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Does Early Incubating Improve the Performance of Start-ups?: Evidence from TIPS in Korea

By JAHYUN KOO*

Recently, the government has been pursuing various policies to create new industries and jobs through the invigoration of start-ups. For the sustained growth of start-ups, it is necessary to look not only at the supply of risk capital but also at policies for venture capital firms that nurture and foster start-ups. The purpose of this study is to estimate the effects of the nurturing and fostering role of risk capital, such as mentorship on the performance of start-ups, and to do this we analyzed the effects, as a newly introduced form of venture capital, of mentoring by an accelerator and investor ties on the performance outcomes of start-ups. We find that mentoring and investor ties for start-up enterprises positively influence follow-up investment in start-ups. In addition, this study finds that with a younger CEO of a start-up, it is more likely that the performance of the start-up will improve. Meanwhile, when examining increases in employment as a measure of the business performance of start-ups, mentoring and investor ties are found to have a positive effect on the increase of employment at start-ups. These results suggest that there is a need to promote policies that strengthen the mentoring role of venture capital in Korea's equity finance policies and in the government's SME support policies.

Key Word: Accelerator, Venture Capital, Business Incubator, Start-up, TIPS (Tech Incubator Program for Start-ups)
JEL Code: G24, G32

I. Introduction

Recently, the Korean economy has been suffering from decreasing economic dynamism, resulting in several years of prolonged low economic growth, a narrowing of the growth gap with regard to Korea and advanced countries, and a deterioration of potential growth (Lee and Cho, 2017). These economic problems are more urgent than ever, as the economic growth model as a fast-follower has shown limitations (Kim, 2016). Thus, it is now time for Korea to transform her old

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economic growth model into a first-mover model through innovation. To become an innovation-driven economy, start-ups by entrepreneurs must be brisk. Entrepreneurs are considered to have the potential to lead economic growth, promote competition, create jobs, improve productivity, and restructure industries (Block *et al*., 2017).

Therefore, the Korean government in recent years has pursued various policies to transform the economic model from imitation-led growth to innovation-driven growth through the invigoration of start-ups (See Table 1). In particular, policies affecting the active role of venture capital in promoting start-ups have been vigorously pursued to establish a virtuous circle of a venture ecosystem. As noted by Perez (2002), "whether the innovator works in the laboratory of a big firm or in his/her garage, someone will be willing to put up the required investment money to test the process, launch the product or expand production". Venture capital – be it a venture capitalist or an angel investor – plays a crucial role in the survival and scale-up activities of start-ups by providing equity capital and bearing the risk of failure.

Due to these policy efforts, the supply of venture capital in Korea has increased drastically in recent years. As shown in Figure 1, the amount of new investment by venture capitalists increased by almost one trillion KRW over four years, from 1.23 trillion won by the end of 2012 to 2.15 trillion won by the end of 2016. Furthermore, the number of newly invested firms jumped from 688 by the end of 2012 to 1,191 by the end of 2016.

TABLE 1—POLICIES FOR ENHANCING THE VENTURE ECOSYSTEM

Date	Measures	Ministry in charge
2013.5	Measures to develop a virtuous cycle in the venture start-up capital ecosystem	Ministry of Strategy and Finance Small and Medium Business Administration
2013.7	Opening of the Korea New Exchange (KONEX)	Financial Services Commission
2013.8	Raising growth-ladder fund	Financial Services Commission
2014.3	Measures to foster M&As	Small and Medium Business Administration
2014.3	Measures to promote global accelerators	Small and Medium Business Administration
2014.3	Measures to invigorate technology-led start-ups	Small and Medium Business Administration
2015.7	Measures to step up equity financing in the SMEs and venture start-ups	Financial Services Commission Small and Medium Business Administration
2016.1	Implementation of equity-type crowdfunding by which start-ups and SMEs are allowed to issue securities through crowdfunding platforms.	Financial Services Commission
2017.11	Measures to create ecosystem for innovation-led start-ups • Creating friendly environments at innovation-led start-ups • Increasing venture capital fund • Creating a virtuous circle of start-up and equity investment	Ministry of Strategy and Finance Ministry of SMEs and Start-ups

Source: Press releases by SME-related Government Ministries.

FIGURE 1. VENTURE CAPITAL INVESTMENT TRENDS

Source: Korean Venture Capital Association, Venture Capital News Letter, 2017 December vol.114.

Although venture capital plays an important role in promoting innovation by supplying a source of funds for commercializing innovations by start-ups, financing radical innovations requires more than merely capital. Not only monetary support but also nurturing and fostering roles by venture capital for start-ups are also important for their growth (Cohen and Hochberg, 2014). In addition to money, early-stage start-ups need mentoring, marketing support, workspaces, investment meetings, as well as legal advice (see Figure 2).

In particular, Korean venture companies have stated that Korean venture capital is rarely helpful aside from the provision of money (see Figure 3).

