

The Difference in the Determinants of Licensing-in and Licensing-out: Evidence from Korean Firms^{*}

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Abstract

Purpose – This paper aims to analyze the determinants of licensing behaviors of manufacturing firms empirically in non-advanced exporting countries.

Research design and methodology – We try to approach licensing behavior from the perspective of innovation strategy and open innovation, and deal with two activities composing licensing, i.e. licensing-in and licensing-out using the result of Korean Innovation Survey

Results – Firstly, Organizational characteristic factors, particularly the size and size related factors influence the firm behavior of licensing-out, but not in case of licensing-in. Secondly, innovation strategy influences the firm behavior of licensing-in, but not in case of licensing-out. Lastly, the determinants of licensing-in and that of licensing-out are different.

Conclusions – In general, firms doing licensing-out have many complementary assets and orientation for global markets. Meanwhile, firms doing licensing-in are innovative firms utilizing patent as an appropriation mechanism. Licensing-out have relevance with product market-related factors and licensing-in have more relevance with technology market-related factors

Keywords: Licensing-in, Licensing-out, Innovative strategy, Organizational factor, Open innovation, Technology market.

JEL Classification Code: O3, M1.

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1. Introduction

As the technological uncertainty and market uncertainty has been increasing, the complexity of technological innovation has increased at the same time. Therefore, it is imperative for technological innovator not to do everything about technological innovation within a single organization, but to utilize the available network surrounding it. These processes make understanding on diverse network-related activities and the effective utilization of network more important than before. With this trend, the technology market and licensing as one of essential ways of transaction within that market has gained more importance (Arora et al, 2001; Anand & Khanna, 2000, etc.). In this way, technology licensing has increased considerably worldwide following a greater emphasis of company strategies on technology exchange through arms-length market transactions, strategic alliances, or cross-licensing agreements (Gambardella et al, 2007). In addition, licensing has been gaining importance in complementing in-house R&D capabilities and accelerating innovation processes in Europe (Sheehan et al, 2004).

Technology market and the proliferation of licensing can impact on how to do technological innovation, and its related behavior. It leads to argument urging the assertive utilization of it. The discussion on open innovation (Chesbrough, 2003; 2006) is typical argument that technological innovation strategy should be designed considering the technology market and licensing.

The effect of licensing can be summarized as follows (Zuniga & Guellec, 2009). It has been related to broad changes in the modes of innovation, globalization and strengthened market competition. A new organization of industrial research has emerged, less centered on the individual firm, more based on networks and markets, and relying more on new entrants and technology-based firms. Innovative firms are increasingly dependent on external sources of knowledge rather than conducting in-house research. Intensified competition, shorter product life-cycles and expanded technological opportunities force businesses to innovate more rapidly and focus their R&D expenditures, hence requiring privileged and rapid access to complementary new knowledge from the public and business sectors. Financial, regulatory (e.g. strengthening of intellectual property rights worldwide) and organizational changes have further boosted technological transactions and fostered development of markets for technology that are often mediated by the exchange or sale of licenses for patented technologies. This led to the change in innovative environment, which is mainly separation of product space and technology space (Lee et al, 2003).

Despite the importance of licensing, the researches and discussions seem to be scarce, and stay at the level of conceptual discussion and description of anecdotes (Zungia & Gullec, 2009). It may hinder the effective understanding on the changing way to do innovation, and its environment as the trend for the growth of patenting and licensing foreshadow the change in firms' strategy. In addition, both licensing, outward licensing and inward licensing has not been dealt with simultaneously, even though both licensing composes the licensing behavior of firms and may be determined from the criterion which are not completely independent from each other. This paper tries to address these gaps with considering both licensing with an aim to enhance the understanding on licensing.

With the development of licensing, it is necessary to consider both product market and technology market simultaneously, when firms try to develop its proper innovation strategies. From this perspective, there can be two issues regarding licensing behavior. First, regarding the determinants of both licensing, there can be different behavior depending on the emphasis given to each market. While some companies can give an equal importance to both markets, other companies can give a unilateral meaning to one of both markets. The meaning of the determinants of each licensing should be analyzed from this perspective in order to enhance the understanding on the relationship between licensing behavior and innovation strategy. Second, from the perspective of open innovation, outward licensing and inward licensing must be done consistently from the business strategy. It is because the concept of open innovation is in fact nothing but building business model utilizing the inward licensing and outward licensing.

