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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 of Japanese FDI in China we empirically examine the effects of IPRs protection system on limiting local imitation and ensuring profits of Japanesen subsidiaries. We find that the IPRs protection system as a whole has such effects in China, and its significance is confirmed in our test. However, when we consider patent and trademark registration system as individual rights of the whole IPRs protection system, our results significantly confirm that the patent and trademark registration system does not work effectively in reducing local imitation and ensuring the profits of Japanese subsidiaries. In fact, they play a role of providing some kind of measure for local imitation in China. The result calls 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 Uruguay Round under the GATT and the foundation of WTO afterwards, Intellectual Property Rights (IPRs) protection has become a major issue not only in trade negotiation but also in strategies of countries, especially in terms of foreign direct investment (FDI) from developed countries to developing them. The background of such a movement is pointed by Reichman(1995) as "…the growing capacity of manufactures in developing countries to penetrate distant markets for traditional

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industrial products has forced the developed countries to rely more heavily on their comparative advantages in production of intellectual goods than in the past. …, the rise of knowledge-based industries radically altered the nature of competition and disrupted the equilibrium that had resulted from more traditional comparative advantages. Not only the cost of research and development 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 appropriators."

As what is pointed by Rapp and Rozek (1990), the benefits of strengthening IPRs protection in a developing country are expected in the form of investment and technology flowing to this country, access by local firms to this technology, and ultimately, economic growth of the country as a whole. However, is IPRs protection really affecting the inflow of FDI from developed countries to developing countries?

Debates concerning this issue have been occurred since the beginning of the Uruguay Round. 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 U.S. 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 and 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.

On the other hand, among 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 results.

Although the debates seem not to have been settled yet, a common point of view can be seen in these studies. It concerns about one of the reasons of why strengthening IPRs protection in a developing country has an effect of increasing inflow of FDI from developed countries. This is directly related to its power on lowering local imitation, which ensures expected profits of investors of the developed countries. However there seems to be little study on IPRs protection and imitation. And the present paper is trying to contribute on this issue empirically.

Before starting our analysis, we look at first the construction of IPRs protection system. Usually a IPRs protection system consists of several factors,

including administrative and legal regulation, patent protection, trademark registration, etc. However, in many early studies the effects of IPRs protection are usually treated as the effects of the IPRs protection system as a whole. Even though there are many papers concerning effects of patent protection, the patent protection is also treated as a proxy of IPRs protection system itself.

Next, consider the performance of a policy system. It might be easy to construct a well-established system. However, whether all the factors of such a well-established system work effectively or not in real world is not necessarily the same thing as what the system-builder could manage. Putting it differently, even if a developing country has built a WTO standardized IPRs protection system, some of factors of the system could not work effectively in the real world. (Here we do not negate the effects of a IPRs protection system as a whole.)

The main issue we study in this paper is whether the patent-protection and trademark-registration system in developing countries effectively performs its role of reducing local illegal imitation. The patent-protection and trademark-registration system is considered as one of the effective measures of IPRs protection. However, if a firm's product is patented, then its main production technology has to be opened; and if a firm's product is trademark-registered, then such a product might be considered as a profitable product. When the patent-protection and trademark-registration system is not perfectly enforced (this means that there exists such a system, however, the administrative and legal regulation on this system is not perfect.), then such a system might facilitate local imitation by utilizing the opened information.

The analysis of the IPRs and imitation provides some policy implications to IPRs in WTO. First, we can make it clear the fact about how the IPRs protection system is working in developing countries. Second, if the IPRs protection system doesn't work effectively in developing countries, then it will help us to consider what the system should be. Consequently the analysis will help us to build a new mode of WTO negotiation that contributes to the world trade and FDI flow.

Our procedure is based on a questionnaire to the Japanese firms that have 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 in China is reported as bad as severely criticized. For example, a Japanese Patent Office

Investigation Report shows that in 1999 about 27% of the total imitations of Japanese products in the world are observed in China. And now China has been accepted as a member of WTO on November 2001. Considering all we focus on China in finding some empirical facts.

