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Is the IPRs Protection working effectively in Developing countries?

--- some empirical findings from Japanese FDI in China ---

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Abstract

By using data from a questionnaire survey to Japanese firms in China this paper empirically examines effects of the IPRs protection on limiting local illegal imitation there. The results robustly show that the IPRs protection system as a whole has such effects in reducing local illegal imitation in China. However, in the test no evidence has been found that the patent and trademark registration, which is a part of the whole IPRs protection system, has such effect. To the contrary the results suggest that the patent and trademark registration system may play a role of facilitating for local illegal imitation in China. The results call for our reconsideration of how the IPRs protection rule in WTO should be.

Keywords: IPRs, WTO, Patent, Imitation, FDI
JEL Classification: O34, O38

I Introduction

Since the end of 80's, Intellectual Property Rights protection (IPRs) has become a prominent issue on the strategies of countries, especially in terms of foreign direct investment (FDI). Later during 1994 to 1995, the introduction of TRIPs in GATT and the afterward WTO pushed this worldwide IPRs protection to a high tide. Such a campaign on IPRs protection reflects the following two features of the nowadays market competition. First, the growing capacity of traditional

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manufactures in developing countries has forced the developed countries to rely more heavily on their comparative advantages in production of intellectual goods. Second, not only the cost of R&D is often disproportionately higher than in the past, but the resulting innovation embodied in today's high-tech products has increasingly become more vulnerable to free-riding imitators.

Due to this kind of global pressure, strengthening IPRs protection in developing countries has become an unavoidable tendency in order to attract more FDI, access more high technology and ultimately to reach the economic growth.

A straightforward reason why strengthening IPRs protection could raise FDI is expected as its power on reducing local illegal imitation, consequently lowers the risk of FDI and ensures the profits of investors. And a preparation of such a TRIPS standardized system is made use of as (1) a symbol of improvement of FDI environment in developing countries; (2) a powerful card at the WTO negotiation for both developed and developing countries. However, although this campaign of IPRs protection has been occurred over a decade, the illegal imitation situation in developing countries has not improved considerably. For example, the Japanese Patent Office yearly Investigation Reporter on the issue of the infringement on Japanese firms' IPRs shows that the situation is turning bad year by year[3]. This raises a question on whether the IPRs protection in developing countries really has the effect on reducing the local illegal imitation or not. Analysis

[3] Visit http://www.jpo.go.jp/index.html for further information.

toward this question might provide some useful policy implications to the IPRs protection in WTO. First, we can make it clear the fact of the performance of the IPRs protection in developing countries. Second, if the IPRs protection in those countries does not perform effectively as expected, then it will helps to consider realistically again what a system should be. Consequently it will lead us to consider seriously what a new mode of WTO negotiation, which contributes to the world trade and FDI, should be.

Unfortunately, very little research has been done concerning this relation in literatures. There are papers concerning the relations among IPRs protection and FDI, trade and economic growth, etc[4]. In spite of intense debates concerning the relation between IPRs protection and FDI since the Uruguay Round, no settled result has been found both empirically and theoretically and those results, no matter what they are, may provide some kind of misapprehensions on this issue [5]. That is, although the most of them argue that the effect of IPRs protection to FDI is through its

[4] Chin & Grossman (1990) and Deardorff (1992) examine welfare effects of the extending IPRs protection from the developed countries to developing countries. They find that in most of the cases strengthening IPRs protection in developing will lower the welfare level. Gould & Gruben (1996) examines empirically the role of IPRs protection in economic growth, utilizing cross-country data on patent protection, trade regime and country-specific characteristics. Their evidence suggests that IPRs protection is a significant determinant of economic growth. Evidences from Maskus & Penubarti (1995) show how IPRs protection is trade-related. And Vishwasrao (1994) shows that the lack of IPRs in developing countries can affect the mode of technology transfer from the developed countries.