From this perspective, this paper tries to analyze the determinants of licensing behaviors of Korean manufacturing firm empirically in order to increase knowledge on the technological licensing and networking through it in non-advanced exporting countries. In specific, we try to approach licensing behavior from the perspective of innovation strategy and open innovation, and analyze two activities composing licensing, that is, licensing-in and licensing-out to identify the possible difference between both determinants using the result of *Korean Innovation Survey*.

The organization of this paper is as follows. Section 2 reviews previous work and sets working hypotheses. Section 3 describes the data and methodology. Section 4 represents the results of our analysis. Lastly, Section 5 makes concluding remarks.

2. Theoretical Consideration

With the rising importance of technology market, it is inevitable to consider two markets, product market and technology market simultaneously, in order to set an effective business strategy, particularly in technology-based firms. It is because the competition field has expanded from just product market to both product market and technology market. Now product market applications and licensing agreements are considered equivalent technology commercialization channels (Lichtenthaler, 2010).

Table 1: Selective previous discussion

Major theme	Selected Papers
Theoretical discussion	Arora, Fosfuri and Gambardella (2001a), Arora, Fosfuri and Gambardella (2001b), Arora (1995), Arora and Ceccagnoli (2006), Arora and Fosfuri (2003)
Empirical study at transaction level	Anand and Khanna (2000), Vonortas and Kim (2004), Gambardella et al (2007)
Empirical study at firm level	Zuniga and Gullec (2009), Pitkethly (2001), Fosfuri (2006), Motohashi (2008), Lichtenthaler (2010)

Previous discussion on licensing which mainly focused on the outward licensing can be distinguished between conceptual discussion and empirical one (<Table 1>). Conceptual discussion has been done in a series of work done by A. Arora, A. Gambardella and A. Fosfuri. They are trying to analyze the economic rationale for individual firm to participate in licensing activities in terms of its impact on its profit. Two important factors are identified, considering the existence of product market and technology market. That is, the revenue effect and rent dissipation effect. Conceptually licensing can impact on the profit of licensor in terms of these two effects, and their relative magnitude can function as an economic incentive.

The revenue effect means the revenue licensor can get in the form of licensing fee received. Rent dissipation effect means the loss of profit due to competition made by the entry of licensee into the product market. Revenue effect depends upon the transaction costs and the relative power for negotiation between licensor and licensee. Regarding rent dissipation effect, the level of product differentiation can affect the magnitude of the effect. If product is highly differentiated, licensing makes it higher the possibility that licensee can be a strong competitor against the licensor rather than other firms. It may enhance the rent dissipation effect and undermine the profitability of licensing. Therefore, licensing tends to be done more frequently if the degree of differentiation is lower. In other words, the number of licenses per patent holder decreases with the degree of product differentiation. In addition, rent dissipation effect is also contingent upon the productive capacity and commercialization capability of licensors (Arora et al 2001; Arora & Fosfuri, 2003; Arora & Ceccagnoli, 2006)

Meanwhile, most of the empirical studies focused on the empirical case studies on the way of licensing in concrete industry such as chemical industry and semiconductor industry. There have come analyses on the determinants of licensing transaction itself, and the licensing behavior of firms with the attempt to gather a large scale of data. That attempt can be seen typically in the work of Zuniga and Guellec (2009) which have done a large survey for around 600 European firms and around 1600 Japanese firms, and summarized the results. It is shown that around 1/5 European firms and 1/4 Japanese firms are doing licensing activities. At the same time, the relationship between firm size and possibility of licensing takes a form of U, and major barrier to licensing is informational one to identify the proper partners. In the past, Anand and Khanna (2000) analyzes the cross-industrial differences in several contractual features such as exclusivity, cross-licensing, ex-ante versus ex-post technology transfers, and licensing to related versus unrelated parties, using US database, and finds that licensing is most important in the chemicals, computers, and electronics industry. Vonortas and Kim (2004) is the typical studies analyzing the characteristics of licensing transaction itself using commercial database in which licensing contract is registered. They are analyzing the market size and recent change in it, the characteristics of relevant firms and their incentive, and the role of licensing in the process of technological diffusion.