This study examines methods which may improve the nurturing and fostering of start-ups by venture capitalists, aside from providing monetary support, while focusing on business accelerators, which are recently attracting attraction from academics and practitioners (e.g., Mejia and Gopal, 2015; Gonzalez-Uribe and Leatherbee, 2017; Dempwolf *et al*., 2014). Particularly, by utilizing data from Start-up Chile,[1] Mejia and Gopal (2015) empirically determined that start-ups actively participating in mentoring activities are more likely to realize accomplishments such as developing a business model and increasing sales, and they are highly likely to attract investors. Gonzalez-Uribe and Leatherbee, also making use of data from Start-up Chile, analytically demonstrated that participation by an accelerator has an impact on the subsequent performance of the start-up.

[1]The Start-up Chile program is Chilean government-supported accelerator located in Santiago, Chile. The program was created by the Chilean Ministry of the Economy with the goal of transforming Chile into an innovation and entrepreneurial hub for Latin America. The project started as a pilot in 2010 with 22 startups from 14 countries providing $40,000 USD of equity-free seed capital to develop a startup for six months. After the success of the pilot, Start-up Chile expanded to two rounds per year in 2011, each round lasting six months (Mejia and Gopal, 2015).

FIGURE 2. START-UP NEEDS ASIDE FROM MONEY

Note: E-survey by Telefónica Global Affairs and New Ventures on "Aside from money, what is the single most important necessity for a startup?"

Source: Salido *et al*. (2013).

FIGURE 3. DEGREE OF NON-MONETARY HELP TO START-UPS BY VENTURE CAPITALISTS

Source: Ministry of SMEs and Start-ups, "Survey on Venture Firms," 2017.

Following Mejia and Gopal (2015) and Gonzalez-Uribe and Leatherbee (2017), this paper examines whether additional roles such as mentoring and arranging meetings with investors by a Korean accelerator has had a positive effect on improving the performance outcomes of start-ups. In addition, the results of this study have policy implications which enhance nurturing and fostering as roles by venture capitalists for start-ups aside from their providing monetary support. In

particular, this study employs data from TIPS (the Tech Incubator Program for Start-ups),[2] which is gaining attention as a notable governmental financial sponsor program for start-ups, with which to analyze the effects of an accelerator on the performance of start-ups. To the best of my knowledge, this paper is the first to carry out an empirical examination of the relationship between the roles of an accelerator and the start-up performance while particularly making use of TIPS data.

The estimation results have shown that mentoring and investor ties for start-up enterprises by an accelerator, such as a TIPS operator, positively influence follow-up investments in the start-ups. In addition, this study finds that a younger CEO of a start-up is associated with a higher likelihood that the performance of the start-ups will show an improvement. In the meantime, when examining the increase in employment increase as a business performance metric of start-ups, mentoring and investor ties are shown to have a positive effect on this outcome as well at start-up enterprises. These results suggest that there is a need to promote policies to strengthen the mentoring role of venture capitalists in Korea's equity finance policies and governmental SME support policies.

The composition of this study is as follows. Section II examines the relevant literature. Section III explores the roles and characteristics of an accelerator as a source of risk capital, including an overview of accelerators in Korea. In Section IV, we discuss the data and empirically analyze the impact of accelerators on the performance of start-ups. Section V summarizes the paper and presents policy implications.

II. Literature Review

It is important for entrepreneurs to survive by securing financing, and especially by securing equity financing, which encourages innovation activities because the debt burden is relatively low even if they fail. In particular, venture capital has been championed that it has promoted innovations by providing a source of funds for commercializing radical innovations (e.g., Kortum and Lerner, 2000; Lerner *et al.*, 2011).

Meanwhile, in order to shape an entrepreneur's ideas and execute them, the roles of nurturing and cultivating risk capital are also very important (Dee *et al.*, 2011).

In particular, mentoring (e.g., know-how related to business model development, technology development, management) and links to various human networks are important with regard to incubating and nurturing entrepreneurs because they provide both human capital and social capital (Berger and Udell, 1998). In that context, an empirical analysis of the effects of the mentoring and network linking activities provided by the accelerator on the performance of entrepreneurs in a recent venture capital model suggests certain implications for policies regarding the incubation of venture capital.

With respect to the nurturing and fostering of start-ups, studies have been mainly concerned with the impact of business incubators on entrepreneurs. It has been

[2]See in detail in Section III and data in Section IV.

found that business incubators have a positive effect on start-ups by, for instance, increasing the survival rate of start-ups by supporting various needs in the early stage for weaker start-up companies (Scillitoe and Chakrabarti, 2010; Bruneel *et al*., 2012; Ratinho *et al*., 2010). In Korea, Jo and Kim (2011) noted that non-physical factors such as management, administrative support, and technical support have a significant effect on the performance of companies backed by incubators. On the other hand, regarding the incubation functions of venture capital, the main focus of recent studies is mentorship by angel investors and venture capitalists, and the majority of studies focus on qualitative discussions rather than on an empirical analysis.

