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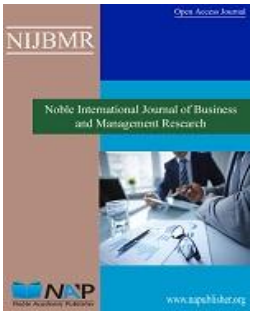

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Birth and Survival of Regional Ventures: Comparison of Regional and Industrial Characteristics

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Abstract: In 1997, the Korean government enacted the Venture Special Act to designate ventures and to provide various supports in finance, tax, human resources and R&D. As a result, the number of ventures reached 31,260 as of the end of 2015. Although ventures are still concentrated in the Seoul, the capital city metropolitan area, the growth of regional ventures is significant, and thus it is forecasted that their share in regional economies will increase. Therefore, the purpose of this research is to identify the differences of the birth and survival of ventures in each region and industry, and to identify the characteristics that affect those differences. According to the analytical results, Korean government should make policies to encourage each megacity, province and metropolitan economic block to have variety of industries, rather than having them specialize in a particular sector.

Keywords: Ventures, Birth, Survival, Regional Economy.

1. Introduction

Technology-based startups named ventures can not only be the driving force of innovation in various industrial areas but they are also playing a vital role in the development of national economy (Autio, 1994;1997; Kortum and Lerner, 2000). In the case of Korea, the number of ventures reached 31,260 as of the end of 2015, and despite difficult management conditions after the global financial crises, they showed good performance with the number of ventures that recorded revenue of 100 billion Korean won (90 million US dollars) or more exceeding 400. These ventures with revenue of 90 million US dollars grew to play a pivotal role in Korea's economy, accounting for 7 percent of Korea's GDP. Although ventures are still concentrated in the Seoul metropolitan area, the growth of regional ventures is significant, and thus it is forecasted that their share in regional economies will increase.

It is a well-known fact that behind the growth of Silicon Valley, the most successful cluster in US, there was the birth and success of ventures which had their bases on technologies. In the 1950s and 1960s, US government's defense industry emerged as the core industry in Silicon Valley driven by intensifying cold war after the 2nd World War, and it paved the foundations for development of electronic industries based on application of defense technologies. Then in 1990s, the regional economy of Silicon Valley had its heyday based on IT technologies, but the dot-com boom in the early 2000 caused it to slow down temporarily. However, having its bases on the existing IT technologies, Silicon Valley established itself as a green industry centered around the photovoltaic sector. It was also these ventures that enabled such transformation into the green industry, which is proven by the fact that 20 percent of investment into green industry ventures is concentrated in Silicon Valley. As such, ventures are important major innovation players which enabled vitalization of regional economies and creation of new growth engines.

In 1997, the Korean government enacted the Venture Special Act to designate ventures and to provide various supports in finance, tax, human resources and R&D. The requirements for a company to be designated and registered as a venture are becoming stricter to further stimulate development of innovative capabilities. In general, companies which receive investment from venture capital firms, companies with a certain volume of research and investment, and companies recognized as having excellent technologies by technology assessment institutions can be registered as ventures. In addition, in order to accumulate and foster ventures, the government started to designate venture development promotion districts since 2001, and now there are 25 areas designated nationwide.

As a result, half of regional ventures are doing business in the promotion district, and are showing great performance with increasing average revenue. Accordingly, Korean Small and Medium Business Administration is working jointly with municipalities to come up with measures to connect regional specialized industries with new growth engine industries and to expand opportunities to attract investment, so as to develop the promotion district where ventures are concentrated as the hub for vitalization of regional ventures.

For such government's efforts to have practical effects, it is important to first identify the characteristics of ventures in different regions and industries. That is because it is important to analyze in which region were ventures most actively born and survived the longest, and in which industries those ventures do business in. Therefore, the purpose of this research is to understand the characteristics of the birth and survival of ventures in different regions and industries, and to find out what factors are causing such differences. Since there has been few or no research analyses on such subject until now, the result of this research will be the foundation for establishing government policies to vitalize regional ventures.

2. Theoretical Backgrounds and Hypotheses

The most adequate concept for regional comparison is the cluster concept. Porter (1998) presented the concept of cluster for the first time, and defined that a cluster is "related organizations such as companies, universities, and research institutions that are interconnected with one another based on the commonness and complementation in certain industrial areas competing against and cooperating with one another". As such, a cluster is where companies of a certain industrial area are geographically concentrated, and thus in order to identify the regional and industrial characteristics that affect the birth and survival of ventures, it is necessary to adopt the concept of cluster.

Companies located within a cluster are known to show good performance in new product innovation, revenue growth and survival. The reason seems to be that competition within the cluster induces innovation of the companies and those companies which succeeded in innovation survive to form competitiveness (Porter, 1998). In addition, Chung and Kanins (2001) revealed that small and medium sized companies which are located in a cluster created much more profit, claiming that it is because they can attract more customers by utilizing the reputation of a well-developed cluster.

