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Impact of Intellectual Property Promotion for Small and Medium sized Enterprises (SMEs) in South Korea: An Examination of IP Star program Impact

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Executive Summary

The creation of new processes and technology - in a word, innovation - is a powerful factor that determines the progress of economies. The creation of new processes and technology can be accelerated by Intellectual Property Rights (IPRs).

However, many Small and Medium-sized Enterprises (SMEs) do not get the most out of their use of the intellectual property, even though they represent over 90 percent of enterprises in South Korea. As a result, the Korean Intellectual Property Office (KIPO) has initiated support services for Small and Medium-sized Enterprises.

This study's main focus is to examine the impact of the IP Star program, which aims to foster the creation and utilization of intellectual property by small and medium sized enterprises. I investigates whether the IP Star program has achieved its intended goals: (1) whether the program increases the creation of intellectual property, (2) whether the policy has a positive impact on sales by the beneficiary group.

In order to assess the impact, I collect panel data which would allow the possibility of observing the before- and after-effects on individual firms as well as providing the possibility of isolating the effects of treatment from other factors affecting the outcome (Cheng Hsiao, 2006).

The panel data analysis provides the following results:

- The IP Star program is significantly associated with increased registration of intellectual property rights.
- However, the IP star program does not have a positive impact on sales.

Based on the findings, I make the following recommendations:

- Business performance should be measured by several dimensions: return on investment; growth, including increase in sales, employees or market share; and profit, including return on sales and net profit margin. For this reason, KIPO should collect these data, which enable it to assess the impact of the IP Star program on the firm's performance.
- Even though the IP Star program has a positive impact on the production of intellectual property, it does not guarantee quality.
- For this reason, the IP Star program needs to focus on how to improve the quality of new intellectual property. At the beginning of developing technology, the IP Star program can identify the intellectual property right type (Patent, Trade Secret, Utility model, etc) to protect innovation and also align it to contribute firm's goals or growth. Considering expensive litigation can have a devastating impact on small and medium sized companies, the IP Star program needs to provide an intellectual strategy to avoid litigation.

Introduction

Intellectual Property (IP) is used everywhere in the economy. It supports innovation and creativity in the market place. A well-functioning intellectual property system encourages innovation in the market. From the view point of developing countries, intellectual property protection may not bring many benefits if they cannot create and utilize their own intellectual property. At an earlier stage in economic growth, catch-up economies tend to pursue an imitation-oriented technology strategy and are passive in protecting intellectual property. However, in the later stages of economic development, as their technological capabilities grow, they start to develop a well-functioning intellectual property system (Yeekyoung Kim 2005). In the long term, a well-functioning intellectual property system provides a favorable environment for innovation and economic growth.

According to the White House, "America’s future economic growth and international competitiveness depend on our capacity to innovate. We can create the jobs and industries of the future by doing what America does best-investing in the creativity and imagination of our people" (Strategy for American Innovation, White Paper in 2011). For this reason, the United States has built an apparent 'virtuous circle' leading from Research and Development (R&D) and the creation of intellectual property rights, to innovation and competitive advantage.

These trends in the intellectual property field led intellectual property offices in many countries to develop strategic policies to support innovation and economic growth by protecting intellectual property rights and reforming intellectual property systems.

Traditionally, a national intellectual property office's functions focus on intellectual property protection and the granting of intellectual property rights. However, the Korean Intellectual Property Office (KIPO) is re-examining its role and is expanding its operations. KIPO has provided comprehensive support for Small and Medium sized Enterprises (SMEs): It operates local support centers to provide

information and consulting services, evaluating the value of intellectual property that small and medium-sized enterprises have.

IP Star program: IP support for SMEs

The IP Star program, which aims to promote the creation and utilization of small and medium-sized enterprises intellectual property, is a good example of KIPO's expanding roles. The IP Star program provides free information and consulting services for small and medium-sized enterprises about how to develop and create intellectual property. It includes analysis of technology trends in recent patents, which is aimed to help create strong and useful patents and prevent duplicate investment. To facilitate the use of existing intellectual property, this program provides subsidies for intellectual property values assessment [1] and mock-up product manufacturing. Under this program, a small and medium-sized enterprises can receive grants covering 100 percent of costs, up to a maximum of $280,000 for three years.

This program started in 2011 but there is no research on the effect of the IP Star program. While many studies have shown that intellectual property systems have positive effects on economic growth, there is apparently no research on intellectual property policy specifically for small and medium-sized enterprises. Even though there are some studies of individual companies, current academic and policy debates[2] have focused on Research and Development (R&D) spending by large firms, which is closely associated with rising profits and market values. Accordingly, less attention has been

[1] It helps small and medium sized enterprises to utilize their intellectual property. If the IP value is assessed by currency such as dollars, they can borrow money from financial institution or sell their intellectual property rights easily in the market.

