. Diversities of continuous variables (i.e., size, investment experience, brokerage, density, degree centrality, betweenness centrality, and power centrality) were measured as coefficient of variation (i.e., the ratio of the standard deviation to the mean, Harrison, Price, and Bell, 1988).[2] Among nine diversities, the author expected three types of diversity will be distinguished as Harrison and Klein (2007) suggested. After conducting a confirmatory factor analysis from orthogonal varimax rotation, three types of diversity were obtained, which showed distinctive variances. Capacity diversity consists of size diversity and experience diversity. Expertise diversity consists of industry preference and stage preference. Finally, network diversity is composed of brokerage, density, degree centrality, betweenness centrality, and power centrality. Brokerage was meas-

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2) Diversity can be variously measured, such as Blau's heterogeneity index (Blau, 1977), Shannon's measure of entropy (Shannon, 1948), coefficient of variation (Harrison et al., 1988), and so on. However, with regard to continuous values such as numeric ones, the coefficient of variation can measure diversity value much more appropriately than other measure. For example, both Blau's heterogeneity index and Shannon's measure of entropy may regard two different syndicates (i.e., a syndicate A of member 1 with brokerage level 0.1 & member 2 with brokerage level 0.9 and a syndicate B of member 3 with brokerage level 0.4 & member 4 with brokerage level 0.5) as the same.

ured as the inverse value of network constraint (Burt, 1992), while density was done as the number of ties divided by the number of pairs within the focal VCF's network (Wasserman and Faust, 1994). Degree centrality was measured as the number of direct ties a focal VCF formed, while betweenness centrality was done as the extent to which an actor lies on the shortest path between two other actors (Freeman, 1979). As in previous VCF research (Sorenson and Stuart, 2001), power centrality was measured by following Bonacich's (1987) measurement. This measure is defined as follows:

$$c(\alpha, \beta) = \alpha \sum_{k=0}^{\infty} \beta^k R^{k+1} 1,$$

where α is a scaling factor, β is a weighting factor, R is a matrix of relationships, and 1 is a column vector of 1's.[3]

3.4 Control Variables

In this study, the author controlled for a number of variables. First, syndicate characteristics may affect a venture company's IPO performance. For example, more syndicate members may increase a venture company's performance (Guler, 2007). As all VCFs of a syndicate potentially contribute both financial and non-financial resources to a venture company the syndicate supports (Sorenson and Stuart, 2008), more VCFs can increase the syndicate's performance. Also, more VCFs may incur less risk to their syndicate (Sorenson and Stuart, 2008). Thus, the author controlled for the number of participating VCFs in a syndicate. Additionally, the composition of a VC syndicate

may affect a venture company's IPO performance. In particular, corporate VC (Dushnitsky and Shapira, 2010) and VC affiliated with a financial institution (Higgins and Gulati, 2006) affect a venture company's performance. Thus, the author controlled for the number of corporate VCF and the number of VCF affiliated with a financial institution within a VC syndicate.

Second, a lead VCF's characteristics can affect the venture company's IPO performance. A lead VCF plays a critical role in the syndicate performance (Gorman and Sahlman, 1989). The author applied three criteria to identify a lead VCF. Following Sorenson and Stuart (2008), the first round investor was considered as the lead VCF. If multiple VCFs invested in the first round, the one that invested in all the rounds was adopted. If more than one VCF still remained as candidates, the VCF that invested the largest amount of money was regarded as the lead investor (Lee and Wahal, 2004). The author controlled for foreignness of a lead VCF to a venture company. If a lead VCF and a venture company are from one nation, they have fewer difficulties in their cooperation, particularly with regard to laws, institutions, and sometimes languages. If the nationalities of these two organizations are different, one was assigned. Meanwhile, if these two organizations are located within the same country, zero was assigned. And the author controlled for network characteristics of a lead VCF. As a VCF's network centrality enhances their investment performance (Hochberg et al., 2007), the author controlled for a lead VCF's power centrality following previous research which adopted Bonacich's measure (Sorenson and Stuart, 2001). In addition, the author controlled for a lead VCF's brokerage by including the inverse value of the lead VCF's network constraint as its brokerage value (Burt, 1992). These values were derived from the same processes that were adopted for calculating a VC syndicate's network diversity.

