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The Role of Venture Capital Investment in Startups' Sustainable Growth and Performance: Focusing on Absorptive Capacity and Venture Capitalists' Reputation

Jihye Jeong [1], Juhee Kim [2], Hanei Son [3] and Dae-il Nam [4,*]

[1] Daedeok Venture Partners LLC, Daejeon 34126, Korea; jhjeong@dvpdvp.com
[2] Institute for Business Research and Education, Korea University, Seoul 02841, Korea; juhee421@gmail.com
[3] HEC Paris, 78350 Jouy-en-Josas, France; hanei.son@hec.edu
[4] Management Department, Korea University Business School, Seoul 02841, Korea
* Correspondence: namdaeil@korea.ac.kr; Tel.: 82-2-3290-2800

Received: 25 March 2020; Accepted: 20 April 2020; Published: 22 April 2020

Abstract: This study provides evidence on how venture capital (VC) investment affects startup firms' sustainable growth and performance. Despite the rich and abundant research on the relationship between VC investment and startup performance, there is no clear evidence about the contribution of VC investment on the performance and market value of invested firms. In order to accurately measure the impact of VC investment, this study explored how VC investment at each stage of growth affects a startup's sustainable growth and performance. Based on signaling theory and information asymmetry, this study proposed a positive link between initial-stage VC investment and a startup's growth and performance. Using a sample of 363 firms listed from 2000 to 2007, this study demonstrated that startups are sustained and perform better as they receive their VC investment at the initial stage. The level of potential absorptive capacity positively moderated this association, unlike realized absorptive capacity, which did not show significant moderating effects.

Keywords: venture capital investment; startup's sustainability; investment round; absorptive capacity; reputation

1. Introduction

Venture capital (VC) firms, which are among external startup investors, have attracted the attention of many scholars due to their influential role in the establishment of young companies [1–3]. VC firms offer not only financial investment, but also valuable intangible assets based on their experience and network [4,5]. This aspect of VC investment is critical, as young firms often lack both financial and intangible resources, including past experience and knowledge, which are necessary for them to develop their business. However, only a limited number of startup firms have been successful in attracting VC investment and the timing of receiving investments ranges from the initial stage to the later stage of startup growth [6]. From this perspective, this study investigates the effects of VC investment receipt on startup performance, focusing on the different initial invested rounds and the role of absorptive capacity, both neglected in the literature.

Extant research on VC companies has examined a wide variety of topics, such as the characteristics of invested startups, the influence of VC investment on firms [7–13], the investment process of VC companies [5,6,14,15], the relationship between VC companies and startups [2], and the investment of VC companies by stage. Despite extensive academic efforts, the impact of VC financing on firm performance is still unclear, as previous studies have shown mixed results on this topic. Some

scholars have revealed the important role of VC in the growth of startups [16–18], while others have demonstrated the insignificance of VC investment in startup performance [19,20]. There is also another stream of research that provides evidence for a negative influence of VC investment on firm performance [21–24].

In addition, several important issues regarding the relationship between VC investment and the performance of startups are still understudied. First, the literature has often overlooked the learning capacity of startups. The firms' subsequent business output after receiving external resources may vary depending on their capacity [25]. Further, how well a startup can accept and exploit new resources provided by VC companies is an important factor in determining its sustainable growth and performance [26]. That is, a startup without proper learning capacity and a well-organized internal system is not able to fully benefit from VC investment. Moreover, companies' learning capacity changes over time, as they pass through different stages of business growth [27]. Second, the intention and behavior of VC companies while investing in startups have also received little attention in the literature. In fact, VC firms can profit from their investment by either helping startups succeed or acting on an opportunistic intent. VC firms can reap their profits from startups by exit through initial public offerings (IPOs) or acquisitions [5,9]. In this case, VC companies can help startups overcome the "liability of newness" [28] by offering them actual support, such as business advice and a useful network. However, it is also possible that the interests of VC companies are not aligned with the success of the startups they finance. As startups are often obliged to disclose the core information about their business to VC companies to receive investments [29], some VC firms may intend to exploit startups' ideas and information in their own best interests [23,30]. Thus, understanding these two possible different intentions of VC companies, which are related to reputation, is a crucial requirement for examining the effects of VC investment on startup performance.