The analysis on the licensing behaviors at firm level is done in Pitkethly (2001), Fosfuri (2006), and Motohashi (2008). Motohashi (2008) as a recent work try to analyze the IP strategy of Japanese firms as a way for maximizing the revenue, utilizing the model developed by Arora and Fosfuri (2003). They find that there is non-linear relationship between firm size and licensing propensity, and small firms lacking complementary assets has higher possibility of licensing, and at the same time, licensing propensity of large firms is due to their cross-licensing propensity. Lichtenthaler (2010) distinguish proactive licensing, which refers to identifying recipients for

technology transactions, and reactive licensing, which relates to offering licenses to infringers of a firm's intellectual property and try to analyze the determinants focusing on external factors such as the strength of patent regime, technological turbulence, transaction frequency and competitive intensity.

It seems that existing theoretical and empirical literature focuses on the motivation of licensing with the emphasis on the relation with market. And they are done independently from business strategy, particularly the overall innovation strategy. Therefore, the licensing behavior is taken as just a one-shot object of decision making without the relationship with long-term strategy. As indicated, the importance and the role of licensing in technological innovation have grown increasingly these days. It is reflected in the plentiful discussion surrounding the concept of open innovation mode. With this trend, the licensing behavior can be determined from the perspective of technological innovation. Therefore, it is necessary to approach licensing behavior from the perspective of innovation strategy.

In addition, extant researches focus just on the behavior of licensing-out. But, the behavior of licensing-out and that of licensing-in should be regarded as integrals, from the perspective of open innovation. While the decision on licensing-in is related to the area of acquisition of technology, one on licensing-out has something to do with the utilization of technology. For consistent technology strategy to be made, the way of technology acquisition should match that of technology utilization. From the perspective of open innovation planning to maximize the potential of technological advantage utilizing the internal and external technology simultaneously, licensing-in and licensing-out should be formed as a kind of packages to be effective conceptually. However, actual process might have different criteria for each behavior. In case of licensing-in there is the issue of complementarity versus substitutability with relation to the firms' internal R&D efforts, different from the revenue issue about licensing-out. With relation to industry difference, it is shown that pharmaceutical companies are usually focusing on inward licensing while chemical and ICT companies are relatively heavier users of cross-licensing (Sheehan & Guellec, 2004). From the perspective of open innovation, the licensing in and licensing-out might be consistent.

We try to approach both licensing from the perspective of innovation strategy and organizational characteristics. The typical determinant of licensing found in previous literature is the organizational characteristics, which mainly are related to the firm size, similar with the discussion about the innovativeness and the firm size, so-called Schumpeterian hypotheses. From the theoretical perspective, small firms are more likely to do licensing to other firms. New technology-based firms (NTBFs) often lack the financial resources and complementary assets like a large sales force to introduce a product successfully to the market. In the case of a strong appropriability regime, contractual modes such as licensing agreements are recommended for small firms to profit from technological innovation (Teece, 1986). As a result, it can be observed that young firms frequently rely on alliances with larger partner firms and use licensing agreements to exploit technological innovation (Kollmer & Dowling, 2004). According to Kollmer and Dowling (2004), while fully integrated firms out-license non-core products because of a misfit with their overall strategy before the marketing and sales phase, not-fully integrated firms such as NTBFs use licensing as their major commercialization channel at their firm's maximum integration level.

Firms lacking adequate downstream commercialization (production and marketing) capabilities are naturally more aggressive licensors. But at the same time, their presence induces more aggressive licensing by their larger rivals with commercialization capabilities as well (Arora & Fosfuri, 2003). Meanwhile, the large firms are less likely to license their technologies. There are two related reasons. The first one has to do with size *per se*, and, the second reason is that large firms are integrated, and typically own the complementary assets for innovation (Gambardella et al, 2007).