Third, characteristics of investment is associated with a venture company's perfor-

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3) We set all main diagonal elements to 0, each element r_{ij} and r_{ji} in the matrix R to 1 if a tie is formed, and 0 otherwise. According to this measure, a focal firm's status is a positive function of the number of ties and the status of other firms the focal firm forms ties with. Also, we followed the example of previous research for the designation of β in this measure and set it equal to three-quarters of the reciprocal of the largest eigenvalue (Podolny, 1993).

mance. The author controlled for the amount of money invested in a venture company by a VC syndicate, which increases the company's IPO performance (Guler, 2007; Waguespack and Fleming, 2009). Simultaneously, this can be a proxy of the venture company's quality, though it comes out via the VCFs' evaluation. Moreover, as length of investment is related to more non-financial supports, this may increase the venture company's performance. Thus, the author controlled for the months from the first investment round to the last one. Meanwhile, the number of investment rounds can increase a venture company's performance, as more rounds mean further financial supports (Tian, 2011). So, the author controlled for the number of the investment rounds a VC syndicate made.

Finally, the author controlled for general market conditions by including location and period variables to the models. Location effect was reflected by including a dummy variable indicating whether a venture company is located in California. A venture company in this specific area is able to obtain the best location advantages in the world and its IPO performance may increase (Dimov and Milanov, 2010). Thus, the author controlled for investment in California by assigning one to a VC syndicate which invested in a venture company located in California. Zero was assigned to other VC syndicates. Following Ritter and Welch (2002), the author categorized the period from 1990 to 2000 into three spans in terms of IPO success rate (i.e., 1990~1994, 1995~1998, and 1999~2000). The author assigned each VC syndicate to one of these three spans according to the syndicate's last investment round and included the dummy variables transformed from these categorical values. In the dataset used in this study, 46.0% of the IPOs was made in the year of the last investment round and 32.8% of the IPOs in the next year.

3.5 Statistical Analyses

To predict the dichotomous dependent variable (i.e., IPO performance of a venture company), the author conducted probit analysis which estimates the probability that an observation with specific characteristics will fall into one of two categories. However, because three independent variables (i.e., capacity diversity, expertise diversity, and network diversity) were significantly correlated with the error term in the model, there might be an endogeneity problem. Therefore, the author adopted 2-stage least square approach to address this problem (Wooldridge, 2002). In particular, a lead VCF' brokerage is positively associated with diversities of the syndicate the VCF leads, because higher brokerage enables an actor to obtain more access to diverse partners (Burt, 1992). Statistically, a lead VCF' brokerage was significantly associated with the endogenous independent variables (i.e., capacity diversity, expertise diversity, and network diversity), while it was not significantly correlated with the error term in the model. Furthermore, all the models presented significant endogeneity at the level of 95% in the Wald test of exogeneity (Wooldridge, 2002). Thus, the author included a lead VCF' brokerage as the instrument in the 2SLS models. The analyses were conducted by using the ivprobit command of the statistical package Stata 11.

IV. Results

Table 1 presents the descriptive statistics variables. It shows mean, standard deviation, 25th value, median, and 75th value of each variable. Table 2 presents correlations of the variables. To assess the potential threat of collinearity, the author estimated the variance inflation factors (VIFs) and found that no variable had a VIF greater than 9.63. These were below the commonly used critical value of 10 (Aiken and West, 1991) and the average VIF of the variables was 2.95.

Table 3 presents the results of the analyses. First, Model 1 is the base probit model only with control variables. This model shows that a lead VCF's foreignness, the amount of invested money, the length of investment, and the number of VCFs sig-

nificantly increase IPO success rate at the .01 level. The model also presents negative effects of a lead VCF's brokerage, the number of investment rounds, and the period from 1999 to 2000 on the rate at the .01 or .05 level.