Accordingly, this study sought to identify the association between the initial VC investment in different stages and startups' sustainable growth and performance while integrating the moderating effects of absorptive capacity and the reputation of venture capitalists (hereinafter referred to as "VC reputation"). Based on the analysis of VC investment in startups at five different stages of growth, this study found evidence that the earlier a startup attracts VC investment, the better its performance will be. This research also demonstrated the moderating effect of potential absorptive capacity, which refers to a company's ability to acquire and absorb external knowledge, on the main effects.

2. Background: The Five Stages of Startup Growth

From its establishment, a firm grows through a step-by-step development process. Understanding startups' growth stages is useful for investigating how VC investment can help them remain sustained and achieve higher performance. In particular, the startups develop their businesses over five stages, which require different efforts and resources depending on their specific objectives [31–33]. As the resources acquired from VC companies also play different roles according to each stage of development, it is essential to consider in which stage the startup is while studying VC investment. For instance, different market positions determine the resources required for a startup depending on its stage of growth.

In the very first stage of startup growth—the Seed stage—the company starts only with a business idea derived from market opportunities. In this stage, however, the startups suffer from a lack of sufficient knowledge and human resources. They generally do not have a specific business plan [9,25,27] and aim to test the market with their prototype. In the second stage—the Early stage—the startups form a business plan based on their technologies and ideas. Some of them conduct a beta test of their products. Even though they do not have sales, they mostly have already identified the market demand and built the beta version of the product or service [25,27]. Next, in the Expansion stage, the startups begin to systemize their organization with credible team members. In this stage, the market responds to their products and services. The startups put their efforts into advertising and finalizing products in order to solidify their presence in the market [25,27]. Then, in the Later stage,

the startups have sales and attempt to broaden their market. Some generate profits, while others with low profitability tend to modify their products or services. In this stage, the startups usually need more financial resources to prepare for their later stage, which includes exit through IPOs and mergers and acquisitions (M&As) [25,27]. Finally, in the Exit stage, the startups enter into the processes of IPO or M&As on their own or through external support [25,27,31].

The lack of resources in each development stage becomes the motivation of startups for VC investment [32]. Therefore, the growth stage of startups is an important factor in understanding the effects of VC investment on startups.

In order to investigate the growth stage of startups, in this research, this study focused on the U.S. context for the following characteristics of the startup and VC ecosystem in U.S. First, the U.S. venture ecosystem has a wealth of capital [34]. VC's investment and fundraising has consistently increased for the past years. As a result, U.S. startups have more opportunities to receive large amount of investment from VC firms at each stage of growth. In addition, VC firms can accumulate lots of investment experience [34,35]. Hence, the startups in the U.S. can acquire both financial and intangible resources from experienced VC firms. Accordingly, focusing on the U.S. context allows the understanding of the growth stage of startups and the need for VC investment at each stage.

3. Theory and Hypotheses Development

3.1. Signaling Effects of Venture Capital Investment on Startups

In the first stage of growth, most startups face the "liability of newness" [13,36]. This causes them difficulties in attracting qualified human resources [37] and also limited external networks, which are crucial for startup development [38]. This study suggests that VC investment enables the startups to overcome this problem.

The startups obtain two types of resources from VC companies: financial and intangible resources, including experience, knowledge, and networks [39,40]. In particular, the accumulated knowledge and experience of VC firms play an important role in helping startups understand the market and commercialize their ideas [41–44]. The wealth of resources determines whether a firm can perform better than others [45]. From this resource-based view, it is possible to assume that the knowledge of VC companies, which is a valuable and collectively accumulated resource, can help the startups to achieve competitive advantage.

