LOCATION DETERMINANTS OF JAPANESE DIRECT INVESTMENT BY INDUSTRY IN CHINA

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I Introduction

Research on foreign direct investment（FDI）and trade is indispensable to examine international economic relations in Asia. Developing countries, such as China and Thailand, receive a large amount of FDI, and Japan is the most important source of FDI for Asian countries. Moreover, not only do Japanese multinational corporations in China and Thailand play a major role in intra-regional trade, but they also are very active in inter-regional trade, vis-à-vis US and EU markets.

As of the end of 2007, there were 12,710[1] overseas subsidiaries of Japanese multinational corporations in Asia. This number far exceeded the number of Japanese subsidiaries in North America (3,547), a region that receives regular attention from Japanese multinational corporations. It also accounts for more than half of the total number of Japanese global subsidiaries (21,264).

Economic analysis of the overseas advance of Japanese enterprises in Asia is necessary to understand the intra- and inter-regional economic relations in the Asian region. China is home to 4,878 Japanese subsidiaries, exceeding any other country with Japanese FDI. China is followed by Thailand (1,577), Singapore (991), Taiwan (896), and Malaysia (759). In comparison, there are only a small number of Japanese enterprises that have an FDI presence in other countries in Asia, such as Nepal. Similar patterns are observable in China, with Japanese multinational corporations investing significantly in Shanghai (1,709), Jiangsu Province (740), and Guangdong Province (721), among others.

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[1] aggregation by author from *Survey of Overseas Japanese Companies* Published by Toyo Keizai Shinposha. 2008

What factors influence Japanese multinational corporations in their location choice when investing China? There are several factors that attract FDI (foreign direct investment) in the receiving country (or region). These are not limited to traditional factors, such as market size, infrastructure, and labor cost, but also include the agglomeration effect throughout the international production network, which has become more and more significant. Do these factors vary based on their industries as well?

In this paper, I attempt to answer the above questions. The analysis use micro-data from the TOYO KEIZAI database by the Conditional Logit Model. Through a comparison of location determinants of Japanese direct investment in 31 Chinese regions from 2002 to 2006 by industry, we see that determinant factors related to theagglomeration effect are more important than the other "traditional factors" in attracting Japanese investment in China.

This paper has important implications in understanding Japanese economic relationships and integration in the East Asia region. It also could serve as a reference to Asian countries' government policymaking regarding foreign direct investment in order to reduce area disparity.

The structure of the paper is as follows: Section II briefly discusses recent trends and characteristics of Japanese manufacturing industries in China. Section III is a brief overview of Survey of Previous Studies. Section IV presents the model and Section V presents the hypotheses and the explanation of variables for the analysis, while Section VI discusses the results of empirical analysis and Section VII concludes the paper.

II Recent Trends and Characteristics of Japanese Manufacturing Industries in China

As the Chinese government does not disclose firm-level data of FDI, we used Japanese data on the firms investing in China, such as the *Survey of Overseas Japanese Companies* Published by Toyo Keizai Shinposha. This survey data covers the location and outlines the business activities of Japanese affiliates in China. It includes the 4938 Japanese affiliates established in China before 2005. Of these, 70% were in the manufacturing sector and 30% in non-manufacturing sectors. Among the industries in the manufacturing sector, the transportation equipment/machinery industry accounted for 32%, the electric and electronics industry for 23%, the chemical industry for 19%, the metal products industry for 10%, the textile industry for 8%, the food and beverage industry for 4% of all the locations. Let us briefly discuss some notable location characteristics of these six industries.

Table 1 shows the patterns of JFDI (Japanese Foreign Direct Investment) inflows in China during 2002-2005 in each location (provinces) by industry. These figures reveal an inequality in the distribution of location by industry. The total number of newly established Japanese manufacturing industry affiliates amounted to 610 in China. Among 31 provinces and special cities, the dominant number of newly established JFDI was established in the eastern region of China. The Yangtze delta (Shanghai:116, Jiangsu:163, Zhejiang:56), and the Zhujiang delta (Guangdo:104) had 72% of the total number of establishments, indicating a very high geographical concentration. New establishments in the transportation equipment/machinery industry in particular were concentrated in the Yangtze delta (Shanghai:16.84%, Jiangsu:27.04%, Zhejiang:6.63%), the Zhujiang delta (Guongdo: 22.45%) and the Beijing Tianjin Area (10.20%). The electric and electronics industry were concentrated in these three areas: The Yangtze delta (Shanghai: 17.81%, Jiangsu: 32.88%, Zhejiang:7.53%), the Zhujiang delta (Guongdo: 15.07%) and the Beijing Tianjin Area (8.22%). JFDI in the chemical industry and metal products industry were preferred in Shangdo (5.79%, 4.55%) than in the Beijing Tianjin Area. These industries were also were concentrated in the Yangtze delta and the Zhujiang delta. Japanese affiliates in the textile industry were concentrated in the Yangtze delta (Shanghai:25%, Jiangsu: 23.08%, Zhejiang: 23.08%), with a low concentration in the Zhujiang delta, while the food and beverage industry was not as concentrated as the other five industries. The difference in the number of established locations by region and by industry suggests that market conditions have different effects on location choice.