Canina *et al.* (2005) found out that companies that utilize differentiated strategies show greater performance than the companies using low price strategies in a given region, based on his analyses on the agglomerate effect according to type of the company. This is similar to the research results by Baum and Haveman (1997) who revealed that new companies which use differentiated strategies from other companies within a cluster survive longer than the companies that don't. These reasons seem to be because newer and smaller companies are affected more by environmental factors of the region and because they have organizational structures which enable easy adjustment to such environmental factors. In other words, the more concentrated with ventures a region is, more innovation is made, and such ventures that respond quickly to the innovation environment are in a more advantageous position than companies that are not.

Hypothesis 1. In regions which have well-developed clusters, more ventures are born and survive longer.

Capello (1999) claimed that a cluster is formed as companies which exist in a single value-chain in the process where value-creating system develops concentrate in a certain region with related organizations and support organizations with a purpose to make a large market. In addition, Capello explained that a cluster can achieve greater performance through intensive knowledge exchange and interaction. According to these definitions, an industrial cluster is a group of related industries in terms of value-chain where specialization related to a particular industry is important. What Chung and Kanins (2001) claimed, that is, it can be interpreted that the argument that small companies would reap far more profits in a cluster is because they can be easily included in a value-chain with conglomerates and they can attract more customers by utilizing the reputation of conglomerates.

As such, the fundamental reason that value-chain is important to ventures is because most of the ventures produce components and related service rather than finished products and service for the end user. Therefore, it is inevitable that forming a sound value-chain which includes conglomerates would have an absolute effect on the survival of ventures. It is not easy to form a sound value-chain which includes conglomerates in regions other than the Seoul metropolitan area where conglomerates are concentrated, and thus for ventures, the existence of conglomerates is important for the value-chain.

Hypothesis 2. In regions which have sound value-chains including conglomerates, more ventures are born and survive longer.

Researchers such as Bell (2005) and Deeds *et al.* (1997) claimed that the reason companies show good performance in a cluster the knowledge spillover effect. Knowledge spillover is a direct or indirect movement of knowledge, and it is through this knowledge spillover that companies find out what technologies other companies are developing or how successful they are in their researches by comparing with other companies. As such, spillover of technologies and knowledge enable companies to reach a place where they could use the latest technologies, thereby enabling them to compete in the most attractive market. That is because, knowledge spillover provides information which can be used to discover a new market opportunity and helps companies to have better understanding on the future technology direction so that companies can constantly work on innovative activities. Through this, ventures which are ready to adopt a new technology and enter into a new market can provide products and service according to the new trend.

Knowledge spillover is more important to ventures that lack resources. Knowledge spillover helps these companies in their innovation efforts and new product development so that they could achieve revenue growth. To vitalize knowledge spillover actively and to make sure it brings about actual performance to ventures, first of all, more knowledge and technologies must be produced, and further, there should be a well- established basis where created technologies can be made into products and commercialized. For this to take place, there should be numerous innovation players, such as universities, research institutions or corporate research centers within the region, and further, the technologies and knowledge created from them must be spread to companies and be commercialized.

Through his research on the growth stage of ventures, Kazanjian (1988) stressed that technological development for product development or commercialization must be preceded if ventures are to grow. In addition, In terms of cooperative commercialization with outside players, ventures tend to face much more difficulty, since they lack reputation and thus takes a lot of money to search for appropriate cooperative partners, and it is difficult to obtain equal opportunities when cooperating (Hsu, 2004). For a venture which lacks complementary assets to successfully achieve commercialization, there must not only be funds, supporting agencies, but also a rich industrial infrastructure such as an industrial complex where they can grow. In other words, in order to utilize a technology produced in the region, the technology itself and related industries must be developed.

Hypothesis 3. In regions where many technologies are created, more ventures are born and survive longer.

Hypothesis 3-1. In regions which have rich industrialization bases, more ventures are born and survive longer.

Discussion on the industrial groups of major companies in a cluster can be made through the agglomeration economy effect set forth below. A cluster pursues the effect of agglomeration economies, and we could understand in what circumstances and what conditions such an effect occurs and a cluster might grow through the hypotheses of MAR, Jabobs, and Porter. MAR is an abbreviation of the agglomeration economies hypotheses made by Marshall (1890), Arrow (1962), and Romer (1986), which claims that since the knowledge which brings about external agglomeration economies have special characteristics per industry, the more a certain industry is specialized in a region, the more the growth of the region is stimulated. Porter (1990) argues that knowledge is industry specific and external economy within a cluster arises more effectively. However, he argues that, contrary to the hypothesis of MAR, the competition between companies plays an important role. The effect of agglomeration economies by Jacobs (1969) agrees to the importance of competition as Porter claimed, but emphasizes that the diversity caused by existence of various industries within a cluster is important in the growth and development of the cluster.