[2] Rogers, 1998 "R&D and IP", Elsevier, 2006 "On patents, R&D and the Stock Market Rate of Return" Robert J. Shapiro and Nam D. Pham, 2007 "Economic Effects of IP-intensive Manufacturing in the U.S", European Patent Office and the Office for Harmonization in the Internal Market, 2013, "IP rights intensive industries: contribution to economic performance and employment in the E.U"

given to the effects of intellectual property policy for small and medium-sized enterprises.

Given many IP offices in developing and developed countries have provided comprehensive supports for small and medium-sized enterprises, the analysis of the effectiveness of this policy is necessary.

Literature Review

Background

Intellectual Property (IP) refers to creations of the mind: inventions; literary and artistic works; and symbols, names and images used in commerce. Intellectual property is divided into two categories: (1) Industrial Property includes patents, trademarks, industrial designs and geographical indications. (2) Copyright covers literary works (such as novels poems and plays), films, music, artistic works (World Intellectual Property Office (WIPO)). This paper will focus on industrial property.

Intellectual Property has characteristics of public goods in its essence: non-rivalrous and non-excludable. Consumption of it by one individual does not reduce the amount available to be consumed by another individual. For example, information in patents can be used by any party without reducing the availability of the information to anyone else.

On the other hand, the non-excludability refers to the fact that, once a technology is created, it is not possible to prevent others from using it. For example, a researcher can acquire patent protection for the design of a new drug, but cannot protect against other researchers using the ideas to develop a new and improved drug design. These characteristics can cause a free rider problem and this is why intellectual property protection is needed.

Intellectual Property Rights (IPRs) encourages the creation of such non-

rivalrous and non-excludable goods by providing temporary protection[3] or providing a legal mechanism to enforce excludability for a limited period of time.

The importance of IP in the business world

Intellectual Property (IP) is indispensable in the business world. A notable example was the case of Samsung Electronics Co. vs. Texas Instruments (TI), which involved 10 U.S patents on dynamic random access memory (DRAM) owned by Texas Instruments. This action was one of many patent infringement actions brought by Texas Instruments against Samsung when Samsung refused to renew its patent licensing agreement with Texas Instruments. After extensive litigation, agreement was reached with Samsung entering into a new patent licensing agreement worth more than 1 billion US dollars with Texas Instruments. The case became a landmark that forced Korean companies to rethink intellectual property. Samsung and other Korean conglomerates began to adopt a strategy for patent protection, including the establishment of a patent division, and encouraging researchers to invent more (Lee and Kim 2010).

When it comes to trademarks, Wal-Mart's case in South Korea can explain the importance of intellectual property protection. Wal-Mart arrived in South Korea in 1998 but could not run a business on its trademark and instead it had to operate as 'Makro' (a chain of Netherlands-based membership clubs) stores for one year, because a third party previously registered 'Wal-Mart'. After litigation that lasted a year, Wal-Mart could use its own mark. Wal-Mart in South Korea is a typical example of a global giant that has failed to localize its operations[4] in South Korea (New York Times, 2006). The failure of Wal-Mart can be attributed to no strategy of localization, but it does not

[3] Protection of patent is generally granted for 20 years, while design and trademark are granted for 10 years.

[4] Wal-Mart put off South Korean consumers by sticking to Western marketing strategies that concentrated on dry goods, from electronics to clothing, while their local competitors focused on food and beverages(New York Times, 2006).

diminish the role of intellectual property as a major force in expanding business.

Theoretical Background

Several models explaining economic growth include investments in new processes and technology as causes, where they lead to increased factor productivity, which in turn pushes forward economic growth. Creation of new process and technology can be accelerated by protection of innovation through Intellectual Property Rights (IPRs).

Nordhaus (1969) found that the protection of intellectual property, which grants innovators temporary monopoly power, enhances incentives to allocate more efforts to Research and Development (R&D) and innovation activities. Studies focusing on entrepreneurial roles find that the establishment and enforcement of Intellectual Property Rights (IPRs) create the incentives leading to entrepreneurial pursuits (R&D, investment, innovations) and in return, the enhanced entrepreneurial activity results in increased capital accumulation and productivity with positive impacts on the rate of economic growth (Park and Ginarte, 1997).

Role of IP at the Country Level

Recent empirical and theoretical studies have not yet reached a clear agreement on whether strengthened Intellectual Property Rights (IPRs) lead to more or less innovation. For example, Kortum and Lerner (2000) failed to find a close relationships between the upsurge in US patenting and the strength of intellectual property rights. Rather they found that the upsurge of patent reflects an increase in the U.S. innovation spurred by change in the management of research. Furthermore Sakakibara and Branstetter (2001) found that there is no significant evidence that strengthening of intellectual property rights contributed to innovative activities in Japan.