[5] Among empirical studies, Ferrantino (1993), by using US's FDI data, found that there is at most a weak association between countries' decisions to join IPRs protection agreements and their decision to pursue " open" policies with regard to trade or FDI. Kondo (1995) found that there is no evidence supporting that FDI is affected by patent protection, by using data on US. Outward FDI. However, Seyoum (1996), based on a study of 27 countries' inflows of FDI, showed that the level of IPRs protection is a strong determinant of inward FDI. And Lee & Mansfield (1996), by using their random sampling data of 100 major U.S. firms in six manufacturing industries, found that the outward FDIs of those 100 major U.S. manufactures are strongly related to the level of IPRs protection of host countries. Among the theoretical studies, Helpman(1993) shows that strengthening IPRs in developing countries will lower the inflow of FDI from these developed countries, by using a dynamic model. On the contrary, Lai(1998) shows the opposite.

power on reducing illegal imitation, however, the direct relation is neglected. So by using those results that IPRs may (or may not) boost FDI, we can not confidently assert that IPRs protection may (or may not) reduce illegal imitation. And this paper is trying to provide some empirical evidence on the direct relation between IPRs protection and illegal imitation.

Our procedure is based on a survey to the Japanese firms having direct investment in China. It is known that China has become a largest FDI host country among all developing countries led by its opening economic policy. Ever since then Japan has become a second largest source country of FDI to China among OECD countries, just following the U.S.

Although China has legally established a series of IPRs protection systems (it is a member of Paris Convention, WIPO), the real situation on IPRs protection there is severely criticized. For example, the aforementioned Japanese Patent Office yearly Investigation Report states that in 1999 about 27% of the total imitations of Japanese products in the world are observed in China. And now China has passed it's first year as a member of WTO. Considering all we focus on China in finding some empirical facts.

To derive the direct relation between the IPRs protection and illegal imitation, two independent variables are selected instead of the state of the IPRs protection in China. One of them is a five point scaled index marked by the respondents to express the total condition of the IPRs protection system as a whole in China. Another one is a dummy variable with its value of 1 showing

that the products of the firm of the respondent has been patented or trademark-registered. By using this dummy variable, the effects of a certain part of the total IPRs protection system in China can be verified. The reason of choosing it is quite obvious since, among a series of IPRs protection measures, the patent and trademark-registration system is expected to be most effective. As the result, our test robustly shows that the IPRs protection system as a whole has the effect on reducing illegal imitation in China. However, the test also shows an interesting result that the patent and trademark-registration system in China does not perform well as it is expected. This result contradicts to our usual expectation, and is meaningful to reconsider what the IPRs protection system should be. The relations among profit, IPRs protection and illegal imitation are also examined in this paper.

The constructions of the paper are as follows. In section II we present a simple theoretical consideration toward the empirical study on the effects of patent and trademark-registration system to reducing local illegal imitation. Section III provides the explanation of our survey, and the data obtained. The empirical results are shown in section IV, and in section V we will work with the relation among profits, imitation and IPRs protection. Conclusion remarks are stated in the final section.

II A Simple Theoretical Consideration toward Empirical Study

For the empirical study, we need first to consider the features of imitation. In some of the theoretical papers, imitation is treated as a costless activity for simplicity. However, in the real world, it is costs a lot and is similar to R&D activity, except that its aim is not to develop new products but to imitate some existing one. Here we adopt the following Grossman and Helpman (1991)'s type of formulation of imitation product function, where the imitation is treated as a type of innovation production function commonly recognized.

$$n^s = f(n^M, L^I), \quad \partial n^s / \partial n^M > 0, \partial n^s / \partial L^I > 0. \tag{1}$$

In equation (1), n^s is the number of fruit of imitation; n^M represents the existing number of Multinational Enterprises (MNE) goods. That is considered as a proxy for information; and L^I represents resources invested for imitation activities.

Then we have to consider the relation between IPRs protection and the fruit of imitation. To shed light on our purpose, we divide the effects of IPRs protection into two parts, (1) the effects of the IPRs protection system as a whole; (2) the effects of a certain part, the patent and trademark-registration system. The effects of the first part indicate those effects, including some kinds of announcement or enforcement effects, that may reduce the resources involved in imitation

activity. The effects of the second part indicate those effects, that may reduce the accessible number of MNC products targeted by imitation. With such consideration, we relate the resources invested in imitation activity to the effects of the IPRs protection system as a whole in the following form.