In addition, recent interest in the entrepreneurial nurture and incubation roles of accelerators, which combine the characteristics of venture capital and entrepreneurial incubators, has been increasing significantly (Cohen and Hochberg, 2014). Accelerators are proposed to increase the likelihood of the success of start-ups mainly through three mechanisms (Miller and Bound, 2011; Dempwolf *et al*., 2014). Firstly, the accelerator makes various resources available to entrepreneurs. Local and stand-alone entrepreneurs can only use limited resources within the capabilities of the start-up team in the region, but the accelerator can bring the start-up into a specific area (i.e., a boot camp) of expertise of the accelerator, thus providing a wide range of resource utilization opportunities. Secondly, the accelerator improves the performance of the entrepreneur by mentoring the entrepreneurs. Accelerators will provide advice about business model development, technology development, business management, and investment promotion activities through a mentor team composed of experts in various fields. Mentoring plays an important role in fostering leaders and career development in organizations (Srivastava, 2013). Lastly, the accelerator provides a variety of human networks, such as angel investors, venture capitalists, and other entrepreneurial accelerators (Cohen and Hochberg, 2014). As investors and entrepreneurs are in the accelerator ecosystem, the information asymmetry problem is mitigated, which opens up opportunities for start-ups to attract further investment.

Despite the active discussions of the positive effects of accelerators on the performance of start-ups, empirical research is limited given that accelerators are a form of risk capital that has emerged relatively recently and because the availability of statistical data is limited. However, in recent years, empirical studies are increasingly being carried out. Mejia and Gopal (2015) conducted an empirical analysis of the effects of accelerator mentoring and investor engagement on the performance of start-ups participating in the Start-up Chile program. Companies that actively participate in mentoring activities are more likely to realize accomplishments in areas such as business development and sales, and such companies are highly likely to attract investors. By making use of data on the participants in Start-up Chile, Gonzalez-Uribe and Leatherbee (2017) also uncovered empirical evidence that entrepreneurial schooling (e.g., management skills or know-how in relation to pitching an idea) bundled with basic services (e.g., cash or co-working spaces) can significantly increase the performance of a start-up, whilst basic services alone barely affect performance outcomes.

However, as far as the author knows, no empirical analysis of the effects of

accelerators on entrepreneurial performance outcomes has been made in Korea. In this study, by making use of data from companies participating in the government's TIPS, we empirically analyzed the effects of mentoring and investor ties on start-up outcomes such as follow-up investment amounts or increased employment, following Mejia and Gopal (2015).

This study was verified by establishing the following hypotheses.

Hypothesis 1: Mentoring by an accelerator (TIPS operator) increases the possibility of attracting follow-up investment for start-ups (entrepreneurs).

Hypothesis 2: An accelerator's (TIPS operator) investor linkage activities increase the possibility of attracting follow-up investment for start-ups (entrepreneurs).

III. Overview of Accelerators

A. *Characteristics of an Accelerator*

It has been argued that venture capital (or venture capitalists) plays an important role in promoting innovation by supplying equity capital as well as providing other types of business support aside from funding to start-ups. However, empirical evidence has often shown that the activities of VCs actually play relatively weak causal role in stimulating the creation of innovative and successful start-up companies (Bernstein *et al*., 2016).

At present, accelerators, which are short-term incubation programs for entrepreneurs that offer mentoring, networking, and equity investment, are attracting attention as a new form of risk capital that can increase the chances of success at start-ups.

The accelerator selects entrepreneurs as a cohort and fosters them intensively for a certain period of time (e.g., six months). It generally provides early-stage seed investment funding in exchange for equity, accelerates the commercialization of entrepreneurial ideas through mentoring, and/or provides direct future funding or links to other investors (Miller and Bound, 2011). Accelerators have played a major role in entrepreneurial ecosystems (e.g., 51 in 2009 and 200 in 2014) since the first introduction of Y-Combinator in the US in 2005 (Lennon, 2013).

The similarities and differences between an accelerator and a business incubator are as follows. Both accelerators and business incubators offer advice, corporate services, money, and office space to nascent firms, forms of help which are more likely to increase their chances of success as compared to firms which have not received such benefits (Isabelle, 2013). The National Business Incubation Association (NBIA) has found that US business incubators provide support for start-ups that cover a variety of industries, ages, and experience levels, whereas accelerators mainly focus on companies that are based on web technologies and that are operated by a young CEO. In addition, the accelerator aims to move quickly from the start-up stage to the next stage. However, the business incubator

aims to achieve a mature stage for the entrepreneur with a self-sustaining system. While business incubators invest almost nothing, accelerators make equity investments in entrepreneurs in order to enjoy future profits. Meanwhile, angel investors mentor investors individually when necessary, as do accelerators but without a boot camp.