Gambardella et al (2007) analyze the determinants of patent licensing at patent level, using PatVal-EU dataset. Its findings are as follows. The most important effect on the probability of licensing is by far the size of the firm. Belonging to a large firm reduces the probability of licensing. A large firm has a probability of licensing that is orders of magnitude smaller than the small firms. At the same time, the patent-related variables such as patent breadth, value, and protection is also shown to have an impact, but not as important.

Meanwhile, Motohashi (2008) try to analyze licensing behavior of Japanese firms focusing on the organizational factors from the perspective of patent utilization. As indicated he argues that there is non-linear relationship between licensing propensity and firm size. It is because of the effects of cross-licensing (an effective tool for reducing the risk of patent infringements in an area where many patents for one product are owned by different firms) which is only available for firms with a large patent pool, simply large firms. Zuniga and Gullec (2009) also find that the relationship between size of the firm and probability to license out is U-shaped: small firms and large firms are more likely to license out their patented inventions. At the same time, it is shown that SMEs have more difficulties to license out their patents than large firms in Europe.

But these factors are just one part of the major factors. We need to consider other factors related to innovation, in addition to the organizational factors, from the perspective of innovative strategy. It is said that licensing would

become an important part of company strategy from the survey of European case (Sheehan & Gullec, 2004). A firm's licensing activities are embedded in the overall strategy and positioning of the firm and cannot be fully understood in isolation (Kollmer & Dowling, 2004). Kollmer and Dowling also find that while not-fully integrated firms use licensing as their major commercialization channel and exploit their core products by licensing at their firm's maximum integration level, fully integrated firms out-license non-core products due to a misfit with their overall strategy before the marketing and sales phase. In this way, external technology commercialization, which means commercializing technologies by means of out-licensing, goes far beyond a marginal activity of commercializing residual technologies. Outward technology transfer often constitutes a key dimension of corporate strategy (Lichtenthaler et al, 2009). Lichtenthaler (2008) also try to show that strategic motives (product-oriented, technology-oriented, and mixed strategic motives) affect licensing decisions, in addition to monetary considerations.

Innovation strategy relates to how to develop suitable technology, and how to appropriate it. Therefore, innovation strategy consists of the technology strategy and appropriation strategy. Arundel (2001) captures corporate innovation strategy as R&D intensity and the share of R&D expenditure targeting product innovation or process innovation, and he regards cooperative R&D agreements as information strategy. Considering the characteristics of non-advanced exporting countries such as Korea, the firms' technology strategies can be categorized as targeting type of market, targeting type of innovation, and the way of innovation. From the perspective of non-advanced countries, type of market has importance for making technological innovation and innovative strategies (Park, 2009). Even roughly, in this paper we set type of market, the effort of innovation, and the way of innovation as main constituents of technology strategies. With relation to appropriation strategy, there are diverse mechanisms for appropriating innovative output. Even simple, one of the critical criteria is the attitude toward patent and its utilization, considering the rapid diffusion of patent registration.

Meanwhile, if we try to reinterpret the meaning of firm size from the perspective of two markets, the size of firm can be related to the status of product market. It can be justified as follows. First, large firms have usually grown in product markets through enhancing product competitiveness commercializing their technological capability. Second, considering the asymmetrical size of both markets, it is inevitable and natural for large firms to capture large market share in product market and to have strong market power in product market with lots of resources, in order to be sustainable.

On the contrary to this, R&D and its related factor can be directly related to technology market considering increasing division of innovative labor and the massive diffusion of open innovation models. R&D can be complemented by the access to and utilization of technology market. At the same time, the output of R&D can be utilized in the technology market. In addition, the utilization of patent has a close relationship with the development of technology market.

3. Data and Methodology

Now we present the empirical model which analyzes the determinants of licensing behavior. In specific, we will try to perform econometric analysis to determine the impact of innovation strategy and organizational characteristics on the likelihood of licensing. In detail, whether there is actual licensing behavior or not in each firm is analyzed in terms of the innovation strategy and organizational characteristics utilizing probit model. As indicated, we perform estimation on the licensing-in and licensing-out respectively.

3.1. Model

We try to estimate the effect of innovation strategy and organizational characteristics on the possibility of licensing behavior in Korean manufacturing firms (<Figure 1>). As licensing intensity is not high in Korean firms, we just deal with dichotomous aspect of licensing behavior. That is whether there is licensing or not using probit model.