$$L^I = g(\boldsymbol{k}), \quad \partial L^I / \partial \boldsymbol{k} < 0, \tag{2}$$

where, $\boldsymbol{k} > 1$ represents the level of IPRs protection system as a whole. Next, we are going to relate the accessible number of MNE goods to the effects of patent and trademark-registration system. With the expectation that the protection may reduce the accessible number of MNE goods, we define

$$n^m = h(p), \quad \partial n^m / \partial p < 0, \tag{3}$$

where $0 < p < 1$ represents the ratio of the number of MNE goods which have been patented or trademark-registered to the total number of MNE goods; and n^m represents the accessible MNE goods targeted by imitation, then we have $n^m \le n^M$. Combining equations (1) to (3), we get the following function of imitation, which is a benchmark equation of our empirical study in the following sections.

$$n^s = F(n^m, L^I) = F[h(p), g(k)] = G(p,k), \quad (4)$$

$$(\partial n^s / \partial p < 0, \partial n^s / \partial \boldsymbol{k} < 0).$$

III Data and Estimation Issues

III-1 About the data

According to a data-base, which is provided by TOYOKEIZAI SHINPOSHA[6], of Japanese firms investing in China 2000 we sampled randomly 412 source firms and sent our questionnaire to their presidents. The answering period was set from 15th July to the end of August, 2001. Among them 98 answers have been returned to us. Although the returned rate is a little lower of 23.8%, from those answers we obtained their 228 subsidiaries' data in 7 manufacturing industries: Glass, Fiber, Vehicle, Food, Chemistry, Machine and Electronics. Among them 188 data are distributed in 13 cities that accepted Japanese FDI actively. They are Peking, Shanghai, Tianjing, Shenyang, Dalian, Qindao, Suzhou, Guangzhou, Shenzhen, Dongguan, Zhuhai, Xiamen and Fuzhou.

In the questionnaire we asked them a series of questions including the location, the category of industry, the investment share with their partners, the amount of investment and the number of years of the establishment of their subsidiaries, etc. And also we asked them whether

[6] Toyokeizai Shinposha is a major data source bank in Japan providing firm level data. Visit http://www.toyokeizai.co.jp for further information about it.

products with the same category of the products of their subsidiaries are imported to China from Japan or other countries; and whether or not local firms are producing products with the same category of the products of their subsidiaries. Concerning the IPRs protection, we asked them whether or not the products of their subsidiaries have been imitated by local firms, and whether or not there are imitated products with the same category of the products of their subsidiaries imported to China from other countries. Further we asked them whether the expected profits of their subsidiaries have been realized, and in the case when it has not been realized we asked them whether imitation is one of the significant factors to make their subsidiaries unprofitable. Continuously, we asked them whether the products of their subsidiaries have been patented or registered for trademark. Finally we asked them to mark the condition of IPRs protection situation of the location of their subsidiaries by a five point Ricard Scale method, with a point 5 designates that the legal enforcement of IPRs protection in that location is excellent.

******* Table 1 and 2 are about here *********

Parts of the data obtained from our questionnaire are shown in Table 1, and the meanings of all elements in Table 1 are stated in Table 2. The Data in Table 1 show us some important information of the Japanese FDI in China in terms of IPRs protection. First, the level of the IPRs protection in China was marked on average at 2.60 point, which implies that the real working of IPRs protection in China is not good enough in comparison with China's IPRs protection system as a

legislatively complete architecture. Second, on average about 62% of the Japanese subsidiaries answered that their products have been patented or registered for trademark. This means that the Japanese subsidiaries in China are relatively sensitive to the protection of their products. Third, Table 1 shows that on average nearly 30% of the products of the Japanese subsidiaries have been imitated. The other information from Table 1 is that on average 57% of the products of Japanese subsidiaries have their competitors in Japan, 36% of the products of Japanese subsidiaries have their competitors in other countries, and nearly 70% of the products of Japanese subsidiaries have their competitors in China. And also on average about 47% Japanese subsidiaries have not realized their expected profits.

******** Table 3 is about here ********

A correlation matrix for all elements in Table 1 shown in Table 3 suggests the direction of our empirical study. That is, the correlation between patent and trademark-registration system and imitation tends to be positive, which is in contradiction to our common sense. In order to check whether this positive correlation is economically meaningful, we go on to the following regression tests.