Moreover, VC firms are expected to be cautious in their investments and attempt to choose the startups with high growth potential [46]. In this regard, one can predict that only startups with a high potential for success attract VC investment in their initial stage. Due to the particularly high information asymmetry in the initial stage, it is difficult for startups to make their potential appealing to external investors and thus attract investments. Accordingly, receiving VC investment in the initial stage plays a significant role as a quality signal, showing that the startup has high value, which also helps it to attract more investment [47,48]. In the initial stage, the startups generally lack concrete performance to show their actual value. Therefore, the startups that have received VC investment in the initial stage can be evaluated as having the potential to achieve high performance, while those that are invested in later stages can be relatively evaluated below their actual value due to information asymmetry. Thus, this study suggests the positive effects of initial investment in the initial growth stage on startup performance.

Hypothesis 1. *The earlier startups obtain initial VC investment, the higher performance will be achieved.*

3.2. Moderating Effects of Startups' Learning Capability: Absorptive Capacity

As mentioned above, intangible assets from VC firms, such as their experience and knowledge, become valuable resources that contribute to the success and sustainability of startups [12,49–51]. In

order to generate high performance and sustain business activity, a firm needs the ability to absorb and utilize the acquired intangible assets. Scholars have explored the role of absorptive capacity, which is defined as "a firm's capability to recognize the value of new knowledge, assimilate and exploit it" based on its previous knowledge [52,53]. As a high-level capability of firms, absorptive capacity allows firms to learn from failures and rebuild other capabilities for success [54–56]. Absorptive capacity has proven to be highly useful in helping firms achieve high performance in the form of innovation, competitive advantage, and financial performance [26,52,54,57].

Depending on the definition and theoretical lens applied, the absorptive capacity process is presented differently. Absorptive capacity process is often defined as including three steps: identification, assimilation, and exploitation, following the definition of the seminal paper of Cohen and Levinthal [52]. Among the scholars who reconceptualized the process introduced by Cohen and Levinthal, Zahra and George saw absorptive capacity as a "dynamic capability pertaining to knowledge creation and utilization" and suggested four dimensions of the absorptive capacity process: acquisition, assimilation, transformation, and exploitation [54]. Acquisition is a firm's capacity to recognize and acquire external knowledge that is useful. Assimilation refers to the routines of the firm in interpreting and understanding acquired knowledge. Transformation is the capability to reform routines in order to combine existing and assimilated knowledge. Exploitation, which is built on the notion of application of knowledge, implies a capacity that allows firms to refine and develop existing competencies by integrating transformed knowledge into their operations.

Zahra and George divided these four dimensions of absorptive capacity into two components that lead to the dynamic capability of firms: potential absorptive capacity and realized absorptive capacity [54]. Potential absorptive capacity, which consists of acquisition and assimilation, refers to the capability to understand and capture new knowledge. Transformation and exploitation are labeled as "realized absorptive capacity," which is the ability to internalize and implement the absorbed knowledge. Potential absorptive capacity and realized absorptive capacity play different roles, although both are essential for enhancing performance.

Scholars pointed out the context and path-dependent characteristics of absorptive capacity as a dynamic capability of firms [54,58,59]. Absorptive capacity is dependent on a firms' prior knowledge and eventually the earlier absorptive capacity of the firms. Accordingly, the level of absorptive capacity can influence the operations of firms in the long term, as it develops over time. Based on this idea, some scholars have showed the moderating effect of absorptive capacity on the relation between entrepreneurial orientation of firms and performance [60]. In addition, it was found that the timing of capability development can affect the startups' sustainability and performance [54,61]. From this perspective, it is possible to expect that the level of absorptive capacity in each stage of startup growth may have different impacts. Therefore, firms that retain a high level of potential absorptive capacity in their initial stage would better control and build their ability to extend the scope of knowledge and technology than others. In other words, it will be more useful for firms to have the opportunity to gain this capacity through VC investment in the initial stage of growth in order to create a learning path based on it. However, firms that are invested later may benefit less from such an experience, as they already have their own learning path developed through the growth process. Thus, the startups' high potential absorptive capacity would strengthen the effects of the initial invested round on firm performance, contrary to the case of low potential absorptive capacity.

