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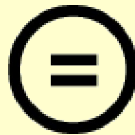
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경영학석사학위논문

**The Effect of Venture Capital Equity Concentration
on the Investment Performance**

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ABSTRACT

This paper explores the effect of equity concentration among venture capital syndicate members on the investment performance. While the importance of equity split on the early stage of a venture firm is widely perceived among business practitioners, the effect of the level of equal/unequal distribution of equity shares, particularly among venture capital syndicate members, has not been empirically explored. Drawing on theories of power and hierarchy, I propose that the higher level of equity concentration will have a negative effect on the investment performance. I also hypothesize that familiarity among syndicate members and being in a later investment stage will moderate the negative effect of equity concentration. I find strong empirical support for the hypotheses.

Keywords

Equity concentration, Venture capital, Power, Hierarchy, Start-up, Time-to-exit

INTRODUCTION

How equity should be split among founders and early investors of a start-up company has been actively discussed from the perspectives of business practitioners (Deeb, 2014; Zwillling, 2010; Wasserman & Hellman, 2016). However, the subject has rarely been explored in the academic literature because of several reasons. The main reason seems to be the lack of appropriate data. The only study, insofar as I know, about the effect of equity split on the performance of firms was conducted using a private dataset that is difficult to access through typical channels (Hellman & Wasserman, 2011). The study examined whether equal equity split among founders has a positive or negative performance impact on performance. The surprising thing is, while data about venture capitalists' activities is more readily available than that about founders, no one has conducted similar research about equity of venture capital investors.

One possible reason is that the equality/inequality of equity split among outside investors was not regarded as important. However, in the context of start-up businesses, the role of early investors and venture capitalists can be as huge as that of founders. Many venture capitalists perform the role of an incubator, board of director, and external monitor in the small and amorphous companies in which they invested (Lerner, Hardyman, & Leamon, 2012). Their power of control over a company can be determined by the share of equity (Ma, Rhee, & Yang, 2013); if equities are unequally distributed among investors, it can mean that power is unequally distributed among them.

Previous studies have shown that while the unequal distribution – or concentration – of power in an organization leads to greater speed, it can possibly sacrifice the benefits from broader search abilities enabled by the equal distribution of power (Siggelkow & Rivkin,

2005; Mihm, Loch, Wilkinson, & Huberman, 2010). Another stream of research about hierarchy has suggested that the higher level of hierarchy – which can be interpreted as similar to the unequal distribution of power – in an organization might be either beneficial or harmful, depending on the contexts (Anderson & Brown, 2010). One of the main contingencies is the presence of rapid change in the external environment; in the rapidly changing environment, organizations with less hierarchical structures might benefit, and vice versa in the relatively stable environment.

Using VentureXpert data provided by Thomson Reuter, I proposed several hypotheses to predict the effect of the level of concentration of equity shares among venture investors on the performance of the invested venture firm. First, I hypothesized that more concentrated equity structure among investors might have a negative effect on the firm performance. It is because previous studies found that in the rapidly changing environment, the effect tends to be observed in that way (Shaw, 1964). Start-ups are unquestionably under the highest level of uncertainty and rapid change, so I assumed the effect here will be observed the same way. Second, I proposed that higher familiarity among investors might reduce the level of uncertainty and the severity of potential power struggle, so it will mitigate the negative effect of concentration of equity shares. Finally, I also assumed that start-ups in later investment stages might face less turbulence and uncertainty than those in early stages, so the factor would also diminish the negative effect of equity concentration. The empirical test of these hypotheses proved that they are all supported.

As a result, this study has two main contributions. First, it can contribute to the debate about the effect of power inequality and hierarchy in organizations. While many studies in this field have focused on more mature, established organizations, this study's focus on start-up firms can make a new contribution by providing an empirical observation

on organizations with the highest level of uncertainty and change. Also, it has an important implication on the business practice of equity split. This field of research is relatively new, and this study might usher in a great number of future studies.

THEORY AND HYPOTHESES

How should equity be split? This is principally an economic question that surrounds the distribution of profits, the assessment of each participant's contribution to the potential profit of a firm, the adjustment of conflicted interests and the ultimate "who gets what" decisions. However, equity and ownership are also closely associated with organizational processes such as decision making authority, networking, and goal-setting (Hillman & Dalziel, 2003; Katila, Rosenberger, & Eisenhardt, 2008; Lincoln, Gerlach, & Takahashi, 1992; Palmer & Barber, 2001). Ownership structure may influence various aspects of organizational lives because having ownership "means of possessing a resource and therefore controlling it" (Pfeffer & Salancik, 1978: 48). Ownership is also a source of legitimate power (French & Raven, 1959) that involves the acknowledgement of the rightfulness of claims on resources and control over them (Kronman, 1983). In corporate governance, people with equity ownership not only have the right to claim their share of returns, but also have a voice in setting the direction of their firm.