When a region is specialized into a particular industry, it has a lock-in effect, and thus in order to resolve this problem, it is important for the cluster to have variety which enables integration of other industries. Here, the variety should be based on relevance and not a kind of variety that occurs when industries having nothing to do with one another agglomerate. This is called 'related variety'. Related variety enhances lateral absorptive capacity among neighboring industries and knowledge spillover, so that innovation could cross the neighboring industries and improve. It is derived from Jacobs (1969) discover that industrial variety is important in the evolution and growth of a region, and starts from the

central concept that geographical proximity enables knowledge spillover among related industries (Cooke, 2008).

Considering the current trend where environment friendliness and convergence is widespread in technologies and industries, Jacob's hypothesis that variety is more important than specialization is more reasonable. This means that transforming the technological and innovative capabilities in one area into other area becomes possible through revelation of entrepreneurship in a region where related variety has been fulfilled. Variety examples that support this are as follows: In California, USA where semiconductor equipment industry was developed, solar energy equipment industry was able to develop, and in Denmark, the advance of the fishing industry and shipbuilding industry was transformed into the wind power turbine industry, and the case of Israel the development of aviation and semiconductor industry led to development of photovoltaic cell industry.

Hypothesis 4. In regions which have variety rather than specialty in industrial sector, more ventures are born and survive longer.

3. Research Methodology

In order to verify the aforementioned hypotheses, this research compared and analyzed the number of ventures that are founded per region and industry, and their 5 year survival. This is because vitalizing regional economy needs not only numerous ventures but also long lasting ventures so that they could grow to become one of those ventures that record 90 million US dollar revenues a year. There are no particular criteria for the survival rate of a company, but this research used the 5 year survival rate method which is the most frequently used.

3-1. Data and Variables

Of the ventures gathered from the Korea Credit Ratings Information Corp., this research represents ventures founded in and after 1998 as the population group. The reason that the year 1998 was used as the criteria was because it was from 1998 that the government strongly pushed forward venture development policies including the venture certification system etc. In addition, since it is possible to find out whether a company has closed or survived at least 5 years since its foundation, ventures for which its existence were traceable as of the 5th year since foundation were used as subjects of the analyses. The number of ventures selected in this method was 10,864. Of these companies, for manufacturing ventures only, we conducted analyses per region and industry based on the industrial classification (KSIC) and their addresses. As for the industrial classification, we divided them up into 46 industries based on manufacturing mid classification criteria. Finally, in order to secure validity of survival rates, for each region, we only accounted for the industries having 5 or more ventures.

For the patent trend analyses, we utilized and Korea Patent Statistics and 'Korea's Patent Trend 2011' material published by the Korea Intellectual Property Office (KIPO), to derive results on domestic patents having applications numbers from 2000 to 2010. In addition, for understanding the current overview of industries and companies per region, we utilized corporate activity research material of the National Statistical Office.

In all industrial sectors including manufacturing, construction, wholesale and retail, and business service sector, the regions with the largest number of ventures were Seoul, followed by Gyeonggi province, and these two regions accounted for about 70 percent of the total. The 5 year average survival rate also showed differences according to regions. And except for Jeju Island which showed significantly low number of ventures, North-Gyeongsang province showed the highest rate with 90.8 percent, and Seoul was the lowest with 76.7 percent.

The manufacturing sector which has the largest foundation rate also shows differences according to megacity and province. In general, it can be seen that numerous ventures are newly born in other special purpose machinery sector and communication equipment and broadcasting equipment sector. Even in the same industrial sector, there were differences in the 5 year survival rate according to region, that is, in the other special purpose machinery sector, Gwangju was the region with the highest survival rate, whereas Daegu showed the lowest survival rate.

Explanatory variables adopted for verifying the hypotheses consist of variables reflecting regional characteristics and industrial characteristics of the regions. Definitions and related hypotheses for each variable are as in Table 1.