As known, probit model can be utilized when the dependent variable is binary. The binary dependent variable is taken to be a function of a set of independent variables. In this setting it is assumed to be a function of innovation strategy and firm specific organizational characteristics and industry specific exogenous variables.

As indicated, licensing can be divided into out-licensing and in-licensing. It is also assumed that possibility of both licensing is assumed to be a function of same independent variables as above.

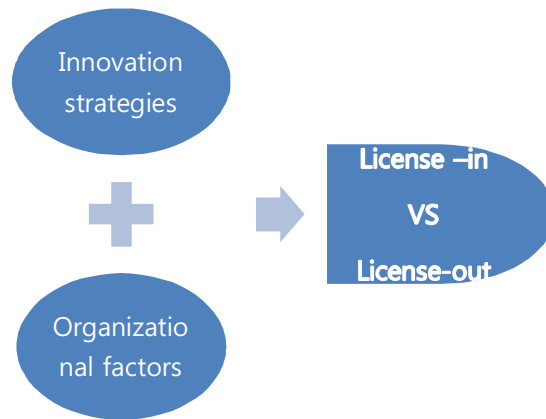


Figure 1: Research Model

3.2. Data

We try to utilize the results of *Korean Innovation Survey* (KIS) done in 2008 by Science and Technology Policy Institute in Korea. The Korean Innovation Survey is approved by the Korea National Statistical Office as Designated Statistics under the Statistics Law and aims at analyzing the technological innovation of manufacturing firms. The definition and methodology of the survey is based on the revised edition of the Oslo Manual (OECD, 3rd edition). The revised edition of the Oslo Manual defines innovation in a broad manner, where organizational and marketing innovations as well as technological innovation are also included. However, the survey mainly focuses on technological innovation, although it also covers issues related to organizational and marketing innovation (STEPI, 2008). Korean innovation survey 2008 firstly surveyed the licensing behavior of manufacturing firms in Korea. The surveys henceforth have not included that behavior as a question item until now.

3.3. Variables

3.3.1 Dependent Variables

KIS surveys the number of patent contract including licensing-in and licensing-out during period 2005-2007. The licensing behavior of each firm can be captured by a dichotomous variable that measures whether each firm made a licensing-related contract. And they can be identified as licensing-in or licensing-out. These two variables are set as dependent variables. Independent variables including control variables are as follows.

3.3.2 Innovation Strategies

As indicated, innovation strategies consist of technology strategies and appropriation strategy. Although corporate technology strategies can be accessed from diverse perspective, this paper try to approach it from the characteristics of non-advanced countries especially that of Korea. Considering those characteristics, three dimensions are important (Park, 2009). The first dimension concerns the effort of innovation, that is, how much spending on formal R&D is made. The second dimension is related to the way of innovation. Its most typical aspect is how the acquisition of technology is made. In other words, this aspect is related to the share of external R&D. and the last dimension is related to the market to be targeted, which can be captured by type of market, foreign market or domestic market. Different type of market necessitates different proper way of responding to different nature of market demand and needs, and therefore impacts how technological innovation should be done.

With relation to appropriation strategy, there can be diverse mechanisms for appropriating innovative output such as intellectual property, lead time and secrecy, and so on. It can be justified that one of the critical criteria is the attitude toward patent and its utilization, considering the rapid diffusion of patent registration and the increasing influence of patent.

In this paper, we set R&D intensity reflecting the effort to innovate, external R&D intensity, export and the utilization of patent as independent variables. All the independent variables can be set using the result of KIS. The R&D intensity and external R&D intensity is calculated by average R&D expenditure divided by average sales for

each firm. The export is also calculated by relative share in the whole sales. The utilization of patent is measured as dichotomy one and set as dummy variables.

3.3.3 Firm Specific Organizational Factors

With relation to organization, there may be multiple of factors to be checked, such as the degree of flexibility, layers of hierarchy, etc. However, in this paper, we focus on the size and size related factors, considering the focus of previous literature and available data.

A measure of firm size is included to test whether there are inherent advantages associated with size that are not independent of other variables, such as complementary assets and superior position in product market. In this paper, size is measured by logarithms of the average number of employees for each firm. The square of size is set to check the non-linear patterns with firm size, following Motohashi (2008). In addition, we set cross-licensing variable as dichotomy one to check the effect of large firms.