The constructions of the paper are as follows. In section II we present a theoretical consideration toward an empirically study on the effects of patent-protection and trademark-registration system on reducing local imitation. Section III provides the explanation of our questionnaire, and the data obtained. The empirical results are shown in section IV, and in section V we will deal with the relation among profits, imitation and IPRs protection. Conclusion Remarks are in the last section.

II Theoretical Consideration toward Empirically Study

Among the existing literatures, there are quite number of papers dealing with the relations among IPRs protection, trade, overall growth rate and welfare, etc. during the period of Uruguay Round and after the establishment of WTO. Chin and 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 there (in Deardorff(1992), the IPRs protection is treated as the patent protection.). Gould and 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 and 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.

All the papers cited above assume that local imitation is a primary source of technology transfer to developing countries. And all those papers share a common point of view that any information through trade or FDI may promote local imitation, and the aim of IPRs protection is just to regulate such local imitation. However, none of them shows any direct relation between local imitation and the strength of IPRs. If local imitation is a main factor impeding the trade or FDI between developing and developed countries, and the usefulness of the IPRs protection in developing countries on increasing trade or inflow of FDI from developed countries are really reflected in its

power on regulating the local imitation, then it is necessary to show some empirical evidences in order to promote IPRs protection.

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 a cost activity 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 kind of imitation product function, where imitation is treated as the type of innovation production function commonly recognized.

$$n^s = f(n^M, L^I),\ \partial n^s / \partial n^M > 0, \partial n^s / \partial L^I > 0. \qquad (1)$$

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

Then we have to consider the relation between IPRs protection and the fruit of imitation. To shed light on our purpose, here we divide the effects of IPRs protection into two parts, (1) the effects of the system as a whole; (2) the effects of a certain part , the patent-protection and trademark-registration system. The effects of the first part indicate those effects, including some kinds of announcement or enforcement effects, may reduce the resources involved in imitation activity. The effects of the second part indicate those effects, which may reduce the accessible number of MNC products targeted by imitation. With the consideration, we relate the resources invested in imitation activity to the effects of the IPRs protection system as a whole in the following form.

$$L^I = g(k),\ \partial L^I / \partial k < 0, \qquad (2)$$

where, $k > 1$ 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-protection and trademark-registration system. With the expectation that the protection may reduce the accessible number of MNE goods, we define

$$n^m = h(p),\ \partial n^m / \partial p < 0, \qquad (3)$$

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 and $n^m \le n^M$. Combining equations (1) to (3), we get the following function of imitation, which is a benchmark equation of our empirically study in the following sections.

$$n^s = G(p,k)\,,\ \partial n^s/\partial p < 0, \partial n^s/\partial k < 0\,. \qquad (4)$$

III Data and Estimation Issues

III-1 About the data

According to a data-base of Japanese firms investing in China 2000, which is provided by TOYOKEIZAI SHINPOSHA[3], 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 where 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 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 been registered for trademark.

[3] 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.

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 of 5 designates that the legal enforcement of IPRs protection in that location is excellent.

Table 1and 2 about here

Part of the data obtained from our questionnaire are shown in Table 1, and the meanings of all elements in Table 1 are listed 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 IPRs protection in China was marked on average at 2.60 point, which implies that the situation of IPRs protection in China is not good enough in comparison with China's well-formed IPRs protection system. 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 have relatively higher sensibility on the protection of their products. Third, Table 1 shows that on average nearly 30% of the products of the Japanese subsidiaries have been imitated. 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 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-trademark-registration and imitation tends to be positive, which is contrary 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 for consideration on 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.

$$n^s = f(n^M, L^I, T, LP), \tag{5}$$

where $\partial n^s / \partial n^M > 0, \partial n^s / \partial L^I > 0, \partial n^s / \partial T > 0, \partial n^s / \partial LP > 0$ 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 (6) in order to conduct our Probit test .