Table 1
Descriptive Statistics[a]

Variable	Mean	s.d.	Minimum	25th	Median	75th	Maximum
1. IPO Performance	0.17	0.38	0.00	0.00	0.00	0.00	1.00
2. Capacity Diversity	0.00	1.00	-2.58	-0.74	0.15	0.70	2.71
3. Expertise Diversity	0.00	1.00	-3.03	-0.62	0.21	0.76	1.91
4. Network Diversity	0.00	1.00	-2.78	-0.60	0.10	0.69	2.25
5. Lead VCF's Reputation	0.08	0.97	-4.27	0.00	0.00	0.00	1.69
6. # of Participating VCFs	0.56	1.22	-0.69	-0.34	0.01	1.06	6.31
7. # of Corporate VCFs	0.22	1.20	-0.49	-0.49	-0.49	0.59	8.15
8. # of Institutional VCFs	0.05	1.15	-0.53	-0.53	-0.53	0.95	8.33
9. Lead VCF's Foreignness Dummy	0.09	0.29	0.00	0.00	0.00	0.00	1.00
10. Lead VCF's Power Centrality	0.35	0.80	-3.14	-0.17	0.54	0.92	1.62
11. Lead VCF's Brokerage	0.41	0.85	-2.04	-0.17	0.58	1.07	1.93
12. Invested Money	0.47	0.84	-3.35	-0.03	0.53	1.07	2.85
13. Length of Investment	0.48	1.13	-0.73	-0.33	0.11	1.07	6.61
14. Investment Rounds	0.55	1.11	-0.79	-0.16	0.47	1.10	7.38
15. Investment in California	0.44	0.50	0.00	0.00	0.00	1.00	1.00
16. Period Dummy (1995~1998)	0.27	0.44	0.00	0.00	0.00	1.00	1.00
17. Period Dummy (1999~2000)	0.65	0.48	0.00	0.00	1.00	1.00	1.00

a. The values were obtained after standardization.

Table 2
Correlations[a]

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. IPO Performance																
2. Capacity Diversity	0.15															
3. Expertise Diversity	0.14	0.00														
4. Network Diversity	0.08	0.00	0.00													
5. Lead VCF's Reputation	0.03	0.06	0.14	-0.11												
6. # of Participating VCFs	0.25	0.54	0.48	0.19	0.15											
7. # of Corporate VCFs	0.13	0.25	0.27	0.20	-0.01	0.55										
8. # of Institutional VCFs	0.10	0.26	0.31	0.18	0.07	0.56	0.22									
9. Lead VCF's Foreignness Dummy	0.07	-0.16	-0.03	0.10	-0.14	-0.12	-0.04	-0.02								
10. Lead VCF's Power Centrality	0.03	0.09	0.18	-0.10	0.83	0.19	0.06	0.09	-0.12							
11. Lead VCF's Brokerage	-0.01	0.12	0.16	-0.14	0.75	0.20	0.08	0.07	-0.12	0.92						
12. Invested Money	0.17	0.39	0.42	0.10	0.18	0.63	0.39	0.36	-0.11	0.23	0.26					
13. Length of Investment	0.21	0.23	0.16	0.15	0.02	0.35	0.09	0.18	0.02	-0.02	-0.07	0.23				
14. Investment Rounds	0.17	0.35	0.24	0.11	0.06	0.50	0.19	0.26	-0.08	0.07	0.04	0.39	0.73			
15. Investment in California	-0.02	0.09	0.01	-0.08	0.21	0.11	0.06	-0.01	-0.21	0.22	0.23	0.10	-0.01	0.04		
16. Period Dummy (1995~1998)	0.09	-0.11	-0.03	-0.07	0.08	-0.09	-0.15	-0.08	-0.07	0.07	0.00	-0.20	0.06	0.08	0.01	
17. Period Dummy (1999~2000)	-0.11	0.12	0.05	0.14	-0.14	0.13	0.22	0.12	0.09	-0.11	-0.03	0.33	-0.02	-0.06	-0.06	-0.83

a. n = 1,127. Correlations above |.06| are significant at the .05 level.