Table 1. Major variables

Name of Variables		**Definition**	**Relevant Hypothesis**
Explanatory variables			
Regional industry characteristics	Number of patents	Number of patents filed during 2000-2010 in each industry and region.	Hypothesis 3-1
	Patent activity index	The share of a particular region's patents in the corresponding industrial sector divided by the share of the corresponding industrial sector's patents in the nation.	Hypothesis 3-1
	Industrial specialization	The share of a particular region's patents in the corresponding industrial sector divided by the share of the corresponding industrial sector's patents in the nation.	Hypothesis 1
	Industrialization capability	The average of the patent activity index of the top 3 industrial sectors with high patent activity index in a particular region divided by the average of the industrial specialization degree of the corresponding industrial area.	Hypothesis 3-2
	Number of conglomerates	The number of companies having 1,000 or more employees in the corresponding industrial sector of a particular region.	Hypothesis 2
Regional characteristics	Patent growth rate	Patent growth rate for 10 years in a particular region.	Hypothesis 3-1
	Industrial concentration degree	The average of the industrial specialization of the top 4 sectors with high industrial specialization degree in a particular region.	Hypothesis 4
	Industry-academic cooperation	Share of cooperative research with corporates in a particular region.	Hypothesis 3-2
	Share of conglomerates' patents	Share conglomerates' patent applications in a particular region.	-
	Share of universities' patents	Share of universities' patent applications in a particular region.	-
	Venture capital investment amount	Venture capital investment amount in a particular region.	-
Dependent variables			
Dependent variables	Number of ventures	The number of ventures founded in the corresponding industrial sector in a particular region.	
	5 year survival rate	The average 5 year survival rate of ventures founded in the corresponding industrial sector in a particular region.	

According to the above material, the birth and survival overview of ventures per megacity and province founded between 1998 and 2003.. The birth and survival overview of ventures analysis was conducted on all industries and not just on industries having 5 or more ventures.

As shown in Table 2, where the statistics for these variables are illustrated, it seems that the difference of variables representing regional and industrial characteristics brought about the difference of venture establishment and 5 year survival rate per region.

In order to find out which are effective factors among the variables of regional characteristics and industrial characteristics that affect the number of ventures and 5 year survival rate, we conducted an econometrical analysis.

In the case of the number of ventures, which is one of the dependent variables, about 33 percent of all data accounts for 0, and the ratio of the industries having zero number of ventures was different according to region.

Table 2. Statistics of major variables

Name of variable	Average	Maximum	Minimum
Number of patents	3,179	48,642	74
Patent activity index	1.21	5.49	0.19
Industrial specialization	1.21	9.10	0.12
Industrialization capability	1.20	7.69	0.04
Number of conglomerates	0.35	8	0
Patent growth rate (%)	7.88	43.00	4.34
Industrial concentration	2.86	6.13	1.67
Industrial-academia cooperation (%)	50.48	74.52	24.33
Share of conglomerates' patent (%)	45.92	70.35	22.38
Share of universities' patent (%)	3.58	12.40	2.14
Venture capital investment amount (billion Korean won)	8,533	32,254	225
Number of ventures	8.05	284	0
5 year survival rate (%)	82.62	100.00	8.16

3-2. Econometric Model

As aforementioned, in the case where observation data with a dependent variable 0 accounts for a high percentage of the total, one should be careful of sample selection bias. As such, since the variable of the number of ventures has a censoring value of 0, the Tobit model must be applied. Application of Type I Tobit model is limited in that it is based on the hypothesis that the effect that the explanatory variable has on the existence of ventures and the effect that it has on the number of ventures is the same (Cragg, 1971). Unlike the above, Type II Tobit model is a bivariate model which treats the existence of ventures and the number of ventures as separate variables. This model has 2 separate probability processes which makes a model of the probability of there being a venture in the sample in the entire regions and industries, and makes a model of the conditional number of ventures in the sample where the ventures exist. Therefore, Type II Tobit model has the advantage that the factor which determines not only the existence of the ventures but also the number of ventures can be analyzed at the same time.

Latent variable (z_i^*) of the existence of ventures of the industry sectors in each region and the observation variable (y_i) of the number of ventures can be expressed as follows:

$$z_i^* = \omega_i'\gamma + u_i \qquad (1)$$

$$z_i = \begin{cases} 1 & if\ z_i^* > 0 \\ 0 & if\ z_i^* \le 0 \end{cases} \qquad (2)$$

$$y_i^* = x_i'\beta + \epsilon_i \qquad (3)$$

$$y_i = \begin{cases} y_i^* & if\ z_i^* > 0 \\ 0 & if\ z_i^* \le 0 \end{cases} \qquad (4)$$

In the above formula, γ, β represent parameter vectors to be estimated, u_i, ϵ_i represent error terms, and ω_i, x_i represent explanatory variable vectors. z_i is an indicator variable representing whether there is a venture in the industries in each region, being 1 when there is a venture, and 0 when there is not. In the case where there is a venture, the number of ventures (y_i^*) is observed in the industries in each sector. If error term (u_i, ϵ_i) follows the bivariate normal distribution, (z_i^*, y_i^*) is based on the bivariate normal distribution $N_2(\omega_i'\gamma,\ x_i'\beta,\ 1,\ \sigma^2,\ \rho\sigma)$. Herein, 1, σ, ρ are the standard deviations of z_i^* and y_i^*, and their

coefficient, respectively. The log-likelihood function of Type II Tobit model is given by formula (5). It is possible to estimate the parameter by applying the maximum likelihood method to formula (5).