III A Brief Survey of Previous Studies

Most studies on FDI location choice in China use overall FDI data without sectoral disaggregation and firm level data. Some earlier studies (He and Chen 1999, Wei et al. 1999, He and Liang 1999) highlight the significance of traditional location factors such as market size (GDP), potential market size (rate of GDP growth), wages, education level, and infrastructure (highways, railways, domestic shipping industry, electric power, etc.). These studies mostly show positive impacts of the market size, potential market size, infrastructure on FDI inflows, as well as the negative effects of higher wages. Chen and Xu (2007), Liu and Wang (2005), and Wang and Xu (2004) found that higher wages, and lower education levels might attract more FDI.

The vast majority of recent publications argue that other factors such as agglomeration economies are more important, and that the traditional approach does not take this into account sufficiently (He 2002, Xiao and Lin 2008, He and Liu 2006).

He (2002) focuses on information costs, agglomeration economies and the local foreign direct investment in China. He found that the coefficient of the effective wage rate is not significant. Instead, the statistical results show that MNE's prefer coastal cities with favorable policies and form regional clusters with other MNE's to reduce market uncertainties and minimize information costs. Xiao and Lin (2008) tried to analyze the reasons for why the Yangtze Delta could attract such a great deal of FDI from industrial clusters. They used several different variables (like rate of own industry, rate of overall industry) to test the agglomeration effects of different industries.

In order to deepen the understanding of the pattern of FDI location, several studies have attempted to use firm-level data for the investigation. As it is rather difficult to gain access to firm-level information from Chinese sources, several researchers used data obtained from the sources outside China.

Wakasugi (2005) analyzed the geographical allocation of Japanese firms in China by using a conditional logit model and found that industry agglomeration proxied by the special economic zones and the abundance of well-educated human resources were largely responsible for a rise in the probability of a region to be chosen as a FDI host, whereas a rise in the real wage cost lowered this probability.

Jin and Tokunaga used data from *Chugoku Shinshutsu Kigyou Ichiran*[2] to analyze location choices of Japanese FDI in China's food industry from 1992 to 2003. Using a negative binominal model, Jin and Tokunaga found that high wages and distance from Japan discourage FDI by Japanese food manufactures, while the availability of raw materials and seaport facilities positively attracted FDI. Unlike other studies, they found that provincial purchasing power, measured by per capita GDP, but not by provincial market size, appeals to Japanese investors in China.

Kang and Lee (2004) investigated the recent FDI trends and the determinants of location choice by using firm level data of Korean and Japanese MNEs in China. Their conditional logit estimation results differ between Korean and Japanese companies. The agglomeration variable is shown to be positive and significant for FDI from the two countries, and regional income is shown to be positive for Japan but negative for Korea.

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[2] *A View of Japanese Enterprise Investments in China*, 2003-2004, In Japanese.

IV The model

The location choice of a company (belonging to a certain industry) at t (year) is considered. There are M (＝31) provinces in China which are the targets that of selection. If the logarithm value of the profit function is expressed as lnΠ s,t, when choosing s (province) and t (year), the company should choose m (province) which fills the following equation:

$$\ln \prod_{m,t} = Max\{ \ln \prod_{s,t} : S = 1, \cdots, M \} \quad (1.1.)$$

Here, logarithm value of a profit function shall be expressed as follows:

$$\ln \prod_{s,t} = \beta' \chi_{s,t} + \varepsilon_{s,t} \quad (1.2.)$$

However, $\chi_{s,t}$ expresses the vector of an attribute of the province in t (year). （β is a coefficient vector presumed about this industry.） $\varepsilon_{s,t}$, expresses an attribute of the area and the characteristics particular to the company which cannot be observed.

As McFadden (1973) showed, when a residual $\varepsilon_{s,t}$, independently follows extreme-value distribution of the same type I the probability of this company which chooses m (province) in t (year) is given by the following formulae:

$$P_{m,t} = \frac{\exp(\beta' x_{m,t})}{\sum_{s=1}^{M} \exp(\beta' x_{s,t})} \quad (1.3.)$$

Therefore, if expressing the number of times from which s (province) is chosen in the industry concerned at t as $W_{s,t}$, （s =1,…, M, t =1, …,Ｔ) and a residual becomes mutually independent in all the location choices, the probability that a location pattern $\{W_{s,t}$: s =1,…, M, t =1, …,T}will be observed is obtained in the following formulae:

$$L = \prod_{t=1}^{T} \prod_{s=1}^{M} P_{s,t} W_{s,t} \quad (1.4.)$$

A model of this type is called Conditional Logit Model

V The hypotheses and the explanation of variables

According to previous studies, foreign firms consider market size, infrastructure, wage level, education level, and the agglomeration effect as the important factors in location decisions.