Hypothesis 2a. *If a startup with a high potential absorptive capacity receives an investment from a VC company in its initial stage, it will be associated with higher performance rather than a startup with a low potential absorptive capacity.*

Realized absorptive capacity helps firms pursue exploitation efficiency [54]. Potential absorptive capacity must be preceded so that the company develops realized absorptive capacity, as this serves for leveraging acquired knowledge in order to build a competitive advantage [54]. In other words,

realized absorptive capacity is less influential when firms have not absorbed enough knowledge to be exploited. By its definition, a firm's realized absorptive capacity is directly linked to the innovation of their internal process or product, as it targets the refinement of knowledge. Since the startups in the initial stage often do not have clear goods or a service to improve, realized absorptive capacity may have relatively weak impacts. In addition, these startups do not have cumulated experience, which becomes the basis of learning. On the other hand, the startups that have reached the later stage hold their own learning path based on repetitive routines and experience. Therefore, the realized absorptive capacity of startups is expected to have a different impact depending on the timing. This study anticipates that a high level of realized absorptive capacity in the initial stage will be related to the lower performance of startups.

Hypothesis 2b. *If a startup with a high realized absorptive capacity receives VC investment in its early stage, it will be associated with a lower performance than a startup with a lower realized absorptive capacity.*

3.3. Moderating Effects of the Reputation of VC Companies

VC companies tend to participate actively in the management and control of the business process, as they own some stock shares [15]. Through this process, they can better understand the internal information of startups, which leads to a reduction in information asymmetry [9,62]. As a result, some VC firms can benefit from the leakage of ideas and technology of startups, which is against the interests of startups [23,63–65]. However, this behavior can negatively affect the reputation of VC companies in the long term, and reputable VC firms are usually reluctant regarding such opportunistic behaviors [29]. In addition, the reputation of VC companies is based on their successful past investments; thus, when reputable VC firms decide to invest in a startup, the market can expect the startup's success. This phenomenon is further maximized in the initial stage of startup growth, in which most of the information has not yet been exposed to the market.

Therefore, when a startup receives investment from a VC firm with a high reputation, it is expected to generate high performance for two reasons. First, given the fact that it was chosen by a VC firm with a high rate of success in the past, the startup is expected to have a high probability of success. In addition, the startup can perform better, as it will be highly evaluated in the market by attracting this investment.

Hypothesis 3. *When a startup receives an investment in its initial seed stage from a VC company with a high reputation, it will be associated with a better performance rather than a startup receiving investments from a VC company with a low reputation.*

Figure 1 shows the research model that comprehends the above hypotheses.

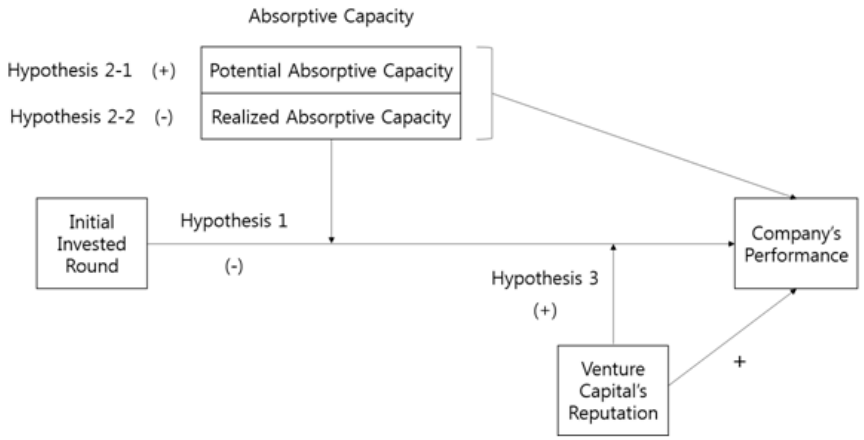

Figure 1. Research Model.