III-2 Specification for Estimate

Our estimate is based on the benchmark equation of (4) in the previous section. However, in order to take it into consideration of how imitation is trade-related, we added trade variable T, and also in order to reflect how local productivities influence local imitation, we add local production information variable LP into the equation (4). Then the imitation production function can be expressed as follows.

$$n^s = f(\boldsymbol{k}, p, T, LP), \tag{5}$$

where $\partial n^s / \partial \boldsymbol{k} < 0, \partial n^s / \partial p < 0, \partial n^s / \partial T > 0, \partial n^s / \partial LP > 0$ are expected. By adding some subscripts representing each subsidiary of a certain industry in a certain city to the variables in equation (5), we specify it into the following equation (6) by which our Probit test is conducted.

$$\begin{aligned} imi_{jki} = {} & \boldsymbol{a}_0 + \boldsymbol{a}_1 Level_j + \boldsymbol{a}_2 PAT_j + \boldsymbol{a}_3 TRAD1_j + \boldsymbol{a}_4 TRADE2_j + \boldsymbol{a}_5 LOCAL_j \\ & + \boldsymbol{b}_i CITY_i + \boldsymbol{g}_k IND_k + \boldsymbol{e}_{jik} \end{aligned} \tag{6}$$

In equation (6), imi_{jki} represents a dummy variable of a certain Japanese subsidiary j of industry k in city i, with its value of 1 means that this subsidiary answered that its products have been imitated and zero otherwise; $Level_j$ represents the point of the IPRs protection situation of a

certain city marked by subsidiary j; PAT_j represents a dummy variable of subsidiary j, with its value of 1 means that this subsidiary reported that its products have been patented or registered for trademark; $Trad1_j$ represents a dummy variable of subsidiary j, with its value of 1 means that this subsidiary reported that products with the same category of its product have been imported to China from Japan, and zero otherwise ; $Trad2_j$ represents a dummy variable of subsidiary j, with its value of 1 means that this subsidiary reported that products with the same category of its product have been imported to China from other countries, and zero otherwise ; $LOCAL_j$ represents a dummy variable of subsidiary j, with its value of 1 means that this subsidiary reported that local firms are producing products with the same category of its product, and zero otherwise ; and $CITY_i$ is a city dummy and IND_k is an industry dummy. The last two independent variables are added in order to derive some local and industrial characteristics.

IV Empirical Results on IPRs Protection and Imitation

The Probit test results are shown in Table 4. The test of subset 1 is based on the benchmark equation of (4), and the results show that the coefficient of IPRs protection system as a whole is negative and statistically significant. This confirms the effects of IPRs protection system as a whole on limiting the local imitation. The result on the coefficient of patent and trademark-registration system shows a positive sign and statistically significant, and this is consistent with the correlation

derived in Table 3. This result may be beyond our normal expectation. One possible explanation of this result is that, the social recognition on patent and trademark-registration system in China is so lower that such a system could not work effectively. Contrary to a normal sense, the actual patent and trademark-registration system is playing a role of facilitating for local imitation. For example, a patented or trademark-registered product may be regarded as profitable, so it will be targeted for imitation in an environment where the social recognition on IPRs is low. In this sense, patent and trademark registration could be a fascinating target for imitation.

******** Table 4 is about here *******

In the subset 2, we have an additional variable, trade with Japan, as an instrument to control international effects. The results on the coefficients of IPRs protection system as a whole and the patent and trademark-registration system are the same as those in the subset 1. The coefficient of trade from Japan is positive and also statistically significant. This suggests that imitation is trade-related.

In the subset 3, we also add another trade- related instrument variable which is trade from other countries than Japan. The results of the coefficients of IPRs protection system as a whole and the patent and trademark-registration system are also consistent with what we obtained in the first two subsets. And the coefficient of trade from other countries is positive and statistically significant. However, in this case the coefficient of trade from Japan tends not to be statistically significant.

To avoid the possible correlation between the variables of trade from Japan and other countries, in the subset 4 instead of using $Trad1_j$ and $Trad2_j$, we added a new dummy variable, $Trad12_j$, with its value of 1 means that this subsidiary answered that products with the same category of its product have been imported to China from both Japan and other countries, and zero otherwise. As a result, the test of the subset 4 shows that the signs on the coefficients of IPRs protection system as a whole and the patent and trademark-registration system are consistent with the result in the first three subsets. And the coefficient of trade from both Japan and other countries is also positive and statistically significant.

In the subset 5, another instrumental variable, local production, is added in order to test its influences on local imitation. The result shows a positive sign on it, however it is not statistically significant. The coefficients of other variables in this case are consistent with what we obtained in the previous subsets.