TABLE 2—CHARACTERISTICS OF INCUBATORS AND ACCELERATORS

Characteristics	Incubators	Accelerators
Clients	• All types, including science-based businesses (e.g., biotech, medical devices, nanotechnology, and clean energy) and those not related to technology; all ages and genders; includes those with previous experience in an industry or sector.	• Web-based, mobile apps, social networking, gaming, cloud-based, software, etc.; firms that do not require significant immediate investment or proof of concept; primarily youthful, often male technology enthusiasts, gamers, and hackers.
Selection Process	• Competitive selection, mostly from the local community.	• Competitive selection of firms from a wider region or even nationally (or globally).
Terms of Assistance	• One to five or more years (33 months on average)	• Generally one- to three-month boot camps
Services	• Offers access to management and other consulting entities, specialized in intellectual property and networks of experienced entrepreneurs; helps businesses mature to become self-sustaining or reach a high-growth stage; helps entrepreneurs round out skills, develop a management team and, often, obtain external financing.	• "Fast-test" validation of ideas; opportunities to create a functioning beta versions and to find initial customers; linkage of entrepreneurs to business consulting and experienced entrepreneurs on the web or in the mobile apps space; assistance in preparing pitches to try to obtain follow-up investment.
Investment	• Usually does not have funds to invest directly in the company; more frequently than not, does not take equity.	• Invests $18,000 to $25,000 in teams of co-founders; takes equity in every investee (usually 4 to 8 percent).

Source: Adkins (2011).

TABLE 3—DIFFERENCES BETWEEN INCUBATORS, ACCELERATORS AND ANGEL INVESTORS

	Accelerators	Incubators	Angel Investors
Duration	Three months	One to five years	Ongoing
Cohorts	Yes	No	No
Business model	Investment; non-profit	Rent; non-profit	Investment
Selection frequency	Competitive, cyclical	Non competitive	Competitive, ongoing
Venture stage	Early	Early, or late	Early
Education offered	Seminars	Ad hoc	None
Venture location	Usually on-site	On-site	Off-site
Mentorship	Intense, by self and others	Minimal, tactical	As needed, by investor

Source: Cohen and Hochberg (2014).

B. *Estimation Strategy*

In Korea, the establishment and operation of accelerators have been increasing, starting with 'Primer', which was introduced in 2010 as the first start-up accelerator in Korea. The government has institutionalized accelerators through an amendment of the Small and Medium Enterprise Support Act following market demands for the development of high-quality accelerators.

The revised bill clarified the criteria for accelerators and systematically supported and fostered entrepreneurs. The main points of the amendment related to accelerators are as follows. First, it is now possible to create an accelerator investment fund, and the legal basis of such funding has been clarified, processes which had not been drawn up than other for investment funds such as venture capitalists and angel investors. Through these measures, investment support for a start-up company by an accelerator, which acts as a catalyst for the entrepreneurial ecosystem, can be made more actively. The government plans to offer various incentives, including tax deductions and the permission to raise funds through private placement by individuals to accelerators when they have been registered with the legal requirements (see Table 4). Meanwhile, the Korean Accelerator Association was launched on December 22 of 2017 with 55 initial members.

Secondly, excluding what is known as the FinTech industry from being placed on the banned list for SME start-up support has boosted start-ups in the FinTech industry and promoted the development of this industry.

In addition, the Small and Medium Business Administration (SMBA, the newly established Ministry of SMEs and Start-ups) has enacted qualification requirements for TIPS operators, who head these private investment-led technology start-up support programs, which state that they must be registered accelerators according to the Small and Medium Enterprise Support Act, thereby regulating the management, supervision and support of private accelerators related to TIPS. Whilst an accelerator in general is a stand-alone start-up incubating program which selects start-ups as a cohort and intensively fosters them for a certain period of time (e.g., six months) in a boot camp, such as Start-up Chile, Y-Combinator in the US, and a number of accelerators in Korea, TIPS is a government-private joint accelerator program intended to boost technology-based start-ups by sponsoring government funding proportional to the TIPS operator's investment to make use of a private investor's incentive for the start-up's success. The TIPS program was initially benchmarked on the YOZMA Scheme in Israel (details given in the following section).

TABLE 4—OUTLINE OF ACCELERATOR REGISTRATION IN KOREA

Condition		Incentives		Obligation	
① Capital: Over 100 million * Non-profit: 50 million, Creative Center: 10 million ② Experts: Over two qualified specialists * over the three years of investing or incubating experience ③ Incubating Space	→	Raising individual funds for early-stage start-ups (Corporations allowed to invest up to 49%)	+	Investment	Invest over 10 million in early stage start-ups and invest over 50% of total funds in early stage start-ups Support for more than three months to early-stage start-ups, including incubating activities
		Capital gains, Dividends Corporate Tax Exemption		Report	Submit reports semi-annually
				disclosure	Disclose organization, personnel, financial conditions, profit and loss statements and other information

Source: Ministry of SMEs and Start-ups, Press release, 2017. 12. 22.