As we consider power in the organizational context, one of the most important questions is how we should distribute power in the design of an organization (Mintzberg, 1979; Mintzberg, 1983). It is rarely distributed equally among employees, group members, or participants in a project in the real-world situations. Companies designate leaders, who are given control over decision making of a unit and the right to direct other members' activities (Bales, Strodtbeck, Mills, & Roseborough, 1951; Keltner, Gruenfeld, & Anderson,

2003; Van Vugt, Hogan, & Kaiser, 2008). The unequally distributed, concentrated power is believed to help facilitate more efficient decision making avoid conflicts (Cartwright & Zander, 1953; Levine & Moreland, 1990). By allocating different levels of authority and responsibilities to different members, groups can coordinate people's opinions and behaviors so that it can minimize internal conflicts (Blau & Scott, 1962; Hinsz, Tindale, & Vollrath, 1997; Cartwright & Zander, 1953). On the other hand, a group of researchers illustrate that this positive function of unequal distribution does not always dominate. The effect is contingent on a number of factors (Pugh, Hickson, Hinings, & Turner, 1969; Galbraith, 1973) and might be counterbalanced with the loss of diversity of opinions and information that can also be a driver of higher performance (Reagans & Zuckerman, 2001).

Speed and Search

One of the most important contingencies on which the effect of distribution of power depends is the degree of turbulence and complexity in the environment (Burns & Stalker, 1961; Duncan 1973; Hall & Tolbert, 2005; Chandler, 1962; Argyris, 1964; Katz & Kahn, 1966). Historically, rapid technological change, globalization and the development of information technology are thought to have driven the changes in organizational forms that emphasize the role of networks, lateral communication, and less hierarchies rather than a traditional bureaucracy (Ghoshal & Bartlett, 1990; Denison, Hart, & Kahn, 1996). The shortening product-development cycle and intensified competition caused by globalization greatly increased the degree of turbulence companies face, thereby forcing them to embrace new organization forms that fasten the decision making process (D'Aveni 1994; Hamel and Prahalad 1994). Also, the convergence of industries caused by technological developments pressured companies to face more complex environment (Drucker, 1988; Sanchez and Mahoney, 1996).

Despite this general tendency of transition into more decentralized and lateral organization forms, centralized power and information still remains the essential feature of modern organizations. Some previous work provided the framework to understand the benefit and disadvantage of centralized structures. According to Siggelkow and Rivkin (2005), turbulent environments require companies to adapt to it in a more speedy way; while the complexity of the environments drives companies to expand their breadth of search. Whereas this study does not provide a general evidence of how centralized or decentralized organizations increase the speed and breadth of search, based on previous literature, we can conjecture that speed may be facilitated in a more centralized setting as opposed to the breadth of search that might benefit from the diversity and lateral communication of a more decentralized group.

A subsequent study clarifies the trade-off between speeding up problem solving and broadening search efforts (Mihm, Loch, Wilkinson, & Huberman, 2010). A hierarchical structure with a centralized decision making process can benefit from higher speed, but might sacrifice the solution quality by failing to enhance the breadth of search. This study, in contrast to Siggelkow and Rivkin (2005) which modelled only two layers of a CEO and employees, models a multiple layer of ranks comprising of a CEO, middle management, front-line management, and front-line problem-solving workers. The analyses show that while there is a clear incentive of hierarchical structure in boosting the speed, some authority should be delegated to the front-line managers at the bottom line to expand the search efforts. This shows that balancing of speed and search is important in the context of formal organizations.

Hierarchy

While the two previous studies on speed and search utilize the computational simulation methods to explore the dynamics of group structure, a large body of research on hierarchy within organizations has produced empirical findings about the subject. As *hierarchy* – “a rank ordering of individuals along one or more socially important dimensions” (Anderson & Brown, 2010) – comes in many different forms, research on hierarchy also has been conducted in many different ways. The first group of hierarchy research takes on the form of experimental studies. For example, in a laboratory setting, several groups of people are given the same set of problems and different intra-group communication structures. While one group is organized to form a “wheel” structure allowing only one person – the leader – to communicate with all the other group members, all the participants in another group are permitted to communicate with each other. Whereas the former represents a more concentrated or hierarchical structure, the latter is considered a rather flatter or lateral structure. According to Shaw (1964), these laboratory studies have shown a mixed result in terms of whether more hierarchical group shows a better performance. The key contingency was the complexity of the task: the more complex the task, the more hierarchical groups tended to bring a better performance.