In contrast, cross-country studies have shown positive effects of intellectual property rights. Gould and Gruben (1996) found that Intellectual Property Rights (IPR)

affect economic growth through the mechanisms of international trade and Foreign Direct Investment (FDI). Kanwar and Evenson (2003) show that intellectual property rights have a positive impact on research and development (R&D) investment and conclude that stronger intellectual property rights protection can help to drive technological progress, which in turn positively impacts economic growth. In addition, Schneider (2005) found that stronger patent rights had positive effects on US patent filings; while for developing countries, patent protection had either a negative or insignificant influence on infrastructure and Foreign Direct Investment (FDI).

Intellectual property protection and establishment do not have positive effects on every country. The economic effects of intellectual property rights may depend on the level of economic development and technological capabilities (Lerner, 2003; Lall, 2003). These findings are consistent with the view that developing countries engage in imitation rather than innovation and may be less likely to benefit from intellectual property rights protection (Falvey, Foster, and Greenaway, 2006).

Role of IP at the Firm Level

The conventional economic growth theory[5] can be also applied at the firm level. Research and Development (R&D) performed by business results in new goods and services, higher quality of output and new production processes. Intellectual property rights have a significant impact on research and development (R&D) (Kanwar and Evenson, 2003) and investment in R&D generally has a positive effect on productivity at the firm level (Griliches and Mairesse, 1984).

In a recent study, Shapiro and Pham (2007) found that America's most productive manufacturing industries, such as pharmaceuticals, were the ones that invested the most in research and development (R&D). They found a strong correlation

[5] The endogenous economic growth theory(Solow, 1957; Romer, 1990; Grossman and Helpman, 1991) identified technological changes and knowledge spillovers as the substantial source of economic growth.

between research and development (R&D) expenditure and productivity (value added per employee).

However, Bessen and Maskin (2000) found that if the characteristics of innovation in developing countries are cumulative rather than radical, intellectual property protection could discourage research and development (R&D) incentives and thus decrease innovation in developing countries. Lall (2003) found that newly industrialized countries in Asia moved to strong intellectual property rights regime after accumulating their innovation capabilities through imitation during early stages of weak intellectual property rights. For this reason he argued that a weak intellectual property rights system provides local companies with opportunities to build technological capabilities by imitating and catching up.

In a recent study of South Korean firm, Lee and Kim (2010) found that firms of different capability levels tend to show varying attitudes and strategies toward intellectual property management and utilization. Blind at al. (2006) analyzed the role of patenting to protect intellectual property based on a sample of German companies in patenting. They found that large companies set up their own independent patenting or intellectual property organization to engage in active patenting activities while smaller companies do not. Furthermore, Song and Shin (2006) showed that intellectual property rights are barriers for the growth of smaller firms, considering that relatively larger companies conduct collaborative R&D and this leads them to use Intellectual Property Rights (IPRs) effectively in their innovations (Park, 2006).

In sum, intellectual property rights have positive effects on entrepreneurial pursuits (R&D, investment, innovations) and these activities can affect economic growth. However, the economic effects of intellectual property rights vary according to the level of economic development and technological capabilities.

Why SMEs

This paper will focus on small companies because they are very concerned with intellectual property rights especially when they are starting to develop a technology. They also do not have sufficient resources and information to deal with intellectual property issues such as creation, utilization and how to deal with litigation.

In most countries, Small and Medium-sized Enterprises (SMEs) represent over 90 percent of enterprises. Small and Medium-sized Enterprises (SMEs) are often the driving force behind a large number of innovations and contribute to the growth of the national economy through employment creation, productive investments and value-added exports. However, many Small and Medium-sized Enterprises (SMEs) do not get the best out of their use of the intellectual property system. As a result, over the years, an increasing number of national IP offices have initiated or improved their outreach and support services for the Small and Medium-sized Enterprises (SMEs) (Guriqbal Singh Jaiya, 2009).

Research Design

This paper examines the impact of the IP Star program, which aims to foster the creation and utilization of intellectual property by small and medium sized enterprises. It investigates whether the IP Star program has achieved its intended goals: (1) whether the program increases the creation of intellectual property, which is measured by the number of intellectual property registration, (2) whether the policy has a positive impact on sales by the beneficiary group.

Since the IP Star program has specific policy targets and identifiable program participants, I statistically compare the program beneficiaries and a comparison group to evaluate the IP Star's impact.

The primary challenge for my analysis is to take account of two systematic selection mechanisms. First, companies choose whether or not to apply for the IP Star program. It is reasonable to assume that companies applying for the IP Star program

may be different both in their potential to produce intellectual property and their potential sales from those that do not apply. Second, among the companies that apply for the IP Star program, KIPO selects program participants in a non-random fashion.