IV. Empirical Results

A. *Data*

In Korea, accelerators were recently introduced, and it is difficult to define the characteristics of entrepreneurs participating in an accelerator program operated by the private sector. In this study, we analyzed the effects of mentoring and investor linkages provided by TIPS operators on the performance of start-ups using 52 companies participating in the government's TIPS program from 2013 to 2015. The TIPS program is a government-sponsored technology start-up support program, as noted above. If an operator, such as an accelerator (e.g., an angel investor) and a

professional VC firm, led for instance by a successful venture businessman, finds a promising entrepreneurial team and invests more than 100 million won and recommends it to the government, the government then supports the team with up to 900 million won, including R&D funds of 500 million won. Operators, through a consortium of universities and research institutes, among others, put the team in the business incubator center where the accelerator fosters the start-up for up to three years by fulfilling the needs of the start-up, such as mentoring and links to other investors. The accelerators can reap a large profit if the start-up succeeds after the government-matching R&D support, and accelerators have an incentive to engage entrepreneurs actively via mentoring and through investor relationships in order to increase the likelihood of the success of the start-up.

The TIPS program sets the success criteria for participating companies, who must engage in M&A or IPO activities (including Konex) or attract more than KRW 2 billion of follow-up investments from venture capitalists, or must achieve annual sales of more than 600 million won. In principle, the government collects 10% of the subsidy from firms that achieve the target objectives.

In the case of Chile, it is difficult to tell the difference between the support effect of an accelerator and the initiative of participating companies due to the fact that

TABLE 5—VARIABLE DESCRIPTIONS

Variable	Description
Follow-up investment	attract=1, not attract=0
Variables related to mentorship and investor ties	
Mentorship	five-point scale (very helpful=5, not helpful =1)
The number of contacts by mobile messenger	five -point scale (above 7=5, nothing=0)
Investor network ties	five -point scale (strongly positive=5, strongly negative=1)
Access to network ties	five -point scale (above 5=5, nothing=0)
Characteristics of the start-up	
Firm ages (months)	Age of the start-up (months)
Size of employment (No.)	The number of people on the founding team
Age of founder	Average age of the founder
Previous occupation	Dummy variable for previous occupation -business administrative position=1, R&D or others=0
Educational background	Dummy variable for founder's educational background -above master's/doctoral degree=1, or others=0
Major	Dummy variable for founder's major field of study -science and engineering=1, economics, management, humanities and others =0
Business type	Dummy variable for type of business -manufacturing=1, knowledge service business and others=0

TABLE 6—SUMMARY STATISTICS

Variable	Unit	Mean	SD
Follow-up investment	1 or 0	0.212	0.412
Firm age (months)	Month	39.212	18.402
Size of employment (No.)	No. of employees	8.519	4.945
Age of founder	Years	43	7.636
Previous occupation	1 or 0	0.327	0.474
Educational background	1 or 0	0.519	0.505
Major	1 or 0	0.846	0.364
Business type	1 or 0	0.346	0.480

Start-up Chile is the single accelerator program in Mejia and Gopal (2015). However, the TIPS program in Korea is a system in which each operating company, specifically an accelerator, selects entrepreneurs and provides mentoring and networking to them. The use of TIPS program data has the advantage of allowing us more clearly to discern the effects of accelerator support on the performance of start-ups.

Whether a venture capital firm attracted follow-up investment was set as a performance index with reference to the role of risk capital. In order to control for the characteristics of start-up companies, we utilized the firm's employment size, the age of the founder, their previous occupation before running the start-up, and the educational background of the founder as control variables. In addition, mentoring satisfaction levels and a preference for the accelerator's IR (investor relation) program were utilized as the accelerator mentoring and investor linkage index. Considering that subjectivity is very high, to ensure objectivity of the mentoring and investor linkage index, we utilized the number of mobile message communication instances with accelerators and the number of monthly average investor introductions as proxy variables.

The data on the characteristics of entrepreneurial firms were obtained from the Korea Angel Investment Association, which administers TIPS, and the proxy variables for mentoring and investor linkage were constructed through a survey of companies participating in TIPS with the cooperation of the association. The total numbers of selected firms for the TIPS programs are 15 in 2013, 39 in 2014, and 79 in 2015, for 133 companies overall. Of these, 52 companies (4 in 2013, 11 in 2014, and 37 in 2015) responded to a survey asking about company performance indicators and satisfaction with mentoring.

According to the basic statistics pertaining to the characteristics of start-ups, the average firm age was 39 months, the employment size was 8.5, and the average age of the founder was 43 years.

B. *Main Findings*

This study quantitatively analyzed econometric models addressing the impact of mentoring and investor ties on the performance outcomes of start-ups using characteristics, mentoring and variables related to the investors in 52 firms

participating in TIPS. Two models were estimated for hypothesis testing.

The hypotheses in this study and the survey items to assess them are as follows.

Hypothesis1-1: Mentoring by TIPS operators increases the likelihood of start-up companies attracting follow-up investment.