$$\log L = \sum_{\{i|z_i=0\}} \log\Phi(-\omega_i'\gamma) - \sum_{\{i|z_i=1\}} \log\Phi\left(\sqrt{2\pi}\sigma\right) - \frac{1}{2}\sum_{\{i|z_i=1\}}\left(\frac{y_i - x_i'\beta}{\sigma}\right)^2 + \sum_{\{i|z_i=1\}} \log\Phi\left[\frac{\omega_i'\gamma + \rho\left(\frac{y_i - x_i'\beta}{\sigma}\right)}{\sqrt{1-\rho^2}}\right] \quad (5)$$

The 5 year survival rate variable, which is another dependent variable, has a value between 0 and 1, the data having values 0 and 1 account for 0 percent and 25 percent respectively. As such since the dependent variable is a positive variable, it cannot be observed in a certain area and thus it is appropriate to apply the Tobit model when it has a censored value (Amemiya, 1984; Tobin, 1958).

When the censoring point of the 5 year survival rate variable y_i is 0 and 1, the Two-limit Tobit model is as the following formula:

$$y_i^* = x_i'\beta + \epsilon_i, \qquad \epsilon_i \sim N(0, \sigma^2) \quad (6)$$

$$\begin{cases} y_i = 0 & \text{if } y_i^* \le 0 \\ y_i = y_i^* & \text{if } 0 < y_i^* < 1 \\ y_i = 1 & \text{if } y_i^* \ge 1 \end{cases} \quad (7)$$

Herein, β is the parameter vector to be estimated, ϵ_i is the error term which follows the bivariate normal distribution, and y_i^* is the latent variable of the dependent variable. The latent variable of the 5 year survival rate can be smaller or bigger than 1, but since 0 or 1 is applied to each case, for the observed 5 year survival rate, it is always a value between 0 and 1 applied thereto.

The log-likelihood function of this model is as the formula (8) below. $\Phi(\cdot)$ and $\emptyset(\cdot)$ each represents the standard regular accumulative distribution function and the regular probability density function. When the maximum likelihood estimator is applied to formula (8), a parameter value maximizing likelihood function is estimated.

$$\log L = \sum_{\{i|y_i=0\}} \log\Phi\left(-\frac{x_i'\beta}{\sigma}\right) + \sum_{\{i|y_i=1\}} \log\Phi\left(\frac{-1 + x_i'\beta}{\sigma}\right) - \sum_{\{i|0<y_i<1\}} \log(\sqrt{2\pi}\sigma - \frac{1}{2}\sum_{\{i|0<y_i<1\}}\left(\frac{y_i - x_i'\beta}{\sigma}\right)^2 \quad (8)$$

In analyzing the 5 year survival rates, in addition to the aforementioned Tobit model, the Repeated Multinominal Logit model is also applicable. For each region, when there is a venture in a particular industry sector, each venture may select one of the alternatives of survival and closure for 5 years.

If these companies survived for 5 years, 1 is given, and they closed, 0 is given. And then, the average value calculated for each industry in each region has the same value as the 5 year survival rate variable. That is, in terms of the 5 year survival rate variable conceptually coincides with the survival selection probability derived by repeatedly selecting survival or closure in the number of times of the ventures in each industry and region. In this regard, the 5 year survival rate variable can be explained under the Repeated Multinominal Logit model which is utilized in analyzing the conduct of repeatedly selecting survival or closure for 5 years.

The relationship between the latent variable of the utility regarding the selective alternative *j* of a venture group *i* which consists of a t_i number of ventures in each industry and region and the explanatory variable is as follows:

$$y_{ij}^* = x_i'\beta_j + \epsilon_{ij} \quad (9)$$

The latent variable y_{ij}^{*} consists of a combination of the linear combination formula of the explanatory variable vector x_i and the estimation parameter vector β_i, and the error term ϵ_{ij}. Assuming that ϵ_{ij} follows the Gumbel distribution, the selection probability regarding the alternative *j* of the venture group *i* is given by the following formula (10).

$$Prob_{ij} = \frac{exp(x_i'\beta_j)}{\sum_{j=1}^{2} exp(x_i'\beta_j)} \qquad (10)$$

The venture group *i* may be selected repeatedly by y_{ij} number of times regarding the alternative *j* (survival or closure). Herein, the selection probability would be the selection probability of formula (10) multiplied y_{ij} times.

$$Prob_{ij}(y_{i1}, y_{i2}) = \prod_{j=1}^{2} \left[\frac{exp(x_i'\beta_j)}{\sum_{j=1}^{2} exp(x_i'\beta_j)}\right]^{y_{ij}} \qquad (11)$$

The log-likelihood function corresponding to formula (11) can each be induced as in formula (12). By applying the maximum likelihood estimation to formula (12), the parameter value can be estimated.