KIPO select firms among applicants on the following basis: (1) the firm should be small and medium sized enterprises; (2) the number of employee should be over five; (3) judges examine the company's financial health, sales, and main product on the basis of the company's application. With these procedures, KIPO tends to select motivated firms which are interested in intellectual property or have financial soundness.

To account for these two selection mechanisms, I will create a control group (140 firms) that will match the treatment group (the IP Star program recipients) on relevant criteria to compare the difference between participants and non-participants. The criteria to collect data of the control group will be (1) firm's size, which is measured by the number of employee, (2) whether the business sector is the same or not.

Secondly, I collect panel data. Evaluating the effectiveness of certain programs using a cross-sectional sample typically suffers from the fact that those receiving treatment are different from those not receiving in. Any apparent difference between the treatment group and control group could be a result of two sources of biases, selection bias due to differences in observable factors between the treatment and control groups and selection bias due to endogeneity of participation in treatment.

However, if panel data over this time period are available, it would allow the possibility of observing the before- and after-effects on individuals as well as providing the possibility of isolating the effects of treatment from other factors affecting the outcome (Cheng Hsiao, 2006). I track the IP Star program beneficiary companies over time and utilize individual company histories of number of intellectual property and volume of sales. Before the IP Star program, the beneficiary companies are included in non-treatment group, which enables me to isolate the effects of treatment.

Lastly, I can control for certain types of omitted variables called unobserved heterogeneity such as a motivation, difference in business practice, cultural aspects of firms by analyzing panel data. If unobserved individual specific characteristics affect the outcome variable, and are correlated with predict variables, simple regression analysis does not identify the parameters of interest. For the estimation of coefficients on variables which vary over time, panel data provide a solution to this problem, and a number of straightforward estimators are available (Hsiao 1986; Wooldridge 2002).

Hypotheses

(1) Participation in the IP Star program is positively associated with the number of intellectual property rights registrations.

(2) Participation in the IP Star program is positively associated with sales volume.

Data collection

I use panel data analysis to test the linkage between increase of intellectual property rights and sales and the IP star program. For the analysis, I collected data on individual companies (140) from 2007 to 2014 from the Small and Medium Sized enterprises Information System (SMIS) and the Korean Intellectual Property Rights Information Service (KIPRIS) database.

Variables

The two dependent variables are the number of intellectual property rights registrations and the sales volume (in Korean Won). The main explanatory variable is a program dummy variable. To control for other factors that could influence the dependent variables, this paper includes other control variables such as the age of the company, region, and whether the firm received other government support.

The age of a company can affect its performance. Older firms tend to build good network business partners and customers, and have good relationship with financial institutions. Firm age represents the experience of firms in the industry which

is the influential factor for firm success (Takalashi, 2009; GEM, 2010).

Considering that the capital region (which includes Seoul, its surrounding Gyeonggi province, and the Incheon metropolitan city) in South Korea compromises nearly 50 percent of the total South Korean population, whether firms are located in the capital region can affect the firm's business.

If a firm received support from another government's program, the impact of the IP Star program can be misinterpreted. Since small and medium sized enterprises have received government supports[6] in South Korea, other government supports other than the IP Star program can affect the firm's success. A description of the variables may be found in Table 1.

Table 1 Variables

Dependent Variables	Explanatory Variables	Reason	Measure	Hypothesized Relationship
Number of IP Registration	Company Age	Firm age represents the experience	years	Positive
	Capital Region	Capital region compromises 50 percent of the total population	Dummy variable	Positive
	Business sector	IP intensive sector such as bio, communication tend to be more active on IP	Sector code	Positive
	Other Program	Other government program can affect firm's business	Dummy variable	Positive
	IP Star Program	IP Star Program aims to foster the creation of IP	Dummy variable	Positive
Sales	Company Age	Firm age represents the experience	years	Positive
	Capital Region	Capital region compromises 50 percent of the total population	Dummy variable	Positive
	Other Program	Other government program can affect firm's business	Dummy variable	Positive
	IP Star Program	IP Star Program aims to foster the creation of IP	Dummy variable	Positive
	Business sector	Business sector can affect sales	Sector code	Positive

[6] Article 3 of Framework Act on small and medium enterprises articulates in South Korea as follows: "The Government shall establish and implement a fundamental and comprehensive policy for small and medium businesses, which fits for the peculiarities of each region considering innovative capacity, competitiveness level, and growth potential of small and medium businesses."