Hypothesis1-2: Entrepreneurs who frequently contact TIPS operators by mobile messages are likely to attract follow-up investment.

Hypothesis2-1: Access to network opportunities for start-ups given by TIPS operators increases the possibility of attracting follow-up investment.

Hypothesis2-2: The number of business meeting between start-ups and investors facilitated by TIPS operators increases the possibility of attracting follow-up investment.

$$Logit\left(Y^{k}\right) = X\beta + Z\gamma + \varepsilon$$

This study estimates whether follow-up investment (1 = attract and 0 = not attract) was attracted using a logit model. In the logit model above, X is a variable which controls for the characteristics of the start-up company. It includes the age of the start-up, the number of employees, the age of the founder, their previous occupation before running the start-up, and the founder's education Z represents the mentoring by the accelerator and the incubation and upbringing function related to the activities of the entrepreneurial network. We undertake the empirical estimation with two types of models. Model 1 estimates whether mentoring has a positive effect on follow-up investment and model 2 investigates whether investor ties have an affirmative effect on follow-up investment. We also conduct run the regression with both subjective and objective proxies for each model.[3]

Specifically, mentoring satisfaction, the number of contacts, satisfaction with investor links, and the number of investor links were used as proxy variables. The detailed questions on the questionnaire pertaining to the four main proxy variables are shown in Table 7. Furthermore, in order to examine the appropriateness as a proxy for subjective satisfaction of the objective proxy variable, the correlation between the objective proxy variable and the subjective variable was analyzed (Table 8). The results of this study are as follows. There is a significant relationship between the number of contacts and the level of satisfaction with mentoring by the TIPS operator. This is also true for the number of investment arrangement opportunities by operators and the subjective satisfaction rating of investor introductions by operators. These findings indicate that the proxy variables for the number of contacts by mobile messages and the number of business meetings provided by TIPS operators are adequate.

Table 9 and Table 10 present the results of the empirical analysis of the effects of mentoring on the performance outcomes of the start-ups. These results are summarized below.

[3]We fully agree with the concern over endogeneity due to selection bias, fixed effects in the operators, omitted variables, and reverse causality, among other areas. However, our data is limited owing to the short TIPS history. More rigorous studies can be done by future researchers with richer data.

TABLE 7—QUESTIONNAIRE ITEMS

Hypothesis	Items	Scale
Model 1-1	Does the accelerator's mentoring help the performance (e.g., sales, employment increase, attracting follow-up investment) of start-ups	five-point scale
Model 1-2	On average, how many times do you and your accelerator exchange text messages every day?	five-point scale
Model 2-1	Does the accelerator actively provide opportunities of investor ties for start-ups?	five-point scale
Model 2-2	On average, how many investors are introduced by the accelerator per month?	five-point scale

TABLE 8—CORRELATION ANALYSIS

	Mentorship (Subjective index)	Mentorship (No. of contacts by mobile phone)	Investor ties (Subjective index)	Investor ties (No. of investor relations)
Mentorship (Subjective index)	1	-	-	-
Mentorship (No. of contacts)	0.2307*	1	-	-
Investor ties (Subjective index)	-	-	1	-
Investor ties (No. of investor relations)	-	-	0.5048***	1

Note: *** Significant at the 1% level; * Significant at the 10% level.

TABLE 9—THE EFFECT OF MENTORING ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 1-1 (Subjective index)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Follow-up investment (attract=1, not attract=0)			
Mentorship	0.177	0.490	0.021	0.500
Firm age	0.046*	1.750	0.005**	2.100
Size of employment	0.031	0.340	0.004	0.350
Age of founder	-0.162*	-1.760	-0.019**	-2.030
Previous occupation	2.648*	1.780	0.311**	2.380
Educational background	-0.261	-0.290	-0.031	-0.280
Major	0.596	0.410	0.070	0.410
Business type	3.600***	2.680	0.421***	4.140
Constant	-0.278	-0.090		
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.296			

Note: *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

TABLE 10—THE EFFECT OF MENTORING ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 1-2 (No. of contacts)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Follow-up investment (attract=1, not attract=0)			
Mentorship	0.503*	1.810	0.056**	2.050
Firm age	0.046	1.540	0.005*	1.890
Size of employment	-0.024	-0.250	-0.003	-0.250
Age of founder	-0.158*	-1.730	-0.018**	-2.240
Previous occupation	2.632	1.590	0.286**	2.290
Educational background	-0.298	-0.310	-0.033	-0.310
Major	1.359	0.890	0.152	0.890
Business type	4.017**	2.350	0.450***	3.940
Constant	-0.686	-0.280		
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.330			

Note: *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

First, the results of the estimation of subjective satisfaction with mentoring are not significant, as indicated in Table 9. However, it is estimated in Table 10 that the number of mobile message contacts, which provides more objective evidence of mentoring satisfaction, has a meaningful positive effect.