$$\begin{aligned} imi_{jki} = {} & a_0 + a_1 Level_j + a_2 PAT_j + a_3 TRAD1_j + a_4 TRADE2_j + a_5 LOCAL_j \\ & + b_i CITY_i + g_k IND_k + e_{jik} \end{aligned} \tag{6}$$

In equation (6), imi_{jki} represents a dummy variable of a certain Japanese subsidiary j of industry k in city i, in which its value 1 means that this subsidiary answered that its products has 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, in which its value 1 means that this subsidiary reported that its product has been patented or registered for trademark; $Trad1_j$ represents a dummy variable of subsidiary j, in which its value 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, in which its value 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, in which its value 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 to derive some locational 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. However, the coefficient of patent and trademark-registration system is positive and statistically significant, and this is consistent with the correlation derived in Table 3. A possible explanation of this result is that, the recognition of patent and trademark-registration system in China is so much lower that such the system could not work effectively. To the contrary to our expectation, such patent and trademark-registration system is actually playing a role of providing some kind of **measure** for local imitation.

Table 4 about here

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

In subset 3, we also add trade from other countries as another independent variable. The results on the coefficients of IPRs protection system as a whole and the patent and trademark-registration system are also consistent with what we get in the first two subsets. And the coefficient of trade from other countries is positive and statistically significant. However, 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, from the subset 4 instead of using $Trad1_j$ and $Trad2_j$, we added a new dummy variable, $Trad12_j$, with its value 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 subset 4 shows that the results on the coefficients of IPRs protection system as a whole and the patent and trademark-registration system is consistent with what we get in the first three subsets. And the coefficient of trade from both Japan and other countries is also positive and statistically significant.

In subset 5, local production is added as an independent variable in the test.

Although the sign of coefficient of this variable is positive, it is not statistically significant. Coefficients of other variables consist with what we get in the previous subsets.

In 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 on region of XF) and there could not be found any meaningful evidence on these variables. However, results of the coefficients of other variables are consistent with what we get in above all subsets.

V On the Profits, Imitation and IPRs Protection

Another issue we are going to test is the relation among profits of the subsidiaries, local imitation and IPRs protection. According to our common sense, it is widely recognized that local imitation will lead MNEs unprofitable, and IPRs protection system as a whole or each separate right or rights of that ensure for those MNFs to acquire their expected profits. Hence the patent and trademark-registration system ensure those MNEs to acquire their expected profits. However, the correlation matrix in Table 3 suggests negative correlation between imitation and unprofitable firms. This leads us to do further regression analysis in order to investigate this issue. Based on our data, 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 certain subsidiary j of industry k in city i, in which its value 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 what are in equation (6).

The two variables of trade and local production are added in the test in order to check the relation between unprofitable and market situation of competition. And the IPRs protection variables are added to confirm whether IPRs protection system have the effects on ensuring firms profits. The results are shown in Table 5.

Table 5 about here

The test of the subset 1 is a basic test. The result shows that the sign of the coefficient of independent variable of IPRs protection system as a whole is positive and statistically significant. 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 on ensuring the profits of firms. In comparison with the effects of IPRs protection system, the results show that the sign of the coefficient of imitation is negative and statistically significant. This result is contrary to our common sense that imitation will make firms unprofitable. It seems odd, but one possible explanation is that the imitators usually tend to target profitable products, so our data show that those firms whose products are imitated might be profitable.

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 and statistically significant. This means that competition with the other products in the same category of a certain subsidiary imported from Japan is a main factor of making this firm unprofitable. Other results consist with what we get in subset 1.

In subset 3, independent variables of trade from both Japan and other countries and local production are added in test. As a result, the sign of the coefficient of trade is positive and statistically significant. However, the result suggests that there is no significant relation between local production and profits of Japanese subsidiaries. Results concerning IPRs protection system are consistent with what we get in 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). And the results also consist with what we get in previous subsets.