Models

I use a Fixed Effects and Random Effect model in order to assess the impact of the IP Star program. The participants for the IP Star program may have more motivation for gaining intellectual property or they may have a unique ability such as unique practice of business than non-participants. Since this factor cannot be observed and can affect other variables such as participating the IP Star Program and other government program, my model should be designed to control for these variables.

I assume that something within the individual company may affect or bias the predictor variables because each company has its own individual characteristics that may influence the predictor variables. For this reason, I use a Fixed Effects model to control unobservable omitted factors. The models are specified as follows:

Model 1: $\textbf{The number of intellectual property registrations}_{it} = \alpha + \beta_1 \text{IP Star}_{it} + \beta_2 \text{Age of Company}_{it} + \beta_3 \text{Region} + \beta_4 \text{Other Program}_{it} + \beta_5 \text{Business sector} + \gamma_i + \gamma_t + \epsilon$

Model 2: $\textbf{Log Sales}_{it} = \alpha + \beta_1 \text{IP Star}_{it} + \beta_2 \text{Age of Company}_{it} + \beta_3 \text{Region} + \beta_4 \text{Other Program}_{it} + \beta_5 \text{Business sector} + \gamma_i + \gamma_t + \epsilon$

where $\text{the number of intellectual property registration}_{it}$ and sales_{it} are the dependent variables, given i and t. The dimensions i and t are individual company and time. γ_i is the individual company fixed effects, while γ_t is a time fixed effects. ϵ is an error term.

Summary Statistics

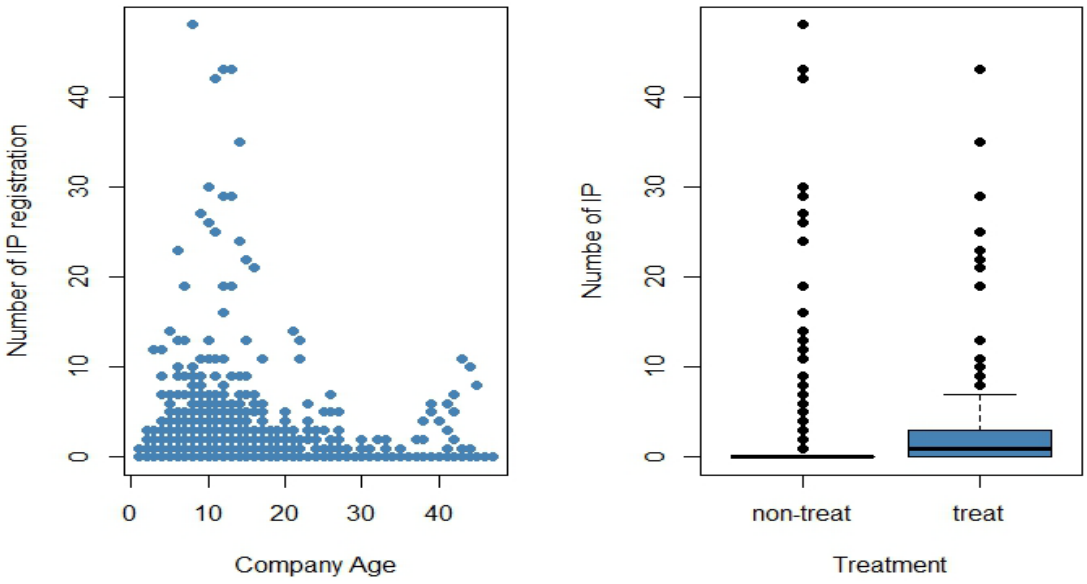
A summary of each variable may be found in Table 2.

Table 2 Summary Statistics

Variables	Mean	Min	Max	St.dev
Year	2011	2007	2014	2.28
Number of IP Registration	1.01	0	48	3.27
Log Sales[7]	8.45	-4.60	12.09	1.57
Company Age	16.61	4	47	8.01
Business Sector	52.5	1	104	50.79
Other Government Program, Capital Region, and IP Star program are dummy variables				
N=2206 observations on 280 firms; Missing data 325 in Sales				

I collected panel data on number of intellectual property (IP) registration and Sales. The follow figures are showing two variables (Number of IP registration against Company Age and the IP Star program) in comparison with each other. I can figure out that there might be no relationship between Number of IP registration and Company age in Figure 1, while there might be some difference between treatment group and non-treatment group because the means of two groups are different. In the Figure 1, the mean of non-treatment group is 0.645 while the mean of treatment group is 2.076.