3.3.4 Industry Specific Factors

Industry can be influential in terms of its importance in the external environment surrounding firms. The influence can be from nature of technology and demand, and the behaviors of other firms including competitors and users. A set of industry dummy variables is included for 22 manufacturing industry groups. Industry dummies are made by using 'beverages and food industry' as a base category.

4. Results

<Table 2> presents the descriptive statistics. It is shown that the percentage of firms doing inward-licensing is just 2.3% and that of firms doing outward-licensing is just 1.0%. That figure is much lower than that of European firms and Japanese firms. <Table 3> represents the correlation between variables. Correlation is low enough to do an effective statistical estimation.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
License-in	3060	0.023856	0.152626	0	1
License-out	3060	0.010131	0.100157	0	1
export	2971	0.104006	0.232961	0	1.212169
R&D	2977	0.051709	0.318982	0	14.47893
External R&D	2977	0.005111	0.027575	0	0.641574
Size	3060	3.879785	1.392105	1.791759	10.12663
Patent utilization	3060	0.232026	0.422195	0	1
Cross-licensing	3060	0.003595	0.059858	0	1

Table 3: Correlation

	In	Out	Export	R&D	External R&D	Size	Patent	Cross
In	1							
Out	0.2045	1						
Export	0.1038	0.1305	1					
R&D	0.0716	0.0167	0.0402	1				
External R&D	0.065	0.0054	0.0363	0.2985	1			

size	0.1896	0.1911	0.3495	-0.0037	0.0333	1		
patent	0.1984	0.1182	0.2225	0.2244	0.168	0.3993	1	
cross	0.0629	0.1601	0.0695	0.0311	-0.0056	0.053	0.0574	1

<Table 4> provides estimation result for the determinants of licensing-out in Korea. The first model includes only organizational factors as independent variables. The second model includes all the variables which might influence the dependent variable.

As a result, it is shown that the organizational characteristics are significant for possibility of licensing-out. That is, there is non-linear relationship between the possibility of licensing-out and firm size, similar with the result of Motohashi (2008) dealing with Japanese firms. In other words, we can find out that small firms lacking complementary assets has higher possibility of licensing, and at the same time, licensing propensity of large firms is due to their cross-licensing propensity, similar result from the analysis on Japanese firms.

In addition, among innovation strategy, just one factor related to market is shown to be significant. That is export enhances the likelihood of doing licensing-out. Other factors do not reveal statistical significance. This hints at the fact that the possibility of licensing behavior does not have relationship with the innovative strategy, after controlling the organizational factors and type of market targeted. Considering that usual large Korean firms have superior position in product market and export market, these results show that the phenomenon of licensing-out has close relationship with position in product market.

Table 4: Determinants of licensing –out

VARIABLES	Model 1	Model 2
Size	-0.574**	-0.481
	(0.273)	(0.303)
Size ²	0.0872***	0.0748***
	(0.0255)	(0.0274)
Cross-licensing	1.438***	1.425**
	(0.552)	(0.576)
Export		0.582*
		(0.309)
R&D		0.605
		(0.512)
External R&D		-1.468
		(4.313)
Patent utilization		0.237
		(0.216)
Constant	-1.984***	-2.207***
	(0.742)	(0.836)
industry dummy	yes	yes
Observations	1935	1719

Note: Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

In case of licensing-in, the organizational characteristics do not show any statistical significance (<Table 5>). However, the factors related with innovation strategy represent statistically significant effect on the possibility to

license-in. in other words, the higher the effort to innovate is, the higher possibility of licensing-in is. It means that licensing-in complement internal innovative activities, similar with the result of survey done in Europe.

In addition, the utilization of patent as an appropriation mechanism tends to enhance the possibility of licensing-in. It can be inferred that innovative firms doing patenting activities are likely to do inward-licensing, and the behavior of licensing-in is a kind of extension from the enhanced innovative activities and utilization of patent.