$$\log L = \sum_{i=1}^{n}\sum_{j=1}^{2} y_{ij} \times ln\left[\frac{exp(x_i'\beta_j)}{\sum_{j=1}^{2} exp(x_i'\beta_j)}\right] \qquad (12)$$

4. Results and Interpretation

4-1. Analytical Results on the Number of Ventures

The aforementioned hypotheses were verified by analyzing the regional characteristics and industrial characteristics of regions that affect the birth of regional ventures, and the results are shown in Table 3. This result shows the variables that have significant effects on the number of ventures in 46 industrial sectors of 16 cities and provinces nationwide. Since it accounts for 46 industrial sectors of all cities and provinces, the total number of observation is 736, of which 33 percent has 0 number of ventures. Considering this characteristic, we applied the Type II Tobit model, a model which treats the existence of a venture and the number of ventures as separate variates. Since it would be the interest of regions to have as many ventures as possible, the analyses herein would focus on the number of ventures rather than existence of a venture.

The difference between model 1 and model 2 is that model 1 uses the patent number which can be said as the absolute value of the innovation performance, while model 2 uses the patent activity index, which can be said as the relative value. The patent activity index is statistically insignificant, whereas the patent number has a significantly positive value (+) at 1 percent significance level. Therefore, it can be seen that more ventures are born from industrial sectors which produce more absolute number of patents within a region.

Table 3. Estimation results on the number of ventures using Type II Tobit model

Explanatory variable	Model 1		Model 2	
	Existence of venture	Number of ventures	Existence of venture	Number of ventures
Constant term	-3.01*** (0.96)	-69.97*** (14.44)	-3.43*** (1.03)	-88.26*** (23.67)
Number of patents	0.48*** (0.06)	11.43*** (0.78)	-	-
Patent activity index	-	-	0.03 (0.09)	0.87 (2.25)
Industrial specialization degree	0.03 (0.13)	0.66 (2.61)	0.16 (0.13)	4.17* (2.45)
Industrialization capability	0.19* (0.11)	4.59** (2.12)	-0.01 (0.10)	-0.14 (3.73)
Number of	0.06 (0.18)	1.39*** (0.53)	0.30* (0.17)	7.82*** (0.70)

conglomerates				
Patent growth rate	1.80 (2.92)	41.82 (45.43)	3.14 (2.80)	80.69 (57.71)
Industrial concentration	-0.16 (0.13)	-3.82** (1.59)	-0.17 (0.12)	-4.52** (2.09)
Industry-academic cooperation	0.78 (1.00)	18.25 (14.12)	1.25** (0.62)	34.01** (16.10)
Share of conglomerates' patents	0.36 (1.07)	8.36 (22.08)	0.46 (1.02)	11.79 (27.69)
Share of universities' patents	-1.57 (5.40)	-36.92 (110.75)	2.14 (5.60)	55.84 (156.83)
Venture capital investment amount	-	-	0.37*** (0.11)	9.69*** (1.49)
σ	-	23.58*** (0.39)	-	25.96*** (0.36)
ρ	1.00*** ($2.27*10^{-5}$)		1.00*** ($3.25*10^{-5}$)	
Log Likelihood function value	-2346.24		-2448.72	
Number of observations	736			

Note: 1) *, **, *** Are statistically significant at 10% level, 5% level, 1% level respectively.
2) Standard errors are in parentheses.
3) Variables for the number of patents and the venture capital investment amount are natural log value.

4-2. Analytical Results on the 5 Year Survival Rates

The results on using the Tobit model for estimation of the effective variables on the 5 year survival rates are as shown in Table 4. These are analytical results on industrial sectors having 5 or more ventures, and of the 16 cities and provinces nationwide, Jeju Island has been excluded since it doesn't have an industrial sector having 5 or more ventures, and thus the table shows the variables that have significant effects on the average 5 year survival rate in each industrial sector in each of the 15 cities and provinces.

The variables that have statistical significance in both models are the industrial concentration which is a regional characteristic variable and the number of conglomerates which is an industrial characteristic within a region. The fact that the estimated coefficient regarding the industrial concentration variable shows a meaningful negative (-) value at 5 percent significance level, which means that there are less ventures being born from regions specialized in a small number of industries. In addition, the fact that the estimated coefficient regarding the variable for the number of conglomerates shows a significantly positive value (+) at 1 percent significance level, which means that numerous ventures are being born in industrial sectors where conglomerates exist and thus form a value chain.