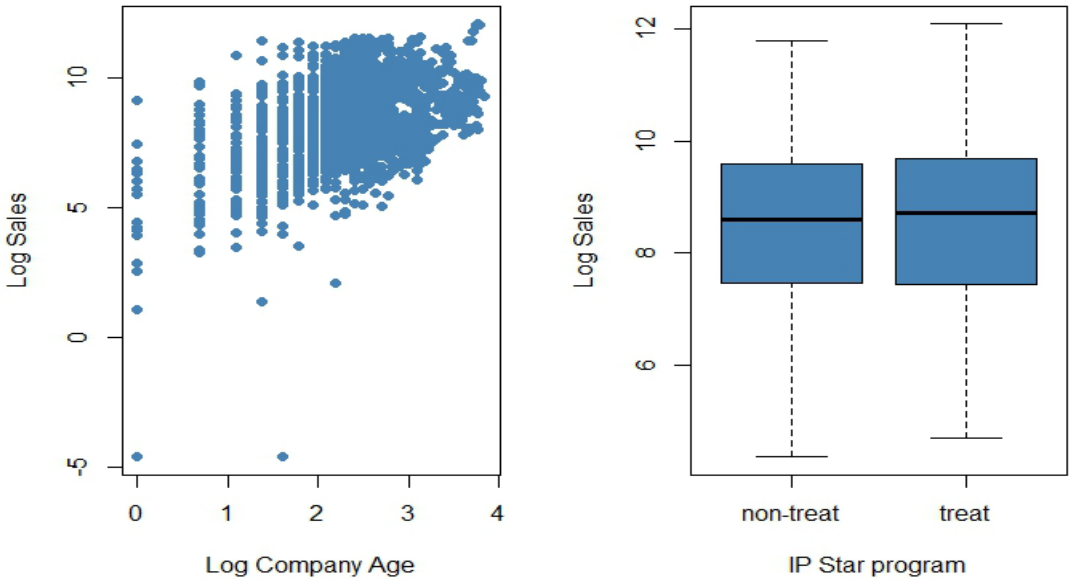
<Figure 1: Number of IP registration plotted against company age and IP Star program>



[7] I transform the Sales by log to correct the positive skew and downsize the scale.

The scatter plot in following figure 2 is illustrating the log sales has positive relationships with log company age (This time I try to correct the positive skew by log-transforming Sale and Company age data). It is consistent with that older firms have already built a good reputation in the market and company age represents the experience of firms in the industry which is the influential factor for firm success (Takalashi, 2009; GEM, 2010). However the box plot illustrates that participant group is not different with non-participant group in sales. In the Figure 2, the mean of non-treatment group is 8.433 while the mean the of treatment group is 8.545. The result of t-test shows there is no difference between two groups (p-value is 0.2147).

<Figure 2: Log Sales plotted against log Company Age and IP Star program>



Results of Model 1

The panel data model utilized for this paper includes Fixed Effects and Random Effects model. The analysis begins with first testing to determine which model is most appropriate.

As I mentioned before, the participants for the IP Star program may have more

motivation for gaining intellectual property. I assumed that something within the individual company may affect outcome variables (Number of IP registration and volume of sales) and also tend to correlated to participate in the IP Star program. In short, characteristics of the IP Star program beneficiary group are correlated with dependent variables and independent variables. For this reason, I use a Fixed Effects model even though a Hausman test for fixed effects versus random effects model shows a non-significant difference[8].

Results[9] show that the IP Star program is associated with a higher number of intellectual property registrations (see Table 3). Since the IP Star program aims to help firms to create intellectual property and to register their intellectual property providing consulting and subsidy, this program has a positive impact on gaining intellectual property rights.

Company age is not significant statistically with a higher number of intellectual property registrations (see Table 3). Just because older firms tend to build good network business partners and customers, and have good reputation in the market, these characteristics do not necessarily affect gaining intellectual property rights.

Table 3 Estimating intellectual property registration

	Estimate	Std. Error	t-value	P-value
Age	-0.035	0.025	-1.405	0.160
Other program	0.077	0.162	0.480	0.630
Business Sector	0.076	0.231	0.331	0.740
IP Star Treatment	1.179	0.162	7.261	<0.001***

R-Squared : 0.033865 F-statistic: 16.8339 on 4 and 1921 DF, Region dropped

[8] Hausman tests were attached in Appendix. I will use Fixed Effects model because selection effects are primary challenges in this paper and Fixed Effects model can control these unobservable factors.

[9] The results were attached in Appendix.

Results of Model 2

Results presented in Table 4 show that the IP Star program is not associated with the volumes of sales. This is because the program aims directly the creation of intellectual property and increase of sale might be long-term outcome. Estimation shows negatively because the sale was transformed by log (The estimation without log is positive).

On the other hand, the company age is associated with the volumes of sales. This result supports the notion that older firms tend to be more successful because of good network business partners and customers and good reputation in the market.

Other remaining independent variables, returned non-significant effects results. These results were not only significant but they were in the opposite direction as originally hypothesized.