Table 5: Determinants of licensing-in

VARIABLES	Model 1	Model 2
Size	0.177	0.144
	(0.195)	(0.210)
Size ²	0.0118	0.00721
	(0.0185)	(0.0197)
Cross-licensing	0.527	0.465
	(0.526)	(0.534)
Export		0.210
		(0.231)
R&D		0.393*
		(0.217)
External R&D		1.121
		(1.344)
Patent utilization		0.684***
		(0.139)
Constant	-3.238***	-3.312***
	(0.531)	(0.583)
industry dummy	yes	yes
Observations	2682	2493

Note: Standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

5. Concluding Remarks and Discussions

This paper tries to analyze the determinants of licensing behaviors of manufacturing firms empirically in order to increase knowledge on the technological licensing. In specific, we try to approach licensing behavior from the perspective of innovation strategy, focusing on licensing-in and licensing-out using the result of *Korean Innovation Survey*.

The findings are as follows. First, organizational characteristic factors, the size and size related factors influence the firm behavior of licensing-out, but not in case of licensing-in. As the discussion on firm size reveals, firms with large size have close relationship with product market and lots of complementary assets such as manufacturing asset and marketing assets, related with product market, rather than the relationship with technology market. Considering that usual large firms have superior position in product market, these results show that the phenomenon of licensing-out has close relationship with position in product market. In addition, the nature of licensing-out is a kind of passive one; it is similar with the characteristics of fully integrated firms analyzed by Kollmer and Dowling (2004) which argues that licensing enables fully-integrated firms to exploit their technology assets exhaustively and focus their internal resources on their core businesses.

Second, innovation strategy influences the firm behavior of licensing-in, but not in the case of licensing-out. In specific, among elements of innovative strategy, using patent mechanism as an appropriation mechanism enhances the possibility of licensing-in, and higher spending on R&D enhances that of licensing-in. However, these factors do not influence the possibility of licensing-out significantly. Meanwhile, export orientation does not enhance the possibility of licensing-in, but license-out. This hints at the possibility that licensing-in has a close relationship with technology market. In addition, licensing-in has active nature with the relation to innovative strategy.

Lastly, the determinants of licensing-in and that of licensing-out are different. If the mode of open innovation is pursued, these two determinants would not be different. Therefore, the degree with which the mode of innovation departs from closed innovation is shown to be low in non-advanced countries such as Korea. If we can divide the innovative strategies into product market-related factors and technology market-related factors, licensing-out have relevance with former factors, and licensing-in have more relevance with latter factors.

It seems that outward licensing can be explained by variables related to product market, while inward licensing can be made clear by variables related to technology market. Firms with established position in product market have pressure to do outward licensing to keep its position under the fierce competition in global markets. This can be elaborated when we consider that Korean firms are famous for their production facility due to vertical integration. At the same time, small firm with negligible position in product market lack commercial capability and complementary assets have no choice but to do outward licensing to raise their profit. This leads to reactive attitude toward licensing. However, on the other hand, innovative firms shown by their effort to innovate might have a motivation to supplement their technology pool with external technology utilizing technology market. This makes their behavior active toward licensing, particularly inward licensing.

Based on this work, generally firms doing licensing-out have many complementary assets and orientation for global markets. Meanwhile, firms doing licensing-in are motivated from the perspective of innovation strategy and appropriation strategy. It can hint at the fact that Korean firms still have a long way to go from the perspective of achieving open innovations. Korean firms, especially larger firms, seem to have paid most of their attention to product market. Therefore, it is time that they should develop business strategy and innovation strategy considering product market and technology market simultaneously in order to exploit the benefit of licensing. Korean firms strong relatively in product market must pay attention to technology market and its licensing pattern to enhance their innovation potentials. Theoretically we come to know that licensing is not a just phenomenon but an outcome of complicated mechanism comprising the situation of product market and technology market and the status at each market and their business and innovation strategies of relevant firms.

This work has some limitations. First, it does not consider the differential characteristics of different sectors in that different sectors make differential strategy more appropriate and suitable according to its nature of technology. Second, it cannot combine actual working of licensing and related behavior at the specific firm level. It is needed that comprehensive analysis on actual mechanism of doing licensing and its relationship with the actual and implemented innovation strategy. In the future, further analysis should be done addressing these limitations.

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