Meanwhile, the variables that have significant outcomes only in one of the two models are the industrial-academia cooperation, which is a regional characteristic variable, and the industrial specialization and the industrialization capability, which are industrial characteristics variables. Since the estimated coefficient for the industry-academic cooperation has a significantly positive value (+) at 5 percent significance level, it can be seen that more ventures are being born in regions where there are high percentage of joint research by corporations and academia. The industrial specialization and the industrialization capability have significantly positive values (+) at 1 percent and 5 percent significance levels, respectively. This means that numerous ventures are being born from industrial sectors where related companies form agglomerates and where developed technologies are effectively commercialized and thus have potential to become core industries of the region. That is because the industrialization variable in this research is the major variable which represents the connectivity of technological development activities and industrialization activities.

The fact that the estimated coefficient for the venture capital investment amount has a significantly positive value (+) at 1 percent significance level means that more ventures are being born from regions where there are much new venture capital investments. Since venture capital investments are done after ventures are born, the fact that the venture capital investment amount is high means that numerous ventures were born, which may well be an obvious outcome.

Table 4. Estimation results on the 5 year survival rates using the Tobit model

Explanatory Variable		**Tobit Model**		
		Model 1	**Model 2**	**Model 3**
Constant term		0.865*** (0.121)	0.763*** (0.137)	0.983*** (0.310)
Number of ventures		-	-	-0.021 (0.015)
Number of patents		-0.018* (0.010)	-	-
Patent activity index		-	0.043** (0.020)	0.043** (0.021)
Industrial specialization degree		-0.017 (0.018)	-0.050** (0.024)	-0.048** (0.024)
Industrialization capability		0.036* (0.019)	0.074*** (0.026)	0.077*** (0.027)
Number of conglomerates		0.002 (0.015)	-0.007 (0.014)	-0.003 (0.014)
Patent growth rate		-0.037 (0.364)	0.013 (0.364)	0.261 (0.433)
Industrial concentration		0.002 (0.012)	0.000 (0.012)	-0.003 (0.013)
Industry-academic cooperation		0.145 (0.104)	0.134 (0.109)	0.109 (0.118)
Share of patents	Conglomerates	0.100 (0.148)	0.113 (0.150)	-0.144 (0.351)
	Universities	-0.142 (0.810)	-0.334 (0.836)	-0.838 (1.198)
	SMEs	-	-	-0.773 (0.897)
	GRIs	-	-	-0.357 (0.368)
Venture capital investment amount		-	-0.009 (0.009)	0.008 (0.016)
σ		0.163*** (0.009)	0.162*** (0.009)	0.162*** (0.009)
Log Likelihood function		16.890	18.528	19.949
Observations		223		

Note: 1) *, **, *** are statistically significant at 10% level, 5% level, 1% level respectively.
2) Standard errors are in parentheses.
3) Variables for the number of patents and the venture capital investment amount are natural log value.

The estimated coefficient for the variable of the number of patents showed a significantly negative (-) value at 10 percent significance level only in the case of model 1, whereas the estimated coefficient for the patent activity index showed a significantly positive (+) value at 5 percent significance level in models 2 and 3. Such a result means that it is not that ventures in industrial sectors that merely produce numerous patents have higher survival rates but that the ventures in industries that are more active in patent activities compared to other industries have higher survival rates.

The fact that the estimated coefficient regarding the industrial specialization degree variable have a significantly negative value (-) at 5 percent significance level in models 2 and 3 means that it is difficult for the ventures in industries where related companies are concentrated to survive. This seems to be because of the severe competition having negative effects on the survival of the ventures. Finally, the estimated coefficient for the industrialization capability variable shows a significantly positive value (+) in all models. Even though the significance levels are different in each model, the industrialization capability have a significantly positive effect on the survival rate, which means that more ventures can survive in industrial sectors where the developed technologies can be effectively commercialized and thus have the potential to become core industries of the region.

Table 5 shows the result of using the Repeated Multinominal Logit model which is another method for analyzing the factors having effects on the survival rates. The results here are not so much different from those from the Tobit model, except for the following few.

The estimated coefficient for the patent activity index variable has changed to be statistically insignificant, and the patent growth rate variable and the share of conglomerates' patent variable which are regional characteristics changed to have a significantly positive value (+) at 10 percent significance level. This means that ventures survive longer in regions where innovation performance was significant recently and where there are higher share of conglomerates among the patent applicants.

Table 5. Estimation results on the 5 year survival rates using the Repeated Multinominal Logit model