In response to the high level of concentration of population and economy in the metropolitan region, the decentralization has been initiated and implemented since 1991. This reform cannot be overlooked. The firm's region is not important for their sales considering above decentralization.

Table 4 Estimating volume of sales

	Estimate	Std. Error	t-value	P-value
Age	0.135	0.009	14.387	<0.001***
Business sector	0.010	0.103	0.097	0.922
Other program	-0.075	0.051	-1.461	0.144
IP Star Treatment	-0.023	0.052	-0.438	0.661
Capital Region	dropped			

R-Squared: 0.16628 F-statistic: 79.6274 on 4 and 1597 DF

Limitations

First, time was a limitation because the Small and Medium Sized enterprises Information System (SMIS) did not provide sales data for 2014. Since the impact of government policy will take time in the final outcome, it will be hard to identify the program's impact unless very detailed data on the confounding factors is collected over a long period. The increased sales due to the IP Star program might be realized over time and therefore not appear in my short time series.

At the same time, a firm's success can-not be measured by only the volume of sales. Business performance can be measured by several dimensions. Murphy, Trailer and Hill (1996) examined 51 published entrepreneurial studies using performance as the dependent variable and found that the most commonly considered dimensions of performance were related to efficiency, growth and profit. Efficiency comprises some financial measures like return on investment and return on equity; growth focuses on increase in sales, employees or market share; and profit includes return on sales and net profit margin (Simon Radipere, Shepherd Dhliwayo, 2014). Therefore, KIPO should collect these data to analyze the impacts on the ultimate long term outcome, business success.

This paper did not consider the quality of intellectual property. The quality of intellectual property is defined as whether the legal requirements are met, in particular the novelty, inventiveness, and practical applicability (Scotchmer, 2004, Wagner, 2009, Graf, 2007). Other definition is focus on contribution to community. High quality patent is prosperous to ultimately be commercialized and brings social and economic welfare (Dan, 2012). This paper defined the patent quality as the degree of meeting the legal requirements. The degree of meeting the legal requirements is a prerequisite for a success in the market.

Generally the quality can be measured by two factors: (1) how often patents are cited as prior art in other patents and research; (2) the commercial value underlying the invention can be measured by how much broad the right enforces

against third parties and possibility of its use and the scope of the use (Sara-Jayne Adams, 2008).

However, I simply collected the number of intellectual property registration in given time periods. Low patent quality can lead to expensive litigation that can have a devastating impact on business, especially of small and medium sized companies. As valuations of companies are increasingly based on intangible assets, poor-quality intellectual property rights have negative impacts on market economies rather than providing incentives to innovation (Sara-Jayne Adams, 2008).

In this context, even if the IP star program has a positive impact on the number of intellectual property registration, it does not mean that the IP Star program helps firms to have good quality intellectual property rights.

Conclusion and Recommendations

This paper has described IP promotion policy, especially the IP Star program implemented by Korean Intellectual Property Office (KIPO) and examined its impact. The results show that the IP Star program is significantly associated with the number of intellectual property registration but the IP Star program was not associated with sales of the beneficiary group.

The interpretation of results should consider this paper's limitations: incomplete panel data (unbalanced panel data), business success should be measured by various dimensions, and this paper could not consider the quality of intellectual property rights.

A future study should be designed to overcome these limitations. KIPO has not set up a procedures to evaluate the IP Star program. First, KIPO did not store data of companies that applied but failed to participate in the program. These data will be a comparison group because these companies have similar motivations to the beneficiary group. Second, KIPO has not collected various dimensions data related to

firm's performance such as return on investment, market shares, etc, which enables it to assess the impact of the IP Star program on the firm's performance.

These data can be gained from some companies[10] that provide firm's information. KIPO can track the beneficiary group for a long time by collecting various dimension data and analyze the impact of the program on business performance.

Quality of intellectual property rights determines the value of the rights and is a precondition for a success in the market. In these contexts, KIPO needs to focus on how to improve the quality of intellectual property.

At the beginning of developing technology, the IP Star program can identify the intellectual property right type (Patent, Trade Secret, Utility model, etc) to protect innovation and also align it to contribute firm's goals or growth. After creation of technology, the program can provide legal services how to get rights in time manner (Present the IP Star program focuses on these services). Lastly, considering expensive litigation might have a devastating impact on small and medium sized companies and the high invalidation rate[11] of patent, this program needs to provide an intellectual property strategy to avoid litigation and to strengthen legal services to minimize litigation.

Within limitations, this paper has tried to examine impacts of the IP Star program and found that the program is associated with increase of intellectual property rights. Current academic and policy debates have focused that R&D spending by firms is closely associated with rising profits and market values. Accordingly, less attention has given to the effects of IP policy for small and medium sized enterprises. This is one of the aspects in this field of research to which this paper contributes.