Results in this section show us the following facts. First, the IPRs protection as a whole has the effects of ensuring the profits of Japanese subsidiaries. Second, the patent and trademark-registration system, which is a part of the IPRs system, has no significant effect on ensuring the profits of Japanese subsidiaries. Second, competition with the products imported from Japan or other countries in the same category of the Japanese subsidiaries is a significant factor making those Japanese subsidiaries unprofitable. Third, local production of the same category of the products

of Japanese subsidiaries doesn't influence the profits of those Japanese subsidiaries. This would imply that the quality of local products has not reached yet to the level of the Japanese subsidiaries', thus the local products cannot be threatening 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 ensuring the profits of foreign subsidiaries, by using data obtained from our questionnaire on Japanese FDI in China. The results are as follows. The IPRs protection system as a whole has the effects on reducing local imitation and ensuring the profits of Japanese subsidiaries in China. However, the patent and trademark-registration system, which is a subsystem of the IPRs protection system as a whole, does not work effectively in China. On the contrary, our results robustly suggest that such subsystem plays the role of providing some kinds of measure for local imitation.

A straightforward possible explanation on the results we obtained is that even if 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 on lowering local imitation because of its legal and administrative regulation effects, thus ensuring the profits of foreign subsidiaries. However to the subsystem of it, which in this paper we refer the patent and trademark-registration system, situation will 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 with such opened information imitators could successfully imitate the product with relatively little resources.

Our findings are quite contrary to the common recognition on the effects of IPRs protection system, however, strongly suggest that a WTO standardized IPRs protection system in developing countries might act like "invisible hands" disturbing the FDI from developed to developing countries. Thus our findings call our attention to consider again what 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

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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.	α_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	α_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	α_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	α_3			0.295	1.325[a]	0.092	0.379						
TRAD2	α_4					0.518	2.231						
LOCAL	α_5									0.310	1.248	0.356	1.172
TRAD12								0.395	1.704[b]	0.390	1.677[b]	0.381	1.381[a]
PE	β_1											0.400	0.824
SH	β_2											0.147	0.346
GU	β_3											0.578	1.241
DA	β_4											0.600	1.170
TEN	β_5											0.244	0.435
XF	β_6											0.717	0.850
SHEN	β_7											0.221	0.213
GLASS	γ_1											0.271	0.537
FIBER	γ_2											-0.083	-0.197
VEH	γ_3											-0.318	-0.484
FOOD	γ_4											0.153	0.022
CHE	γ_5											-0.025	-0.073
MACH	γ_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	

a. One tail test. Significant at the level of 10%.

b. Significant at the level of 10% .

Table 5. 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.	λ_0	0.633	1.939	0.580	1.738	0.351	0.901	1.327	1.400
Level	λ_1	-0.231	-2.120	-0.243	-2.207	-0.237	-2.136	-0.292	-2.362
PAT	λ_2	0.162	0.770	0.062	0.279	0.049	0.223	-0.248	-0.103
imi	λ_3	-0.370	-1.622[a]	-0.412	-1.784	-0.464	-1.988	-0.523	-2.109
TRAD1	λ_4			0.304	1.473[a]				
TRAD2	λ_5								
LOCAL	λ_6					0.077	0.354	0.331	1.219
TRAD12						0.538	2.570	0.406	1.700
PE	ω_1							-0.851	-1.026
SH	ω_2							-1.020	-1.293[a]
GU	ω_3							-1.061	-1.291[a]
DA	ω_4							-0.712	-0.838
TEN	ω_5							-0.504	-0.587
XF	ω_6							-0.510	-0.472
SHEN	ω_7							-1.330	-1.099
SU	ω_8							-0.521	-0.602
GLASS	σ_1							-0.428	-0.865
FIBER	σ_2							-0.425	-1.217
VEH	σ_3							0.003	0.007
FOOD	σ_4							1.330	1.830
CHE	σ_5							0.140	0.429
MACH	σ_6							0.134	0.375
$\overline{R}^2$		0.033		0.045		0.070		0.134	
Observations		179		177		179		178	
Fraction of Correct Predictions		0.581		0.571		0.659		0.624	

a. One tail test. Significant at the level of 10%.