In addition to the laboratory studies, many scholars have conducted research in a variety of empirical settings to examine the effect of steeper hierarchy on the performance of organizations. As with the results of experimental research, empirical studies have barely shown clear relationships between the level of hierarchy and the performance. In a study that regarded hierarchy as the number of ranks in formal organizations settings, no significant positive relationship between the steepness of hierarchy and performance outcomes was found (Ronan & Prien, 1973). Likewise, other studies that focused on the number of ranks in an organization did not find relevant evidence that more hierarchical

organizations produce better performance outcomes in terms of research productivity, profitability, or return on equity (Meltzer & Salter, 1962; Leonard, 1990). Furthermore, some studies that analyzed the effect of the level of centralization on the performance of a firm even found that more centralization might result in worsening the performance rather than improving it (Tannenbaum, 1961; Ivancevich and Donnelly, 1975; Ouchi, 2006).

Several of more recent studies have focused on the informal structure of hierarchy within groups instead of formal structures. One study examined how status, which is an informal type of power held by individuals or organizations, affects the breadth of search efforts (Perretti & Negro, 2006). It revealed that team members with different status and one- and three-layer organizations are associated with better exploration outcomes, as opposed to middle-status members and two-layer structures. Other studies have pointed out additional contingencies that might influence the effect of hierarchy on the performance of a firm besides factors such as complexity or the level of turbulence in an environment. For example, one recent study showed that the clarity of the informal hierarchy within the board of a firm might facilitate the smooth interactions among board members and affect the effect of the hierarchical structure (He & Huang, 2011). Also, another study examined the possibility of defining the concept of hierarchy in association with network properties such as acyclicity, rather than power or status (Bunderson, Van der Vegt, Cantimur, & Rink, 2015).

Although many scholars endeavored to clarify the mechanism by which power structure and hierarchy affects organization performances, there are several limitations in each stream of research described above. First, some research has focused only on the influence of formal structures of groups of firms. Research based on computational simulation solely dealt with the conditions of formal characteristics of organization

structures such as the number of ranks, decision making authority, and the official communication channels (Siggelkow & Rivkin, 2005; Mihm et al., 2010). Also, experimental studies on the effects of organizational hierarchy set formal rules of communication among participants and observe their behavior under carefully manipulated environments (Carzo & Yanouzas, 1969; Maier & Solem, 1952). While the formal structure of organizations have very important influence on the functioning of groups, more diverse forms of informal hierarchical structures need to be examined to fully understand the mechanism of the distribution of power.

Second, while there is an emerging body of research exploring the impact of informal power and hierarchy structure of firms (He & Huang, 2011; Peretti & Negro, 2006), one potential source of it, ownership, has not been extensively studied in the organization theory literature. Whereas the formal structure is important in determining how power is distributed among members of a large organization, the informal structure is often more important in a smaller setting such as a team, board of directors, and venture investors. In the case of a small number of people setting the direction of an organization such as board of directors, ownership can be a very important source of power and legitimacy as discussed above (Pfeffer & Salancik, 1978). However, insofar as I know, there have been few attempts to explore how distribution of ownership can influence the performance except for an example such as Ma, Rhee, & Yang's (2013) work.

Finally, most of the empirical studies about this subject have been conducted in the context of large, established organizations. Although there have been a variety of research studying the influence of power and hierarchy in multiple situations such as a large manufacturing firm (Ronan & Prien, 1973), research organizations (Meltzer & Salter, 1962), and national non-profit organizations (Tannenbaum, 1961), few studies empirically tested

the influence of power and hierarchy in the context of newly founded organizations. This is surprising considering the importance of the start-up economy in the contemporary business environments. While it can be easily understood that factors such as power and hierarchy are rather ‘bureaucratic’ and are rarely discovered in the world of start-ups and new, young organizations, it is not true because they are a sort of human group and not free from the issues such as power struggle. To examine this unexplored question and fill the research gap, this study attempts to conduct an empirical testing in the context of start-up companies and venture capitalists investing in them.

Start-up and Venture Capital Context

Venture capitals (VC), the financial institutions that invest in start-ups in their nascent stages, perform many functions beyond the typical role of investors in more mature and established companies (Bygrave & Timmons, 1992). They help their portfolio companies set a strategic goal, create networks, direct marketing and customer relations, and supervise the direction of their invested companies. (Hsu, 2004; Podolny, 2001) Their purpose is to the ventures’ successful exit, which often indicates either initial public offering (IPO) or acquisition by another company. (Stuart, Hoang, & Hybels, 1999). VCs often form syndicates with other VC firms to raise capital, reduce risks, and obtain different type of expertise (Sorenson & Stuart, 2001).