In the subset 6, dummy variables of city and industry are added in the test, (Guangzhou, Shenzhen, Dongguan and Zhuhai are integrated as one region of GU, and Xiamen and Fuzhou are integrated as a single region of XF), and there could not be found any meaningful evidence on these variables. However, the results of the coefficients of other variables are also consistent with all we obtained in other subsets. This suggests that the difference among cities is not significant.

We have to mention that there is a possible econometric problem in the above test in terms

of the used data set. That is concerning the independent variable of *Level* , the point reflects each subsidiary's subjective evaluation on IPR. Therefore, if the products of a certain firm have been imitated in a certain location, this firm may give a lower evaluation in terms of a smaller point of the IPRs protection condition. This implies that the dependent variable of *imi* may be considered as a determinant of the independent variable of *Level* . To avoid this kind of possible endogeneity problem we remove the independent variable of *Level* in the equation (6), and undertake our test again. The results are shown in Table 5, and are consistent with what we have obtained in Table 4.

******* Table 5 is about here ********

V Profits, Imitation and IPRs Protection

It is quite often said that local illegal imitation is a major cause for MNEs to be unprofitable, and the IPRs protection will ensure MNFs to gain their expected profits. Here in this section we test whether it is true or not by using on our data. At the same time, we reconsider the role of IPR protection from the different aspect.

Our Probit test is conducted under the following equation.

$$unprof_{jki} = l_0 + l_1 Level_j + l_2 PAT_j + l_3 imi_j + l_4 TRAD1_j + l_5 TRADE2_j + l_6 LOCAL_j + w_i CITY_i + s_k IND_k + u_{jik} \quad (7)$$

In (7), $unprof_{jki}$ is a dummy variable of a subsidiary j of industry k in city i, with its value of 1 means that this subsidiary answered that its expected profits have not been realized, and zero otherwise. The meanings of other variables are the same as in equation (6).

The independent variables of trade, $TRAD1_j$ and $TRAD2_j$, and local production are added as instruments in the test in order to control the relation between unprofitability and market situation of competition. Later in the test, a new independent variable $TRAD12_j$, which represents the situation of trade from both Japan and other countries, will be introduced instead of using the independent variables of $TRAD1_j$ and $TRAD2_j$. This is to avoid the possible correlation between the independent variables of trade from Japan and trade from other countries.

Because of the statistically significant relation between IPRs (including the situation of patent and trademark-registration system) and imitation shown in previous section, we first remove the dependent variable imi_j in equation (7), and test the influence from IPRs protection to firm's profits. The results are shown in Table 6.

******** Table 6 is about here ********

The test of the subset 1 is a basic one. The result shows that the sign of the coefficient of independent variable of the IPRs protection system as a whole is negative and statistically significant. This suggests that the IPRs protection system as a whole has the effects of ensuring firm's profits.

However, the coefficient of the independent variable of the patent and trademark-registration system is not statistically significant. In other words, there is no evidence from our data showing that the patent and trademark-registration system may have the effects of ensuring the profits of firms .

In the test of subset 2, a dependent variable of trade from Japan is added to investigate influence of the intra-industry competition to the profits of firms. And the results show that the coefficient of this variable is positive but not statistically significant. Other results are consist with what we get in the subset 1.

In the subset 3, independent variables of trade from both Japan and other countries and local production are added. As a result, the sign of the coefficient of trade from both Japan and other countries is positive and statistically significant. This implies that intra-industry competition makes firms unprofitable. The result also suggests that there is no significant relation between local production and profits of Japanese subsidiaries. The results concerning IPRs protection system are consistent with the previous two subsets.

In subset 4, the dummy variables of both city and industry are added (Guangzhou, Shenzhen, Dongguan and Zhuhai are integrated as one region of Gu, and Xiamen and Fuzhou are integrated as on region of XF). Although there is no significant evidence for those dummy variables, the results concerning IPRs (including patent and trademark-registration system) are also consistent with the tests in previous subsets. However, in this case the dependent variable of trade from both

Japan and other countries tends to be not statistically significant.

Then, we remove the independent variables of $Level_j$ and PAT_j in equation (7) to test the influence of local imitation to firm's profits. The results are shown in Table 7.

****** Table 7 is about here ******

In Table 7, it is clearly shown that in all four subsets of our tests there has no statistically significant evidence suggesting that local imitation may make firms unprofitable.