Explanatory variable		**Repeated Multinominal Logit model**		
		Model 1	**Model 2**	**Model 3**
Constant term		1.558*** (0.461)	1.400** (0.673)	4.568** (1.979)
Number of ventures		-	-	-0.106** (0.054)
Number of patents		-0.129*** (0.030)	-	-
Patent activity index		-	0.131 (0.108)	0.116 (0.124)
Industrial specialization		-0.133 (0.085)	-0.292** (0.134)	-0.228 (0.175)
Industrial capability		0.184*** (0.069)	0.331*** (0.114)	0.330*** (0.122)
Number of conglomerates		0.053 (0.041)	0.025 (0.033)	0.034 (0.033)
Patent growth rate		2.418* (1.466)	1.993 (1.606)	1.848 (2.276)
Industrial concentration degree		-0.008 (0.060)	-0.006 (0.067)	-0.057 (0.068)
Industry-academic cooperation		0.700 (0.432)	0.474 (0.495)	0.472 (0.579)
Share of patents	Conglomerates	1.272* (0.697)	1.271* (0.755)	-2.364 (2.010)
	Universities	2.748 (3.941)	1.034 (4.146)	-10.721 (7.135)
	SMEs	-	-	-9.206* (4.749)
	GRIs	-	-	-2.282 (1.944)
Venture capital investment amounts		-	-0.095** (0.038)	0.059 (0.060)
σ		-	-	-
Log Likelihood function value		-2159.347	-2163.036	-2158.155
Observations		223		

Note: 1) *, **, *** are statistically significant at 10% level, 5% level, 1% level respectively.
2) Standard errors are in parentheses.
3) Variables for the number of patents and the venture capital investment amount are natural log value.

The analytical results on the number of ventures and the 5 year survival rates can be summarized as follows:

Comparing the estimation results on the industrial specialization degree variable, the industries which have an advanced cluster within the region are helpful, albeit by a small degree, to the birth of ventures, but also have negative effect on the survival of those ventures, also albeit by a small degree. Accordingly, hypothesis 1 doesn't apply.

Regarding hypothesis 2, industrial sectors where conglomerates exist within the region can be regarded as advantageous to the birth of ventures, and connecting this fact with the results that the 5 year survival rate is high in the regions having high share of patents by conglomerates, we can say that the existence of conglomerates which show active innovative performance such as patent activities is advantageous to ventures. In addition, the industries where a lot of technologies are created within the region are advantageous for the birth of ventures and ventures survive longer in regions where recent innovation performance is high. Lastly, ventures are regarded to survive longer in industrial sectors having excellent industrialization capability.

Consequently, more ventures can be born and survive longer in industrial sectors where industrialization bases are excellent and a lot of technologies are created within the region. In addition, numerous ventures are born and can survive longer in industrial sectors having conglomerates which are active in innovation activities and have good value chains. On the other hand, regions having various industries rather than 1 or 2 specialized industries can create more ventures.

5. Conclusion and Policy Implications

Regional characteristics which have significant effects include the share of conglomerates' patents, industrial concentration, venture capital investment amount, and patent growth rate etc.

Industrial concentration has a negative (-) effect on the birth of ventures, and thus the government should make polices to encourage each megacity, province, and metropolitan economic bloc to have variety of industries, rather than having them specialize in a particular sector. This means that the government should focus on variety rather than specialization, which is important at this point where green technology and convergence technology are emerging as a new issue nowadays. Of course, this should be a relevant variety and not an irrelevant variety. Silicon Valley which is transforming from a semiconductor equipment industry cluster into a solar energy equipment industry cluster, and Denmark which is advancing from an agriculture, fishing, and shipbuilding economy into a wind power turbine industry are cases in point.

In addition, since patent growth rate is one of the important variables that increase the survival rates of ventures, the government should make polices to encourage active spillover of knowledge and technologies within regions. Furthermore, considering the fact that the share of conglomerates' patents is one of the important variables that cause increase of the survival rates, the government should make conglomerates take the role of innovation creators in the region, that is the starting point in the value chain, and not a main player merely in the uppermost position in the value chain. To this end, there needs to be policies providing support for establishing joint conglomerates & SME research centers in each region.

As for local governments, policies of each region should take into account the industrial characteristics which have significant effects on the number of ventures and the 5 year survival rate.

According to the analytical results, the number of conglomerates, number of patents, and industrialization capability are the major industrial characteristics. Therefore, at the megacity and provincial level, governments should identify the industrial sectors which are active in filing patent applications, which have the necessary industrial foundations for commercializing the filed patents, which have conglomerates, and which are easy to create sound value chains, and then focus on providing support for the ventures in those industries. Consequently speaking, industrial sectors which have industrialization capabilities, at least the region's average or more number of patents, at least one large company with 300 or more employees, and the 5 year survival rate which is at least or above the region's average are the promising venture industry groups that each megacity and province should focus their support for.

Finally, considering that the industry-academic cooperation has an effect on the number of ventures, and that the number of patent applications made by universities in non-metropolitan areas is twice that of universities in metropolitan areas, it is necessary to come up with vitalizing start up from the local university. In other words, it is necessary to newly establish and strengthen education courses for entrepreneurship at the regional level. The idea of this entrepreneurship course is a 2 year graduate degree course consisting of participating in education programs in the first year and participating in corporate founding projects in the second year, and good ideas selected from the corporate founding projects would be used in actually founding such companies with financial support.

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