As with founders sometimes having difficulties in creating a consensus, coordination among VC investors can be challenging (Ring & Van de Ven, 1992). The conflict can sometimes be severe when there is a conflict of interest or conflicting opinions about the direction and profitability of the invested firm (Ma et al., 2013). VC syndicates can have group problems like any other form of organization (Chahine et al., 2012), and

considering their influence in the guidance of a start-up firm, their group problems are highly likely to be translated into the invested firm's problem (Gompers, Kovner, Lerner, & Scharfstein, 2008).

Most previous studies assume that VC investors can coordinate their behaviors under a financial contract (Chahine et al., 2012; Gompers & Lerner, 1999). Financial contracts between VC firms are often very sophisticated and well-documented in delineating the role and responsibility of syndicate members, particularly about equity shares (French & Raven, 1959; Lerner et al., 2012). However, as any form of formal contract cannot cover and prevent every potential problem, financial contracts and ownership structure defined in them cannot prevent all the problems that might arise from disagreements, conflicting opinions, and even power struggle among VC syndicate members (Guler, 2007; Ma et al., 2013).

Although ownership does not always coordinate behaviors in concert, it is a major source of power for members on a board of a company. The equality or concentration of equity shares among investors can be interpreted as the equality or concentration of power in decision making process in a company. However, how the distribution of power affects firms' performance in a start-up setting has rarely been explored. One notable exception is Hellmann and Wassermann (2011) studying the effect of the division of founder equity in new ventures. In this study, they suggest that founders trade off the simplicity of accepting an equal split, with the costs of negotiating a differentiated allocation of founder equity. They show that equal splitting is associated with lower pre-money valuations in first financing rounds. Their study also suggests that this effect is more prominent in teams that make quick decisions about founder share allocations. However, any similar research in the context of venture capital has not been conducted in the academic literature thus far.

Drawing on the previous studies that emphasized the contingency in which rapid environmental change worsens the effect of concentrated power or hierarchical structure, I deduct:

Hypothesis 1: The concentration of equity among investors will negatively affect the exit performance of venture firms.

While I assume the negative effect of the concentrated equity structure, I suggest that familiarity among syndicate members rising from past experience might moderate the negative main effect of equity concentration. Relationships that are built on the repeated, shared interactions between organizations can generate trust and expected codes of behavior (Ring & Van de Van, 1994). Studies show that once trust is established between exchange partners, it can lead the partners to exchange repeatedly with the same partners because they have better information about partners' dispositions and motives (Cook and Emerson, 1978; Kramer, 1999). Venture capitalists frequently agree with this perspective, and past collaboration experience between two VC firms is often used as a proxy for network ties between the firms (Sorenson & Stuart, 2001).

This increased sense of trust among syndicate members can reduce uncertainty surrounding the financial contract, which can lead to the mitigation of the uncertainty originating from the rapid environmental changes in a start-up setting. Also, it can reduce the severity of potential power struggles among investors, which might enhance the interaction and coordination among decision makers on the board. Therefore, I assume that familiarity moderates the negative effect of equity concentration on the investment performance. I hypothesize:

Hypothesis 2: Greater familiarity among VC syndicate members will diminish the negative effect of equity concentration.

Since the effect of concentrated equity is assumed to be dependent upon the degree of uncertainty in the environment, reduced uncertainty can be a factor which mitigates the presumably negative effect of equity concentration. In the life cycle of a start-up, the company faces different degree of uncertainty on different phase of its growth. For instance, start-ups in its earlier stages are typically considered to be a high-risk investment among venture capitalists (Ma et al., 2013). On the other hand, investment funds of venture capital and private equity firms tend to focus on later-stage start-ups, which are thought to prove its business model and profitability to certain extent.

Accordingly, I can presume that being at a later-stage will reduce the degree of uncertainty surrounding a focal start-up company. This can mitigate the negative effect of equity concentration caused by rapidly changing external environments. In my dataset, information on six investment stages is provided: seed/startup, early stage, expanding stage, later stage, buy-out/acquisition, unidentified other stage. Following Dali et al.(2013), I rearrange this information as two stages: seed/startup, early stage, and expanding stage as comparatively earlier stages; and later stage, buy-out/acquisition and unidentified other stage as later stages. In this later stage, start-ups companies become more mature to provide an opportunity to reduce uncertainty and harvest investments.

Hypothesis 3: Venture firms being on a later stage will diminish the negative effect of equity concentration because of reduced uncertainty.