This result suggests that mentoring enhances the success of entrepreneurs through tacit knowledge transfers on the topics of product development, talent recruitment, resource management, branding, investment pitching and business pitching (Stuart and Sorenson, 2005; Klepper and Sleeper, 2005).

Regarding the other variables, when the start-up business has been in business longer, it has a greater possibility of attracting follow-up investment. In addition, a younger founder is more likely to succeed in attracting subsequent investments. With regard to pitching ideas, a younger CEO is linked to a higher likelihood of accepting mentoring. For occupations before running the start-up, it was found that business administrative positions are more advantageous for attracting follow-up investment than a background in R&D. Technology development is important for start-up companies to grow, but it appears that the ability of management to develop technology as a business model and explain it to investors is also an important factor in the success of the start-up company.

The effects of the characteristics of each industry on the performance of the start-ups in each industry indicate that the manufacturing industries are better than the service industries on this measure. There is a tendency for the manufacturing industry to be more developed in Korea than the service industry, with one example being software. Alternatively, this may be a reflection of the uniqueness of TIPS.

Table 11 and Table 12 present the estimation results pertaining to the influence of investor links by the accelerator on the performance outcomes of the start-ups.

The results of model 2-1 in Table 11 suggest that when an operator is more likely

TABLE 11—THE EFFECT OF INVENTOR TIES ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 2-1 (Subjective Index)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Follow-up investment (attract=1, not attract=0)			
Investor ties	0.653	1.590	0.074*	1.840
Firm age	0.054*	1.790	0.006**	2.310
Size of employment	0.050	0.490	0.006	0.510
Age of founder	-0.183*	-1.770	-0.021**	-2.210
Previous occupation	2.832*	1.770	0.322**	2.580
Educational background	-0.434	-0.460	-0.049	-0.450
Major	0.972	0.630	0.110	0.620
Business type	3.797**	2.530	0.429***	4.090
Constant	-2.874	0.375		
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.318			

Note: *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

TABLE 12—THE EFFECT OF INVENTOR TIES ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 2-2 (No. of IR)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Follow-up investment (attract=1, not attract=0)			
Investor ties	0.603**	1.980	0.069*	1.940
Firm age	0.052*	1.900	0.006**	2.290
Size of employment	0.025	0.250	0.003	0.250
Age of founder	-0.184*	-1.770	-0.021**	-2.030
Previous occupation	2.854*	1.800	0.323**	2.480
Educational background	-0.329	-0.350	-0.037	-0.340
Major	0.801	0.590	0.091	0.580
Business type	4.211***	2.830	0.479***	4.210
Constant	-0.518	1.980		
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.312			

Note: *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

actively to arrange an investor, there is a greater likelihood that a start-up will succeed in attracting subsequent investments. The estimation results for the number of investor meeting arrangements in Model 2-2 strongly support this implication in Table 12.

This result suggests that entrepreneurs can inform investors of the existence of the entrepreneurial team through the network and raise the possibility of investment attraction and success by mitigating the asymmetric information problem to investors through frequent interviews with investors. These results are similar to those in previous studies (Stuart and Sorenson, 2005; Hallen, 2008). The effects of other variables on follow-up investments in start-ups are qualitatively similar to the results for follow-up investment inducement in relation to mentoring.

C. *Robustness Checks*

The mentoring and investor linkage effects by accelerators on the performance outcomes of start-ups, such as employment increases and sales increases as well as subsequent investment attraction were assessed. In order to examine the robustness of the empirical results of accelerator mentoring and investor linkages on subsequent investment, we utilized employment growth as a proxy for firm performance.

First, the results show that the effect of mentoring on increased employment at start-ups is positively estimated in Table 13 and Table 14. Furthermore, in Table 15 and Table 16, the influence of investor linkages by operators on employment is also estimated with a positive sign. We also found that a greater number of investor arrangements is linked to a greater probability that the employment increase will be higher than average.

TABLE 13—THE EFFECT OF MENTORING ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 1-1 (Subjective Index)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Employment increase (above average=1, below average=0)			
Mentorship	0.182	0.500	0.038	0.690
Firm age	0.008	0.490	0.002	0.490
Size of employment	0.076	0.940	0.016	0.970
Age of founder	-0.009	-0.160	-0.002	-0.160
Previous occupation	0.574	0.570	0.121	0.570
Educational background	-0.071	-0.080	-0.015	-0.080
Major	1.462	1.480	0.302	1.560
Business type	-0.981	-1.300	-0.203	-1.380
Constant	-3.851	-1.400		
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.119			

Note: *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

TABLE 14—THE EFFECT OF MENTORING ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 1-2 (No. of contacts)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Employment increase (above average=1, below average=0)			
Mentorship	1.164***	2.610	0.201***	3.140
Firm age	-0.000	0.000	0.000	0.000
Size of employment	0.029	0.350	0.005	0.350
Age of founder	-0.013	-0.240	-0.002	-0.240
Previous occupation	0.406	0.440	0.072	0.430
Educational background	-0.252	-0.290	-0.044	-0.290
Major	2.598**	2.380	0.450**	2.510
Business type	-0.991	-1.200	-0.171	-1.290
Constant	-4.534*	-1.940		
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.241			

Note: *** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level.