The results in this section show the following facts. First, the IPRs protection as a whole has the effects of ensuring the profits of Japanese subsidiaries. Second, there is no statistically significant evidence from data showing that the patent and trademark-registration system, which is a part of the IPRs protection system, may has the effects on ensuring the profits of Japanese subsidiaries. Third, competition with the products imported from Japan or other countries in the same category of the Japanese subsidiaries might be a significant factor making those Japanese subsidiaries unprofitable. Forth, there is no statistically significant evidence showing that the local production of the same category of the products of Japanese subsidiaries may influence the profits of those Japanese subsidiaries. This might suggest that the quality of local products has not reached yet to the level of those of Japanese subsidiaries, thus the local products cannot be a threat of those products of Japanese subsidiaries.

VI Conclusion Remarks

In this paper, we have studied empirically the effects of IPRs protection system on limiting local imitation and on the profits of foreign subsidiaries, by using data obtained from our questionnaire on Japanese FDI in China. Our results strongly suggest that the IPRs protection system as a whole has the effects on reducing local imitation in China. This result is a supporting fact of recognition of general rules and strengthening IPRs protection in developing countries.

On the other hand, the results also indicate that the patent and trademark-registration system, which is a subsystem of the IPRs protection system as a whole, does not necessarily work effectively in China. To the contrary, our results robustly suggest that such subsystem may play a role of providing some kind of measure for local imitation.

A possible explanation of such results obtained is that even in a situation where the recognition extent on the IPRs protection is quite low, the IPRs protection system as a whole may have the effects of lowering local imitation because of its legal and administrative regulation effects, and thus ensuring the profits of foreign subsidiaries. However as for the subsystem of it, in this paper we are refering to the patent and trademark-registration system, the situation may be different. Because the production information of a patented product is opened and a product registered for trademark is considered as a profitable one, so the risk of being imitated rises up. And by utilizing

those opened information imitators could successfully imitate the product with relatively little resources.

Our findings are quite consistent with the common recognition on the effects of IPRs protection system. And, WTO standardized IPRs protection system in developing countries is an important archtecture in allocating the FDI from developed to developing countries. Thus our findings call our attention to reconsider how the IPRs protection rule in WTO should be.

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Table 1. Data from our questionnaire

No	CITY	OBSER	IMI	IPRL	PATR	COMP1	COMP2	COMP3	PROF
1	PK	21	0.3333	3.0526	0.8571	0.6667	0.4762	0.7143	0.4762
2	SH	75	0.2162	2.7246	0.6164	0.5333	0.2933	0.7200	0.4189
3	GZ	11	0.5455	2.7778	0.6364	0.7273	0.5455	0.8182	0.5455
4	SHZ	9	0.0952	2.7500	0.5556	0.3333	0.2222	0.6667	0.3333

5	ZH	6	0.0000	2.6667	0.1667	0.1667	0.6667	0.8333	0.5000
6	DG	3	0.6667	2.0000	0.6667	0.6667	0.3333	0.6667	0.3333
7	SZ	13	0.2500	3.0833	0.6154	0.5385	0.6923	0.9231	0.6154
8	TJ	19	0.2105	3.0000	0.7222	0.3684	0.3158	0.5263	0.6111
9	XM	1	0.0000	2.0000	1.0000	1.0000	0.0000	0.0000	0.0000
10	FZ	4	0.5000	2.0000	0.6667	0.5000	0.2500	0.5000	0.7500
11	QD	6	0.0000	3.2500	0.1429	0.5000	0.5000	0.8333	0.5000
12	DL	18	0.3333	2.5300	0.4706	0.3889	0.4444	0.7778	0.5556
13	SHY	2	0.5000	2.0000	1.0000	1.0000	0.0000	1.0000	0.5000
	Sum	188							
	Average		0.2808	2.6027	0.6244	0.5684	0.3646	0.6907	0.4723

PK: Peking; SH: Shanghai; GZ: Guangzhou; SHZ: Shenzhen; ZH: Zhuhai; DG: Dongguan;

SZ: Suzhou; TJ: Tenjin; XM: Xiamen; FZ: Fuzhou; QD: Qindao; DL: Dalian; SHY: Shengyang.