METHODS

Sample

To investigate the effect of equity concentration on the performance of start-up firms, I constructed a panel of global venture firms during the period 1975-2016. The sample is collected from VentureXpert, which is now owned by Thomson Reuter. The data source provides comprehensive information including the founding date, investors, IPO, industry, region of a single venture firm. I used the whole set of data available from VentureXpert to avoid potential biases. The sample thus covers all the industries, regions, and time periods contained in the data source. VentureXpert has been widely used in various forms of start-up/venture capital research (Podolny, 2001; Sorenson & Stuart, 2001, 2008; Dushnitsky & Lenox, 2006; Petkova, Wadhwa, Yao, and Jain, 2014). Although it is difficult to claim that it is a perfect database for studying start-ups and venture capital firms, it is still one of the most comprehensive and up-to-date databases on their activities.

The window of observation spans a period of time from 1975 through 2016. The initial sample with proper investor information consists of around 100,000 observations across industries and countries. Since I was focusing on measuring the equity concentration among investors, I excluded from the sample venture companies with only a single investor. The final sample consists of 30,108 observations after excluding those companies and deleting other various types of erroneous observations (e.g. Herfindahl-Hirschman Index exceeding 10,000; the founding date greater than the date of first investment). Comparisons of exit performance of companies that are included in the final sample and those that are not suggests no significant statistical difference between the two groups of observations.

Dependent Variables

The goal of venture capitalists and other investors involved in financing a start-up company is to make money by liquidating their stakes at a higher valuation. There are generally two ways of achieving this. The most prominent and profitable one is often the initial public offering (IPO), in which the start-up goes public and sells shares in the stock market (Gompers and Lerner, 2001). Also, stakes in a company can be liquidated by being acquired by another – typically larger and more established – company. When venture capitalists, investors, and even start-up founders refer to *exit*, it typically means these two events. Previous studies on venture capital and start-up businesses also use this definition (Gompers and Lerner, 2000; Hochberg, Ljungqvist & Lu, 2007; Ma et al., 2012).

The exit performance of a start-up company can be measured in three ways theoretically. First, we can simply determine whether a company made an exit by going public or being acquired. The dependent variable will take a binary form and the logit or probit model can be applied to analyze this type of dataset. Second, we can measure how long it has taken for a company to make an exit. Since the life span of a typical venture capital fund is 10 years (Lerner, Hardyman & Leamon, 2012) and thus the venture investments are under some practical time pressure, time-to-IPO or merger and acquisitions (M&A) can represent the effectiveness of a venture investment. The shorter the time-to-exit, the better the performance of a certain start-up can be assessed. The final way to calculate the exit performance of a firm is to measure the return of a certain investment. Direct as it might be, the amount of return from investments is normally kept secret by companies and there is no existing database providing this information. Consequently, scholars have frequently been using time-to-exit to study the performance of start-ups (Stuart, Hoang & Hybels, 1999; Hochberg et al., 2007; Ma et al., 2012). Following previous studies, I

measured time-to-IPO and time-to-M&A as a proxy for the start-up performance and combined the two variables into one dependent variable, time-to-exit.

To measure time-to-IPO and time-to-M&A, I subtracted the date of the first investment into a company from the date of IPO and that of acquisition, respectively. The difference was then converted into the time unit of month. I also conducted an analysis to examine whether there is a difference between the impact of independent variables on the event of IPO and that of acquisition. The two impacts did not differ significantly ($t = 0.15$, $p = 0.8$), allowing for combining the two variables into a single dependent variable in this study.

Independent Variables

Concentration of venture capital equity

To examine the main effect of the degree of concentration of equity among venture capitals on the exit performance of the start-up supported by them, I operationalized the independent variable as Herfindahl-Hirschman Index, a widely used measure of market concentration. In the context of industrial economics, it is normally defined as the sum of the squares of the market shares of firms within an industry. Despite its economic origin, it is now widely used as the measure of concentration in many other contexts. It can be exploited to measure the geographic variety of a firm's research efforts (Ahuja, 2000), the generality and originality of a patented innovation (Hall, Jaffe & Trajtenberg, 2001), and the functional heterogeneity of a team (Hambrick, Cho & Chen, 1996). Consistent with these previous studies, I calculate the concentration of equity as the sum of the squares of the equity shares owned by each investor.

Familiarity

I measured familiarity using the number of dyadic ties among all of the venture capital firms participating in an investment in the previous five years (Gulati & Garigiulo, 1999; Gulati, 1995; Ma et al., 2012). The five-year window is generally accepted as the criteria for determining whether two firm is familiar with each other or not – because “if two firms have not coinvested within a five-year period, it seems unlikely that their members remain close confidants” (Sorenson and Stuart, 2001: 1568). The dyadic ties were counted based on the number of prior collaborations between two firms throughout industries. Ties between every possible pair among investors were counted and added to calculate familiarity.