Table 3
Probit Estimates of IPO Performance[a, b]

Variables	Model 1 (probit)	Model 2 (ivprobit)	Model 3 (ivprobit)	Model 4 (ivprobit)
Control				
# of Participating VCFs	0.24(0.06)**	0.58(0.05)**	-0.21(0.10)*	0.12(0.08)
# of Corporate VC	0.04(0.04)	-0.06(0.04)†	0.00(0.04)	-0.06(0.05)
# of Institutional VC	-0.07(0.05)	-0.10(0.03)**	-0.08(0.04)*	-0.11(0.04)**
Lead VCF's Foreignness	0.57(0.16)**	-0.14(0.23)	0.07(0.21)	0.25(0.21)
Lead VCF's Power Centrality	0.25(0.16)	-0.06(0.05)	-0.12(0.04)**	0.03(0.07)
Lead VCF's Brokerage[c]	-0.34(0.15)**			
Invested Money	0.37(0.09)**	0.18(0.10)†	-0.17(0.14)	0.32(0.09)**
Length of Investment	0.25(0.06)**	0.05(0.08)	0.08(0.08)	0.12(0.08)
Investment Rounds	-0.17(0.07)**	0.07(0.08)	-0.02(0.07)	-0.10(0.07)
Investment in California	-0.11(0.10)	-0.02(0.08)	0.08(0.08)	-0.03(0.10)
Period Dummy (1995~1998)	-0.23(0.18)	-0.24(0.13)†	0.04(0.15)	-0.31(0.16)†
Period Dummy (1999~2000)	-0.89(0.19)**	-0.27(0.28)	-0.06(0.30)	-0.93(0.19)**
Predictor				
Capacity Diversity		-1.10(0.15)**		
Expertise Diversity			1.10(0.12)**	
Network Diversity				0.73(0.20)**
n	1,127	1,127	1,127	1,127
LR χ^2	144.96			
Wald χ^2		822.44	986.34	265.64
Log-likelihood	-445.11	-1,815.68	-1,866.46	-1,971.93

a. Standard errors are reported in parentheses.
b. † $p < .10$, * $p < .05$, ** $p < .01$.
c. Included as an instrumental variable in Model 2~Model 4.

Models 2~4 include each diversity as an independent variable in addition to the controls in Model 1. As mentioned above, the author adopted 2SLS approach because three types of diversity are endogenous independent variables. Model 2 shows that capacity diversity significantly decrease IPO success rate ($p < .01$), lending strong support to Hypothesis 1. On the contrary, Model 3 and Model 4 indicate that expertise diversity and network diversity increase IPO success rate, as predicted in Hypothesis 2 and Hypothesis 3. The findings also provide strong support to these hypotheses ($p < .01$). The findings also provide strong support to these hypotheses ($p < .01$).

V. Discussion and Conclusions

This study addressed an organizational syndicate's performance which is affected by the characteristics of the syndicate's members. More specifically, the study inves-

tigated the relationship between VC syndicate diversity and the syndicate's performance. The author showed that VC firms maintain three distinct types of diversity in their syndicate (i.e., diversity in capacity, expertise, and network) by conducting a confirmatory factor analysis of 1,127 VC syndicate investments. Then, in 2SLS approach with probit analyses, the author demonstrated that capacity diversity decreases the performance and that expertise diversity and network diversity increase it. This result confirms that three types of diversity is differentiated within a VC syndicate and that their effects on performance vary according to the type.

As an additional test, the author analyzed a lead VCF reputation's diversity's effect. A lead VCF plays a critical role in the syndicate performance (Gorman and Sahlman, 1989). Also, reputation has been shown as a meaningful determinant of VCF performance (e.g., Nahata, 2008; Wuebker, Hampl,

and Wuestenhagen, 2015). By the way, a lead VCF's reputation can affect, not only the syndicate performance, but also the relationship between syndicate diversity and performance. However, as distinct types of syndicate diversity affect performance differently, the interaction between a lead VCF's reputation and diversity will differ according to the type of diversity. Thus, the author investigated each moderating effect of a lead VCF's reputation on three types of diversity: capacity, expertise, and network. The results showed that the negative effect of capacity diversity on IPO success is reduced by a lead VCF's reputation and that the positive effect of network diversity on IPO success diminishes as a lead VCF's reputation increases.[4]

This study makes two primary contributions. First, this study extends the understanding of VC by suggesting meaningful determinants of VC syndicate performance. More specifically, VC syndicate diversity was demonstrated as determinants of the performance. Second, it represents a step forward in research on diversity and its effect on performance. This study examined three types of diversity that VCFs maintain in their syndicate and their distinct effects on performance. The results demonstrated that diverse VCFs in capacity tend to obtain lower performance, while diverse VCFs in expertise and network obtain higher one.