Table 2. List of the meaning of each item in Table 1

IMI	The ratio of the number of subsidiaries in a certain location answered that their products have been experienced been imitated by local firms to the total number of subsidiaries in this location.
IPRL	The average points of the IPRs condition in a certain location marked by every subsidiaries in this location with a scale of 5.
PATR	The ratio of the number of subsidiaries in a certain location answered that their products have

	been patented or trademark registered to the total number of subsidiaries in this location.
COMP1	The ratio of the number of subsidiaries in a certain location answered that the same products have been imported to China from Japan to the total number of subsidiaries in this location.
COMP2	The ratio of the number of subsidiaries in a certain location answered that the same products have been imported to China from other countries to the total number of subsidiaries in this location.
COMP3	The ratio of the number of subsidiaries in a certain location answered that the same products have been produced by local firms to the total number of subsidiaries in this location.
PROF	The ratio of the number of subsidiaries in a certain location answered that their expected profits have not been achieved to the total number of subsidiaries in this location.

Table 3. Correlation Matrix of all items in Table 1

	IMI	IPRL	PATR	COMP1	COMP2	COMP3	PROF
IMI	1						
IPRL	-0.4361	1					
PATR	0.39904	-0.4875	1				
COMP1	0.34551	-0.4859	0.77185	1			
COMP2	-0.0939	0.67691	-0.6767	-0.5899	1		
COMP3	0.26237	0.38488	-0.3928	-0.249	0.51807	1	
PROF	0.34707	0.30861	-0.3087	-0.4465	0.48307	0.587928	1

Table 4. Probit Estimate Results of Equation (6)

Variable	Coefficient	Subset 1		Subset 2		Subset 3		Subset 4		Subset 5		Subset 6	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Cons.	$á_0$	-0.314	-0.909	-0.379	-1.058	-0.626	-1.649	-0.546	-1.447	-0.837	-1.873	-1.127	-1.636
Level	$á_1$	-0.334	-2.888***	-0.339	-2.927***	-0.309	-2.631***	-0.324	-2.788***	-0.315	-2.693***	-0.339	-2.562***
PAT	$á_2$	0.902	3.762***	0.788	3.315***	0.857	3.304***	0.817	3.314***	0.873	3.455***	0.906	3.318***
TRAD1	$á_3$			0.295	1.325	0.092	0.379						
TRAD2	$á_4$					0.518	2.231**						
LOCAL	$á_5$									0.310	1.248	0.356	1.172
TRAD12								0.395	1.704	0.390	1.677*	0.381	1.381
PE	$â_1$											0.400	0.824
SH	$â_2$											0.147	0.346
GU	$â_3$											0.578	1.241
DA	$â_4$											0.600	1.170
TEN	$â_5$											0.244	0.435
XF	$â_6$											0.717	0.850
SHEN	$â_7$											0.221	0.213
GLASS	$ã_1$											0.271	0.537
FIBER	$ã_2$											-0.083	-0.197
VEH	$ã_3$											-0.318	-0.484
FOOD	$ã_4$											0.153	0.022
CHE	$ã_5$											-0.025	-0.073
MACH	$ã_6$											-0.093	-0.248
$\overline{R}^2$		0.136		0.147		0.171		0.156		0.159		0.203	
Observations		179		177		177		179		179		178	
Fraction of Correct Predictions		0.748		0.763		0.774		0.760		0.760		0.787	

*** significant at the level of 1%; ** Significant at the level of 5% ; * significant at level the level of 10%.

Table 5. Probit Estimate Results of Equation (6)

Variable	Coefficient	Subset 1		Subset 2		Subset 3		Subset 4		Subset 5		Subset 6	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Cons.	$á_0$	-1.150	-5.728	-1.233	-5.611	-1.423	-5.931	-1.457	-4.907	-1.689	-5.140	-2.104	-3.577
Level	$á_1$												
PAT	$á_2$	0.783	3.347***	0.672	2.734***	0.755	2.965***	0.847	3.526***	0.761	3.078***	0.803	3.008***
TRAD1	$á_3$			0.287	1.308	0.633	0.265						
TRAD2	$á_4$					0.586	2.582**						
LOCAL	$á_5$							0.351	1.441	0.353	1.443	0.419	1.403*
TRAD12										0.432	1.870*	0.348	1.266
PE	$â_1$											0.461	0.970
SH	$â_2$											0.261	0.627
GU	$â_3$											0.731	1.608
DA	$â_4$											0.736	1.470
TEN	$â_5$											0.306	0.548
XF	$â_6$											1.144	1.370
SHEN	$â_7$											0.515	0.526
GLASS	$ã_1$											-0.081	-0.164
FIBER	$ã_2$											-0.137	-0.328
VEH	$ã_3$											-0.347	-0.525
FOOD	$ã_4$											-0.320	-0.458
CHE	$ã_5$											0.013	0.038
MACH	$ã_6$											0.025	0.700
$\overline{R}^2$		0.062		0.066		0.098		0.070		0.086		0.141	
Observations		179		177		177		179		179		178	
Fraction of Correct Predictions		0.726		0.723		0.723		0.726		0.726		0.775	