Later stage

I constructed a dummy variable which is 0 when a focal start-up that received a round of investment was in an early stage at the time, and 1 when the start-up was in a later stage. I determined whether the start-up was in an early or a later stage referring to the information provided by VentureXpert. In the database, the investment stage of a company is classified into six categories. The first three categories are seed/startup, early stage, and expanding stage. The next three categories are later stage, buy-out/acquisition, and unidentified other stage. Following Ma et al.(2012) which identified the characteristics of each stage earlier than this study, I combined the six categories into a binary system.

Control variables

Several variables that might influence the exit performance of a start-up were measured and included in the regression as controls. The total amount of money invested in

a company was calculated in the logarithmic form to solve the issue of skewed distribution. Three separate variables were also included to measure the syndicate size. The number of investor firms was measured by converting the information in the column “Name of ea. Firm Invested in Company” in VentureXpert dataset. The number of funds was measured by using the column “Name of ea. Fund Invested in Company” in the same dataset. The number of rounds was calculated with the column “Round Info: Date, Disclosed Amt, Investo”. These are included in the analysis because the greater the number of investor firms, funds, or rounds, the higher potential for success a start-up receiving the investments might have.

I also controlled for the industry to which a focal start-up belongs. Some industries show the higher rate of IPO or acquisition performance because of either the industry cycle or other internal properties of the industry. For example, it takes far longer for biotechnology start-ups to go public than for IT companies due to the immense amount of capital required for research and development and the time-consuming process of clinical trials (Kenney, 1988). I initially classified industries into three categories – Information Technology, Biotechnology, and Others – utilizing the column “Company Industry Major Group” of the venture dataset. I used more narrowly segmented sub-groups to cross-check the validity of this classification, and found the same results across different grouping methods. The region of a firm was also controlled using “Company Specific World Region”. Finally, I included the decade in which a company was founded as a control variable. I also checked the result of using year variable instead of decade and found no significant difference.

Model Specification

By regarding the dependent variable as both the occurrence of and elapsed time toward the event of exit, I could apply the analytic technique of event history to this study (Allison, 1984; Eisenhardt and Schoonhoven, 1996). Accordingly, I used the Cox proportional hazard model to estimate the effect of independent variables and controls on the performance of time-to-exit (Cox, 1972). Proportional hazards model is a type of survival models, which associate the time that elapses before some event (e.g. the death of a patient taking a certain type of drug) occurs with independent covariates. Cox proportional hazard model is one of the most frequently used methods to predict the duration of certain events in business literature and social science. For instance, it can be applied to analyze the survival of a firm in a certain industry (Eggers, 2014), entry timing (Bayus and Agarwal, 2007), the time duration of innovation (Katila & Shane, 2005).

RESULTS

Table 1 presents the descriptive statistics and correlation matrix of the variables in this study. In Table 1, the three control variables related to the number of investors and investments – the number of investor firms, funds, and rounds – are highly correlated. Although this does not seem to be a severe problem considering the variance inflation factor, I performed an additional robustness check analysis to ensure reliable results. As prior studies suggest (Pollock & Rindova, 2003; Sine et al., 2005; Petkova et al., 2014), I orthogonalized the problematic variables and repeated analyses. There was no significant difference between original analyses and this version of analyses for robustness check.

— Insert Table 1 about here —

The mean of the variable ‘exit’ is 0.27, which means 27 percent of venture investments included in the sample successfully exited through either IPO or acquisition. Figure 1 shows that 9.3 percent of VC-funded start-ups go public through an initial public offering and 19.3 percent of those investments are liquidated by acquisition. Being combined, the total percentage of VC-funded start-ups that make successful exits is 27.3 percent in this sample. Whereas this may not represent the accurate exit rate of the entire population, this is broadly consistent with previously known statistics and can prove the general reliability of the sample.

— Insert Figure 1 about here —

Table 2 reports the results for the Cox proportional hazards regression conducted to examine the likelihood of exit event. In the Cox model, the coefficient of a variable greater than 1 means that there is a positive effect of the variable on the dependent variable, and the coefficient less than 1 means vice versa. Model 1 is the baseline model that only includes control variables. In model 2, I added the main effect of the degree of equity concentration among investors. The effect of the degree of equity concentration is significantly less than 1 at the 0.01 level, which means that it decreases the rate of exit, supporting Hypothesis 1b. The direction and significance of control variables in model 2 rarely change.

Model 3 added the interaction term of the degree of equity concentration and familiarity. The interaction effect is in the opposite direction of the main effect and is significant at the 0.01 level. It implies that, as Hypothesis 2 predicts, the negative impact of equity concentration on the exit performance is moderated by higher familiarity among syndicate members. Most of the control variables in Model 3 remain the same direction and significance as in earlier models, either.