TABLE 15—THE EFFECT OF INVENTOR TIES ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 2-1 (Subjective Index)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Employment increase (above average=1, below average=0)			
Investor ties	0.433	0.145	0.086	1.530
Firm age	0.010	0.610	0.002	0.610
Size of employment	0.094	1.220	0.019	1.270
Age of founder	-0.009	-0.170	-0.002	-0.170
Previous occupation	0.638	0.670	0.129	0.660
Educational background	-0.172	-0.190	-0.034	-0.190
Major	1.596*	1.670	0.318*	1.770
Business type	-1.059	-1.440	-0.211	-1.550
Constant	-5.444*	-1.860		
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.143			

Note: * Significant at the 10% level.

TABLE 16—THE EFFECT OF INVENTOR TIES ON THE PERFORMANCES OF START-UPS (LOGIT)

Model 2-2 (No. of IR)	Coefficient	Z-statistics	dF/dx	Z-statistics
Dependent Var.	Employment increase (above average=1, below average=0)			
Investor ties	0.681*	1.790	0.132*	1.960
Firm age	0.009	0.510	0.002	0.510
Size of employment	0.072	0.950	0.014	0.980
Age of founder	0.002	0.030	0.000	0.030
Previous occupation	0.520	0.570	0.103	0.560
Educational background	-0.118	-0.140	-0.023	-0.140
Major	1.677	1.440	0.326	1.500
Business type	-0.717	-0.970	-0.139	-1.020
Constant	-4.903*			
Observation	52	52	52	52
Year (dummy)	YES	YES	YES	YES
Pseudo R^2	0.162			

Note: * Significant at the 10% level.

V. Conclusions and Policy Implications

It is important for start-ups to obtain financial resources to enter the stage of growth after the start-up stage, and this is the primary role of venture capitalists. However, the role of nurturing by venture capitalists has been recently championed to increase the possibility of the success of a start-up. In this study, we analyzed the effects of mentoring and investor ties by an accelerator, a newly introduced form of venture capital, on start-up outcomes. In particular, we analyzed the effects of accelerator-based mentoring and investor links on the performance outcomes of 52 start-up companies participating in the government's TIPS program, which is a type of accelerator. As a result, it was found that the mentoring and investor-linking activities of an accelerator have a positive effect on attracting follow-up investment. In addition, it was estimated that a younger CEO of the start-up company is linked to a higher likelihood that the performance of the start-up company will improve.

On the other hand, in the estimation result when using increased employment as a proxy for the business performance of the start-up company, mentoring and investor-linking activities positively affect the employment increase by the start-up. These results have the following implications for Korean venture capital policies and government SME support policies.

First, it is necessary to promote policies that strengthen the mentoring role of venture capitalists when the government supplies risk capital. Considering that most risk capital in Korea, such as angel investments, venture capital, and accelerators, is matched by the government's policy funds, such as a ‘fund of funds’ and ‘growth ladder funds’, it is necessary to assess the mentoring plans of

venture capitalists when designating a matching government fund. With regard to the TIPS program, in which the role of mentoring is relatively active, an evaluation of mentoring is not considered in the selection and evaluation of the accelerator operator. This is also the case for other governmental policy funding programs as well.

Meanwhile, in the mid-to-long term, it is necessary to create policies that strengthen the mentor capacity of accelerators. To this end, a policy for establishing a virtuous circle of professional workers, such as professional investors within the entrepreneurial ecosystem, is also needed.

Second, it is necessary to establish a system that can increase the acceptance of mentoring for start-up firms. In order to maximize the effect of mentoring, it is necessary to ensure a positive and open attitude at start-up companies toward mentors. In Korea's entrepreneurial ecosystem, it is known that start-up firms are often annoyed when considering mentoring by venture capitalists, considering it a form of entrepreneurial intervention, and they passively take part in mentoring by venture capitalists. If risk capital included in policy funds is invested in start-up companies, it is necessary to provide educational programs that stress the importance of mentoring for start-up companies.

Third, it is necessary to improve governmental mentoring support policies through a mentoring voucher system. While the government provides a variety of mentoring programs for start-ups, once a program is selected, entrepreneurs can apply for mentoring within a given period, despite its appropriateness, as opposed to a tailor-made schedule for the start-up. Such a stipulation is being investigated.

Meanwhile, this study also has some limitations (e.g., unable to control for fixed effects of operators; not making use of long-term performance metrics such as sales and net profits) due to data constraints. An in-depth study is planned to determine whether accelerators have effects on start-up performance measures such as sales increases and survival rates as opposed to merely follow-up investments. More rigorous investigations are deferred to future researchers, who may find richer data by mining currently unavailable sources.

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