In terms of managerial implications, this study can be useful to VCFs. First, managers in a lead VCF are able to understand what kinds of VCFs should be invited. They can encourage non-lead VCFs that are diverse in terms of expertise and network position to join the syndicate, while they avoid inviting non-lead VCFs that are diverse in terms of capacity. Second, this study also provides a useful reference to managers in a non-lead VCF. For example, if they consider to join a VC syndicate composed of diverse members, they will be able to examine the types of diversity the syndicate maintains through

the result of this study. Then, they can expect higher performance by choosing a diverse syndicate in expertise and network position and by avoiding a diverse syndicate in capacity. In conclusion, through the findings of this study, managers in both lead VCFs and non-lead VCFs are able to make better decisions. In addition, through this study, both managers of an entrepreneurial company and potential investors can learn about the importance of a VC syndicate's diversity as a determinant of performance and take advantage of this study as a useful guide in their decision making.

This study has several limitations. First, the sample size was reduced because of missing values, particularly, of lead VCFs. Thus, the final sample might be biased, because some syndicates which have not obtained decent performance may intend to conceal their investment failures. Second, the time frame in this study did not include the recent VC syndication after 2010. However, reflecting the 10-year window for identifying venture companies'success in IPO is essential (Guler, 2007), future studies will be able to address in the period. Nevertheless, this study provides several meaningful opportunities for future research. First of all, VC syndication is a theme which has been less explored in the entrepreneurship research. Although this study focused on diversity of a VC syndicate and its effects on performance, other factors of a syndicate wait for more investigation. In particular, processes of a VC syndicate is not yet clearly understood. Future studies will help us understand them if they address these questions: How a VC syndicate is formed and operated? What are decision making processes within a VC syndicate? What are effects of a syndicate member change on performance? Second, the analysis results imply that the type of VCFs may be another critical predictor of syndicate performance. Will corporate VCFs increase the performance? Will syndicate members affiliated with a financial institution increase the performance? What will be a desirable potion among various types of

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4) Further details are available upon request.

VCFs? Answering these questions will bring valuable insights to entrepreneurship researchers. In addition, other characteristics of a lead VCF and their effects on performance will be another research topics which need to be addressed. Size, type, expertise, nationality, and experience, and social status will be meaningful determinants of its syndicate performance. In conclusion, further studies on all these issues will bring better understanding to entrepreneurship researchers.

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벤처 캐피탈 신디케이트의 다양성: 세 가지 범주와 성과에 미치는 영향

신 상 윤*

본 연구는 벤처캐피탈 신디케이트의 다양성과 그 신디케이트가 지원하는 벤처 기업의 IPO 사이의 관계에 대해 조사하였다. 구체적으로는 Harrison and Klein의 다양성에 대한 세 가지 분류(Separation, Variety, and Disparity)를 기반으로 하여, 벤처캐피탈 신디케이트에 적용되는 세 가지 종류의 다양성(Capacity diversity, Expertise diversity, Network diversity)을 제시한 뒤, 각 다양성이 성과에 미치는 효과를 분석하였다. 이를 검증하기 위하여 6,268개의 벤처캐피탈에 의한 1,127건의 벤처캐피탈 신디케이트 투자를 2단계 최소 자승법을 통하여 분석 한 결과, 제시된 가설 모두를 유의미하게 지지하는 것으로 나타났다. 세 다양성 중에서, Capacity다양성의 경우 성과를 감소시키지만, Expertise 다양성과 Network 다양성은 성과를 향상시키는 것으로 드러났다.

주제어 : 벤처캐피탈 신디케이션 다양성 기업공개(IPO)

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