In model 4, the interaction term of the degree of equity concentration and the later stage dummy is added to the model instead of familiarity. The interaction effect is also greater than 1, indicating that being in a later stage moderates the negative effects of equity concentration on time-to-exit. It is significant at the 0.05 level and consistent with Hypothesis 3. The negative main effect is weakened in companies which were funded in their later stages, and the effect of control variables remains the same.

In the final regression, I included all of the main and interaction terms in Model 5. The main effect of equity concentration remains the same and so does the interaction effect of equity concentration and familiarity among investors. However, the interaction effect of equity concentration and the later stage dummy does not remain its significance in this full model. Besides this, the results of the full model are consistent with those shown in model 3 and model 4.

— Insert Table 2 and Table 3 about here —

DISCUSSION

This study was conducted to explore the influence of the concentration of equity among venture capital investors. It tested the hypothesis that the concentration of equity has a negative effect on the time-to-exit performance of a venture company and further examined conditions in which the negative effect can be lessened. Using a dataset of start-up companies and their performances, this empirical analyses support the main and interaction hypotheses. The results show that a start-up company whose venture capital investors have more concentrated equity structure tends to have a disadvantage in time-to-exit performance, while higher familiarity among the venture capital investors and being in

a later stage at the time of investments mitigate the negative effect of concentrated equity structure. These findings have some implications for both theoretical research and business practices.

First, this study sheds new light on how distribution of power and control might work in the environment characterized by rapid changes. Whereas many studies have conducted about this subject in more mature, established organization settings, we can hardly find similar research in a more contemporary and rapidly changing area. Specifically, this study can connect the literature of business venturing and that of hierarchy and power which should be explored at the same time to fully understand how start-ups function differently than established firms. As mentioned in previous studies (Shaw, 1964), the functioning of power and hierarchy depends on contingencies such as the level of change in the external environment. This study suggests the contingency theory might be true in terms of the difference between start-ups and mature organizations.

Second, the findings have implications for business practices. The findings that unequal distribution of equity among venture investors might negatively influence the performance of a start-up company suggest a potential benefit of distributing equity as flat as possible. While Ma et al.(2013), one of a few studies that dealt with similar subject in this setting, suggested that the mismatch between ownership-based power and status-based power might lead to a negative result in a venture firm's direction, this study even suggests the uneven distribution of ownership-based power itself can have a negative impact, either. Companies can possibly benefit from distributing ownership as flat as possible and exploiting more diverse knowledge and broader search opportunities flowing from it.

Despite these potential contributions for both academic discussion and field practices, this research has an important limitation that should be considered in interpreting

and applying the implications. This study is about the effect of equity concentration of venture capital investors, not founder of the start-up firms. This should be considered because in general, equity split among founders is much more heavily discussed topic among business practitioners than that among venture capital investors. In most cases, founders have more equity than investors, and thus have more control and power struggle over the direction of a firm. The most ideal research setting should be, therefore, equity distribution among founders. Because data related to founders are very rare and could not be available for this study, I limited the research to examining the dataset of venture capital investors which is more readily accessible, and instead controlling the sample by excluding firms with too little venture capital equity shares. I hope future studies might explore the direct effect of equity distribution among founders and see whether the findings of this study hold true for founders. Only a very small amount of studies (Hellmann & Wasserman, 2011) have been conducted in this area; there might be more extensive and interesting research opportunities as the start-up economy expands and the data availability improves in the future.

Table 1. Summary statistics and correlations

Variable	Mean	S.D	2	3	4	5	6	7	8	9	10	11
1. Exit	0.27	0.45										
2. Equity concentration	6287.7	3303.3										
3. Familiarity	3.24	15.39	-0.27									
4. Stage dummy	0.45	0.50	-0.02	.05								
5. ln(total amount)	8.61	1.99	-0.22	.18	.30							
6. Non-VC affiliation	0.28	0.44	-0.11	.21	.08	.11						
7. Num. of investor firms	3.38	3.37	-0.31	.22	.13	.38	.20					
8. Num. of funds	3.88	4.32	-0.33	.19	.14	.26	.12	.84				
9. Num. of rounds	2.62	2.50	-0.11	.17	.11	.19	.15	.45	.43			
10. Decades	2.38	1.00	-0.01	.15	.03	-0.09	.14	.13	.16	.16		
11. Bio/Medical dummy	0.16	0.36	-0.13	.06	-0.01	.05	.05	.15	.14	.18	-0.03	
12. Non-high tech dummy	0.41	0.49	.13	-0.11	.23	-0.05	-0.01	-0.26	-0.25	-0.20	.03	-0.36