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[10] KISLINE(www.kisline.com) is a good example in South Korea. This site provides business information, financial information, sale, employer and employee, etc.

[11] Invalidation rate of patent by appeal board of KIPO varied between 50.5% in 2006 and 60.1% in 2009 (source: Korean Intellectual Property Office)

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Appendix

1. Model 1 (Dependent variable: No. of IP)

- **Fixed Effects Model**

Oneway (individual) effect Within Model
Unbalanced Panel: n=280, T=4-8, N=2205

Residuals				
Min.	1st Qu.	Median	3rd Qu.	Max.
-22.4000	-0.4680	-0.0532	0.1240	26.8000

Coefficients				
	Estimate	Std. Error	t-value	Pr(>|t|)
Age	-0.035	0.025	-1.405	0.160
Other program	0.077	0.162	0.480	0.630
Business.sector	0.076	0.231	0.331	0.740
Treatment	1.179	0.162	7.261	5.538e-13 ***

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1
Total Sum of Squares: 8914.3 Residual Sum of Squares: 8612.4
R-Squared : 0.033865 Adj. R-Squared : 0.029504
F-statistic: 16.8339 on 4 and 1921 DF, p-value: 1.4258e-13

■ Random Effects Model

Oneway (individual) effect Random Effect Model (Swamy-Arora's transformation)

Unbalanced Panel: n=280, T=4-8, N=2205

Effects:			
	var	std.dev	share
idiosyncratic	4.483	2.117	0.432
individual	5.889	2.427	0.568

theta					
Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.600	0.705	0.705	0.703	0.705	0.705

Residuals :					
Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
-14.900	-0.5280	0.528	0.001	-0.021	31.000

Coefficients :				
	Estimate	Std. Error	t-value	Pr(>|t|)
(Intercept)	-0.041	0.735	-0.056	0.955
Age	-0.020	0.015	-1.375	0.169
Other program	0.086	0.161	0.536	0.591
Business.sector	-0.002	0.005	-0.439	0.660
Region	-0.116	0.322	-0.360	0.718
Treatment	1.166	0.137	8.483	<2e-16 ***

Signif.: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1
Total Sum of Squares: 10197 Residual Sum of Squares: 9850.3
R-Squared : 0.033984 Adj. R-Squared : 0.033892
F-statistic: 15.4718 on 5 and 2199 DF, p-value: 5.5325e-15

■ Hausman Test for Model 1

Hausman Test

data: Y ~ X
chisq = 4.9206, df = 4, p-value = 0.2955
alternative hypothesis: one model is inconsistent

2. Model 2 (Dependent variable: Log Sale)

■ Fixed Effects Model

Oneway (individual) effect Within Model
Unbalanced Panel: n=280, T=3-8, N=1881

Residuals :

Min.	1st Qu.	Median	3rd Qu.	Max
-8.200	-0.201	0.022	0.2360	5.260

Coefficients :

	Estimate	Std.Error	t-value	Pr(>|t|)
Age	0.135	0.009	14.387	<2e-16 ***
Business.sector	0.010	0.103	0.097	0.922
Other program	-0.075	0.051	-1.461	0.144
Treatment	-0.023	0.052	-0.438	0.661

Total Sum of Squares: 771.98 Residual Sum of Squares: 643.62
R-Squared : 0.16628 Adj. R-Squared : 0.14117
F-statistic: 79.6274 on 4 and 1597 DF, p-value: < 2.22e-16

■ Random Effects

Oneway (individual) effect Random Effect Model (Swamy-Arora's transformation)
Unbalanced Panel: n=280, T=3-8, N=1881

Effects:

	var	std.dev	share
idiosyncratic	0.403	0.634	0.188
individual	1.736	1.317	0.812

theta :

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
0.732	0.820	0.820	0.817	0.820	0.832

Residuals :

Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
-9.010	-0.247	0.049	0.002	0.329	4.510

Coefficients :

	Estimate	Std.Error	t-value	Pr(>|t|)
(Intercept)	7.063	0.362	19.489	< 2e-16 ***
Age	0.103	0.006	14.933	< 2e-16 ***
Business.sector	0.004	0.002	1.702	0.088
Other program	-0.081	0.052	-1.553	0.120
Region	-0.082	0.171	-0.482	0.629
Treatment	0.076	0.048	1.596	0.110

Total Sum of Squares: 893.21
Residual Sum of Squares: 768
R-Squared : 0.14075 Adj. R-Squared : 0.1403
F-statistic: 61.1365 on 5 and 1875 DF, p-value: < 2.22e-16

■ Hausman Test for Model 2

Hausman Test

data: Y ~ X
chisq = 0.9057, df = 4, p-value = 0.9237
alternative hypothesis: one model is inconsistent