4. Method

4.1. Data

In order to test our hypotheses, 363 IPO firm data were collected from 2000 to 2007 from the United States from multiple sources. First, the data on initial investments from VC firms were collected from Thomson One. Second, Compustat data from Wharton Data Research Service (WRDS) were used to observe post-IPO performance, negotiation power, and absorptive capacity. All startups in the sample were listed and firm performance was measured through value performance via Tobin's Q instead of IPO. This helped to clarify the different performance and values of the listed startups according to the initial investment round.

4.2. Variables

Dependent variable. Simplified Tobin's Q suggested by [66] was used as the dependent variable. As suggested by James Tobin and William Brainard in 1968, Tobin's Q is the standard for determining share price properness and a numerical indication of how much profit is generated, especially in comparison with the investment amount. It is often used as an index to study investment trends. This study assessed the performance of startups by Tobin's Q in order to analyze their performance against market expectations. This allowed the observation of both the internal and external evaluation of firms. Tobin's Q is the market value of a startup divided by its net asset value. A Tobin's Q greater than 1 indicated that the market highly evaluates the startup's profitability. When it is equal to 1, the market expectation and the internal evaluation of a startup are identical. Finally, a value less than 1 implies that the startup is undervalued in the market.

Independent variable. In order to measure the initial investment, which is our independent variable, the timing of the initial investment from VC companies was classified into five stages. By using data from Thomson One, the startups that received no VC investment were indicated by 0. Then, the startups invested in the seed, early, expansion, later, and exit stages were indicated by 1 to 5, respectively.

Moderators. Extant research has used various indicators to measure a firms' absorptive capacity, such as research development costs [67], research and development intensity [52,68,69], the ratio of manpower of research and development [70], education level of the manpower of research and development [71], and firm size [68]. In this research, absorptive capacity was studied by two dimensions—potential absorptive capacity and realized absorptive capacity—according to [54]. Potential absorptive capacity was measured as the development costs up to IPO [54,67], while realized absorptive capacity was observed based on the number of patents held by the startups at the time of IPO [54].

To identify VC reputation, this study adopted as a reference the reputation index provided by [72], which is an annual measurement of the reputation of VC firms from 1990 to 2010. The index includes the average investment amount for the past five years of the participating ventures, the average number of investment funds, the number of invested firms, the investment amount, the number of the invested firms that went public, and the age of the VC firms. For VC companies under the age of five, the value was measured by including all available information.

Control variables. Control variables were also included in the analysis in order to exclude unintended effects on firm performance. The number of employees, firm age, total investment, total costs for intangible assets, leverage ratio, return on assets, and industry sector were selected as control variables.

First, the number of employees and the age of the firms are not only related to performance but also antecedents of absorptive capacity [59,73]. As the number of employees, which reflects the firm size, did not follow a normal distribution, a logarithm was used [74]. Second, the total amount of external investment is also associated with the performance of startups through firm strategy. For instance, when the startups aim for a high level of efficiency or technology, high performance can be

achieved with large investments [75]. In addition, when the startups receive more external investment, learning time and problem solving are reduced, which in turn improves performance [76]. In addition, the costs for total intangible assets, including design costs, license, and patents (WRDS), have impacts on performance [45,77], as these assets enable firms to create sustainable competitive advantages. Leverage ratio, which refers to the dependency of firms on external financing, is known to have negative impacts on financial performance [78]. It was calculated by dividing total debt by total assets in the IPO year. The fifth control variable—return on assets (ROA)—is the value of net income divided by the total assets, which implies how startups efficiently managed their capital [79,80]. Finally, the industrial sector was identified according to the four-digit Standard Industrial Classification (SIC) code, which is also an important factor in performance.

5. Results

Table 1 displays the descriptive statistics of the variables, the average, the standard deviation, and the correlation. This study ensured that the multicollinearity problem was not present, as each variable did not show a high correlation. As described in Table 1, the startups mainly received VC investments between the early and expansion stages (3.62). The average performance (Tobin's Q) of the samples (3.01) shows that the startups that receive VC investments mostly achieve a performance superior to that expected by the market.