Figure 1. The ratio of start-ups which make exits in the sample (N=30,108)

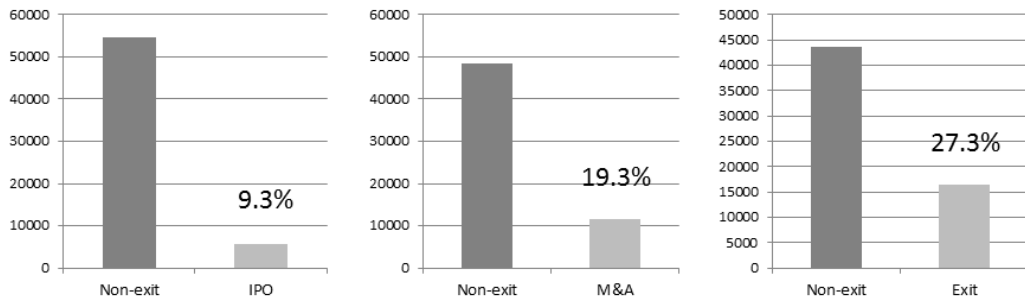


Table 2. Results of Cox proportional hazards analysis

Independent variables	Dependent variables		
	(1)	(2)	(3)
Familiarity	1.0009* (.000)	1.0014** (.000)	1.0004 (.000)
Later Stage dummy	1.125** (.020)	1.126** (.019)	1.126** (.019)
Ln(Cumulative Investment)	1.200** (.006)	1.201** (.006)	1.199** (.006)
Non-VC affiliation	.957* (.018)	.949** (.017)	.946** (.018)
Num. of investors	1.004 (.008)	.993 (.008)	.993 (.008)
Num. of funds	1.010 (.006)	1.013* (.006)	1.014* (.006)
Num. of rounds	.911** (.003)	.910** (.004)	.910** (.004)
Decades	1.390** (.014)	1.393** (.014)	1.391** (.014)
Region dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Equity concentration		.999985** (.000)	.999** (.000)
Equity concentration × Familiarity			1.000001** (.000)
Equity concentration × Later Stage			
Observations	30,108	30,108	30,108

Notes. Standard errors in parentheses. *, **: significant at the 5%, and 1% level, respectively

Table 3. Results of Cox proportional hazards analysis

Independent variables	Dependent variables	
	(4)	(5)
Familiarity	1.001** (.000)	1.0004 (.001)
Later Stage dummy	1.077* (.034)	1.078* (.034)
Ln(Cumulative Investment)	1.199** (.006)	1.198** (.007)
Non-VC affiliation	.949* (.018)	.946** (.017)
Num. of investors	.993 (.008)	.994 (.008)
Num. of funds	1.010* (.006)	1.014* (.006)
Num. of rounds	.911** (.004)	.910** (.004)
Decades	1.391** (.014)	1.390** (.014)
Region dummies	Yes	Yes
Industry dummies	Yes	Yes
Equity concentration	.999981** (.000)	.999982** (.000)
Equity concentration × Familiarity		1.000001** (.000)
Equity concentration × Later Stage	1.000008* (.000)	1.000008 (.000)
Observations	30,108	30,108

Notes. Standard errors in parentheses. *, **: significant at the 5%, and 1% level, respectively

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벤처 캐피탈 투자자들 간의 지분 집중도가 투자 성과에 미치는 영향

장 미 영

경영학과 경영학 전공

서울대학교 대학원

본 연구는 벤처 캐피탈 신디케이트 참여자들 사이의 지분의 집중도가 투자 성과에 미치는 영향을 연구한다. 벤처 기업의 초기 시기에서 지분을 어떻게 나누는가가 기업 실무자들 사이에서는 중요하게 인식되고 있는 반면, 지분이 균등하게/불균등하게 분배된 정도가 어떻게 영향을 미치는지, 특히 벤처 캐피탈 신디케이트 구성원들 사이의 경우에 어떻게 영향을 미치는지 경험적으로 연구된 바가 없다. 권력과 위계에 관한 기존 문헌에 기초하여, 본 연구는 높은 수준의 지분 집중도가 투자 성과에 부정적인 영향을 미칠 것이라고 예상한다. 또한, 신디케이트 멤버들 사이의 친밀도가 높거나 후반부 투자 단계에 있는 기업들의 경우에는 이러한 부정적 영향이 완화될 것이라고 예측한다. 본 연구는 위 모든 가설이 유의미하게 지지됨을 보여준다.

주요어: 지분 집중도, 벤처 캐피탈, 권력, 위계, 스타트업, 타임투엑시(Time-to-exit)