*** significant at the level of 1%; ** significant at the level of 5%; * significant at level the level of 10%.

Table 6. Probit Estimate Results of Equation (7)

Variable	Coefficient	Subset 1		Subset 2		Subset 3		Subset 4	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Cons.	$ë_0$	0.480	1.539	0.416	1.300	0.219	0.573	1.292	1.395
Level	$ë_1$	-0.189	-1.788*	-0.194	-1.827*	-0.184	-1.721*	-0.233	-1.950**
PAT	$ë_2$	0.062	0.305	0.033	0.154	0.066	0.309	-0.165	-0.713
imi	$ë_3$								
TRAD1	$ë_4$			0.260	1.280				
TRAD2	$ë_5$								
LOCAL	$ë_6$					0.039	0.182	0.272	1.021
TRAD12						0.476	2.318**	0.349	1.452
PE	$ù_1$							-0.942	-1.171
SH	$ù_2$							-1.096	-1.431
GU	$ù_3$							-1.214	-1.521
DA	$ù_4$							-0.857	-1.037
TEN	$ù_5$							-0.598	-0.714
XF	$ù_6$							-0.673	-0.626
SHEN	$ù_7$							-1.422	-1.164
SU	$ù_8$							-0.612	-0.728
GLASS	$ó_1$							-0.433	-0.897
FIBER	$ó_2$							-0.423	-1.217
VEH	$ó_3$							0.028	0.060
FOOD	$ó_4$							1.332	1.814*
CHE	$ó_5$							0.136	0.418
MACH	$ó_6$							0.148	0.417
$\overline{R}^2$		0.018		0.026		0.046		0.109	
Observations		179		177		179		178	
Fraction of Correct Predictions		0.536		0.559		0.553		0.601	

** Significant at the level of 5% ; * significant at level the level of 10%.

Table 7. Probit Estimate Results of Equation (7)

Variable	Coefficient	Subset 1		Subset 2		Subset 3		Subset 4	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
Cons.	$ë_0$	-0.173	-1.194	-0.341	-1.590	0.073	0.136	-0.416	-0.681
Level	$ë_1$								
PAT	$ë_2$								
imi	$ë_3$	-0.282	-1.300	-0.289	-1.342	-0.289	-1.302	-0.351	-1.551
TRAD1	$ë_4$	0.206	1.037						
TRAD2	$ë_5$	0.238	1.160						
LOCAL	$ë_6$			0.109	0.527			0.297	1.203
TRAD12				0.468	2.396**			0.288	1.275
PE	$ù_1$					0.101	0.168	0.116	0.191
SH	$ù_2$					-0.101	-0.184	-0.038	-0.069
GU	$ù_3$					-0.022	-0.037	0.026	0.044
DA	$ù_4$					0.229	0.374	0.286	0.465
TEN	$ù_5$					0.275	0.437	0.366	0.580
XF	$ù_6$					0.065	0.081	0.197	0.242
SHEN	$ù_7$					0.032	0.032	-0.111	-0.108
SU	$ù_8$					0.510	0.790	0.436	0.672
GLASS	$ó_1$					-0.824	-1.900*	-0.680	-1.474
FIBER	$ó_2$					-0.546	-1.750*	-0.427	-1.304
VEH	$ó_3$					-0.235	-0.551	-0.004	-0.008
FOOD	$ó_4$					0.391	0.667	0.567	0.940
CHE	$ó_5$					0.178	0.581	0.203	0.642
MACH	$ó_6$					-0.098	-0.320	0.032	0.098
$\overline{R}^2$		0.023		0.036		0.064		0.079	
Observations		185		187		186		186	
Fraction of Correct Predictions		0.595		0.594		0.591		0.597	

** Significant at the level of 5% ; * significant at level the level of 10%.