Table 1. Descriptive Statistics.

	Model 1		Model 2		Model 3		Model 4		Model 5	
Variables	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
(Constant)	5.672	0.000	6.067	0.000	6.091	0.000	5.88	0.000	6.073	0.000
Total invested capital	−0.25 ***	0.000	−0.22 ***	0.000	−0.20 ***	0.000	−0.20 ***	0.000	−0.202 ***	0.000
Intangible assets	−0.099 *	0.018	−0.088 *	0.038	−0.086 *	0.043	−0.084 *	0.049	−0.088 *	0.039
Leverage ratio	−0.02	0.565	−0.022	0.523	−0.022	0.526	−0.021	0.535	−0.022	0.524
Firm age	−0.066 †	0.096	−0.05	0.215	−0.045	0.272	−0.049	0.225	−0.05	0.215
Number of employees	0.019	0.662	0.021	0.622	0.025	0.567	0.021	0.623	0.021	0.624
ROA	−0.056	0.172	−0.053	0.201	−0.045	0.279	−0.052	0.203	−0.053	0.203
Agriculture and mining industry	−0.047	0.193	−0.064 †	0.091	−0.071 †	0.006	−0.06	0.119	−0.064 †	0.095
Construction industry	−0.018	0.601	−0.019	0.587	−0.022	0.525	−0.019	0.590	−0.019	0.586
Manufacturing industry	0.008	0.849	−0.049	0.366	−0.065	0.235	−0.029	0.635	−0.05	0.381
Transportation industry	−0.062 †	0.096	−0.088 *	0.032	−0.095 *	0.021	−0.08 †	0.057	−0.088 *	0.036
Wholesale and retail industry	−0.029	0.440	−0.05	0.214	−0.062	0.122	−0.045	0.269	−0.05	0.216
Finance and insurance industry	−0.16 ***	0.000	−0.19 ***	0.000	−0.20 ***	0.000	−0.18 ***	0.000	−0.19 ***	0.000
Services industry	0.157 ***	0.000	0.11 *	0.023	0.095 †	0.05	0.125 *	0.017	0.11 *	0.029
Public administration industry	−0.027	0.432	−0.035	0.313	−0.048	0.174	−0.033	0.350	−0.035	0.313
Number of patents	−0.002	0.950	0.000	0.995	0.01	0.772	0.03	0.579	0.000	0.998
Reputation	0.027	0.463	0.019 †	0.600	0.014	0.715	0.021	0.566	0.023	0.765
R&D expense	0.225 ***	0.000	0.221 ***	0.000	0.363 ***	0.000	0.225 ***	0.000	0.221 ***	0.000
Initial invested round			−0.089 †	0.086	−0.117 *	0.049	−0.061	0.370	−0.09	0.158
R&D expense × Round					−0.162 *	0.033				
Patent × Round							−0.046	0.454		
Reputation × Round									−0.004	0.961
F-value	13.699 ***		13.096 ***		12.718 ***		12.427 ***		12.387 ***	
R-square	0.272		0.275		0.28		0.275		0.275	
Adjusted R-square	0.252		0.254		0.258		0.253		0.252	

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

Our hypotheses were tested as displayed in Table 2. First, all control variables were included in Model 1. The results show that total invested capital, total costs for intangible assets, firm age, and certain industrial sectors (freight and finance industry) negatively influence performance ($\beta = -0.205$, $p < 0.001$; $\beta = -0.099$, $p < 0.05$; $\beta = -0.066$, $p < 0.1$; $\beta = -0.062$, $p < 0.1$; $\beta = -0.161$, $p < 0.001$). Moreover, a positive influence of R&D expense and service industry was verified on firm performance ($\beta = 0.225$, $p < 0.001$; $\beta = 0.157$, $p < 0.001$). The remaining control variables have no meaningful effects on the dependent variables.

Table 2. Results of the Main Effect Analysis.

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
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Adjusted R-square	0.252		0.254		0.258		0.253		0.252	

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

Then, Model 2, which included the initial investment round, was tested to examine hypothesis 1. As a result, hypothesis 1 was weakly supported, confirming the negative relationship between initial investment round and startup performance ($\beta = -0.089$, $p < 0.1$). Thus, the earlier a startup is invested by VC firms, the better it performs. This implies not only a better performance of the startup, but also a firm value higher than the market expectation. Likewise, the later a startup receives VC investment, the lower it is evaluated in the market.

In Model 3, R&D expense, the interaction term of R&D expense, and the initial investment round were added to test hypothesis 2-1. The moderating effect of the potential absorptive capacity on the association between the initial investment round and startup performance was confirmed ($\beta = -0.162$, $p < 0.05$). Figure 2 displays this moderating effect.

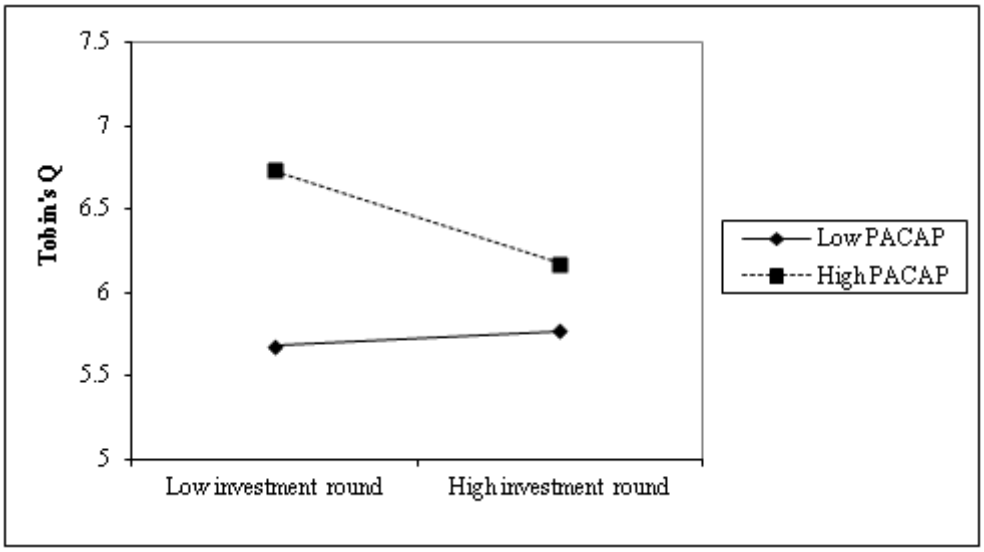

Figure 2. Correlation Graph of Hypothesis 2-1.

As a result, Figure 2 shows that a startup with low potential absorptive capacity performs better when it receives VC investment later, while a startup with high potential absorptive capacity achieves higher performance if VC investment occurs at the early stage. As predicted in hypothesis 2-1, potential absorptive capacity strengthens the relationship between the initial invested round and future performance.

With regard to hypothesis 2-2, no moderating effect of realized absorptive capacity was found in Model 4. Thus, it is concluded that realized absorptive capacity does not influence the main effects.

Finally, Model 5 included the interactive term of VC reputation and the initial investment round in order to examine the moderating effect of VC reputation. The results show that there is no moderating effect of VC reputation. Thus, hypothesis 3 was rejected.

6. Discussion

This study investigated the impact of the initial VC investment round on a startups' sustainable growth and performance. The analysis revealed that the earlier a startup is initially offered investment by VC firms, the higher the startup's performance. This indicates that VC investment leads to sustainable growth in the initial stage. Another major finding is that potential absorptive capacity has moderating effects on this relationship, unlike realized absorptive capacity. These findings generally support the predictions of this research based on the signaling theory and absorptive capacity theory.

As a robustness check, this study empirically examined another model that replaces our dependent variable as underpricing, which is a method that undervalues the actual value of the startups based on the stock price on the day of IPO [81]. The results corroborated the main argument showing that the startups that obtain VC investment in the initial stage tend to engage in underpricing more than others ($\beta = -0.16$, $p < 0.05$). These results imply that a startup that is able to attract VC investment in its initial stage creates a positive signal, showing its potential for future success [41]. The startups that receive external investment often prove their potential through IPO and their continuous growth is expected even after the IPO [48]. This expectation encourages external investors to acquire shares for high profit in the future, which becomes the motivation for underpricing. As a result, it strengthens the argument that initial VC investment at the initial stage increases the firm value by reducing the positive signal to the market and the information asymmetry.

Our analysis did not reveal the moderating effects of realized absorptive capacity, suggested by hypothesis 2-2. The authors believe that these results can be partly explained by extending the initial stage of startups into the idea development phase. The argument of hypothesis 2-2 was based on the idea that realized absorptive capacity is more useful for startups in the later stage, as they have cumulated their own knowledge stock and learning experience over time. In this study's assumption, the startups in the initial stage do not have time to acquire external knowledge and develop their own knowledge. In fact, the startups that attract VC investment can be considered as having a certain level of knowledge and technology or sufficient potential for growth [46]. Given that many startups start their business after they have already developed promising technologies or products, one can expect that even startups in the initial stage can hold potential absorptive capacity that they have developed since the preparation phase. In addition, one can also consider the possibility that the number of patents of startups has not successfully captured the moderating effects of realized absorptive capacity.

In addition, a supplementary analysis was performed to investigate the direct effect of absorptive capacity on performance. It was found that potential absorptive capacity improved startup performance ($\beta = 0.03$, $p < 0.001$) and realized absorptive capacity had no significant effect. This result also indicates that the number of patents may not have adequately measured realized absorptive capacity of firms. It also leaves room for further research about the role of each dimension of absorptive capacity in improving performance.

Moreover, the moderating effect of VC reputation, suggested by hypothesis 3, was not found in our analysis. There are several possible explanations for this result. First, this study adopted Tobin's Q as the dependent variable to measure startup performance compared to the value expected in the

market [82]. If there is insufficient information on the firm that has gone public, the market expectation can be improved simply by attracting VC investment, as suggested earlier by the signaling effect and information asymmetry [41,43,47]. Accordingly, choosing a direction between nurturing and exploiting to sustain VC reputation in the market will not significantly affect market expectations. Second, the sample data in this study only includes the startups that finished IPO and showed good performance. Therefore, it can be assumed that VC investment in this study was largely aimed to help startups grow. Finally, the reputation index used in the empirical research was based on the VC firm that had the most shares. It is possible that other investors with fewer shares had different intentions and directions for investments. The mixed VC investment intention may have culminated in insignificant results.

Several limitations of this study and avenues for further research are also suggested. First, since the sample firms are all limited to the United States, the results do not reflect the reality of other countries or contexts. Although this study addressed the advantages of focusing on the U.S. context, there could be some room for further research opportunities using non-U.S. samples to include cultural or policy-wide differences of VC investment. Given the startup and VC ecosystem could be different across countries [83], future research can consider institutional variables and cross-national dimension by collecting cross-country data. Second, Tobin's Q has a limit for revealing the startups' financial performance or actual value. Additional analyses using various dependent variables may enrich the findings about the role of the initial investment timing of VC firms. Moreover, studying both listed and non-listed startups in the sample may provide insights for startup survival in the long run in relation to investment intention based on VC reputation.

Despite some limitations, this study broadens our understanding of the effects of VC investment considering the initial investment round and the role of absorptive capacity. This study focused on the timing of investment receipt to examine how VC investment influences startup performance. Another major contribution of this study is that the high absorptive capacity of startups in the initial stage has an impact on driving VC investments into performance.

Author Contributions: Writing—original draft, J.J., J.K., H.S. and D.-i.N. All authors have read and agreed to the published version of the manuscript.

Funding: This research is partially supported by the Korea University Research Grant.

Conflicts of Interest: The authors declare no conflicts of interest.

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