In my estimation, I adopt log of real GDP (Gross Domestic Product) as the representative variable of market size. There are more investment opportunities as the market size is bigger, as usual. The estimated coefficient of real GDP (ln_gdp) is expected to be positive. One of the important factors in the location decision is the well-organized infrastructure, especially the infrastructure in the transportation department. In this paper I adopted transportation networks such as roads, railway, and inland sea routes, and defined the infrastructure by the total length of road, railway and inland sea routes per square kilometer. The estimated coefficient is also expected to be positive.

Three different types of labor variables are considered: one is the labor cost, which captures a level of produce cost. Lower wages mean that firms could bring their production costs down, particularly in labor-intensive industries. So the expected sign of labor cost (ln_wage) is negative. Labor productivity is also an important factor that influences Japanese multinational corporations when chosing a location. Labor productivity is an index of efficiency of labor, defined by output-real GDP per worker. The estimated coefficient is also expected to be positive. The third type is human capital, which captures the quality of labor. The ration of high-school-educated workers is expected to have positive sign.

In addition, regional dummies are used to capture the policy differences in different regions. For example, the Chinese government launched the China Western Development Project in 2000 to foster the economies in western areas, which is relatively underdeveloped in China. There are three regional dummies: the western dummy (dwest), the central (or middle region) dummy (dmid) and the eastern dummy (reference group). These dummies control policy differences.

Finally, there is the agglomeration effect. Under certain conditions, the agglomeration of industries and firms in a region will prove beneficial to firms seeking to employ qualified labor forces and intermediate materials in an efficient manner. This *Marshallian externality* serves as a favorable factor in attracting further entrants to the region. Some previous studies on the location choice of foreign firms have noted the agglomeration effect. Head et al. (1995) pointed out that the agglomeration of Japanese affiliates in the United States indicated a positive effect of such agglomeration. In such a period of transition in China from a planned economy to a market-oriented one, it was difficult for foreign firms to collect accurate information regarding regulations and incentives provided by both the central government in Beijing and the local government in each province. Firms sometimes encountered inconsistencies or contradictions in the policies of the central and local governments. In addition to efficiency in employing labor and procuring arts and materials, a high degree of agglomeration is an indicator that a region is providing foreign affiliates with favorable economic conditions, especially in the regions with a concentration of local firms or foreign affiliates.

The agglomeration of foreign affiliates attracts other plants from their home countries; this fact has been confirmed by statistical data on the location of Japanese affiliates. Wakasugi (2005) pointed out that a major reason for this is that Japanese affiliates in China constitute a type of vertical fragmentation of the manufacturing process. A number of Japanese affiliates were established in China for the purpose of expanding the development of the parts-assembly network from the home market to plants abroad. Once a firm from the network shifts its plant to China, it triggers other firms to shift their plants as well. Moreover, it is easier for Japanese firms to collect information regarding the Chinese market from Japanese affiliates than from Chinese firms themselves. This suggests that new Japanese affiliates are apt to locate in regions characterized by an agglomeration of Japanese firms.

To test the agglomeration effect, I use five variations of the "number of firms" for the estimation: (1) the number of industry firms in China, (2) the number of other countries' affiliates in China, (3) the number of Japanese affiliates in China, (4) the number of Japanese manufacture affiliates, (5) the number of Japanese affiliates in the same industry. With regard to the estimation of the estimation of the agglomeration effect, I estimated five cases: (1) the agglomeration effect with Chinese firms, (2) the agglomeration effect with other foreign affiliates, (3) the agglomeration effect with Japanese affiliates, (4) the agglomeration effect with Japanese manufacturing affiliates, (5) the agglomeration effect with Japanese affiliates in same industry.

I estimated the parameters for six industries as a whole and by industry. These industries are: (1) the electric and electronics industry, (2) the transportation equipment/machinery industry, (3) the chemical industry, (4) the metal products industry, (5) the textile industry, and (6) the food and beverage industry. These six industries account for approximately 80% of the total number of plant locations in the manufacturing sector.

Basic information on the variables used in the analysis are shown in Table 3. The explaining variables are taken from the *China Statistical Yearbook* (2002-2005), while the explained variables are taken from the *Survey of Overseas Japanese Companies* published by Toyo Keizai Shinposha.

The explaining variables and the explained variables comprise of the panel data of 31 provinces and special cities spanning 4 years. Since I assumed that Japanese affiliates make their location choice on the basis of market conditions in the previous year, I gave a one-year lag to all the explaining variables in the estimation. In a statistical sense, this method is effective for avoiding the simultaneous equations bias.

VI The Results

I applied the conditional logit model to investigate the locational determinants of JFDI inflows in the manufacturing industry to Chinese provinces. The results of the analysis are shown in Table 4-10. Table 6 presents the estimated results based on the panel data of Japanese Manufacture industry as a whole, while Table 5-10 presents the estimated results by industry.

For the Japanese manufacturing industry as a whole (Table 4), the results show that market size (ln_gdp) and transportation infrastructure (infra) have positive impacts on JFDI in manufacture industry inflows. The relationships, which are shown to be statistically significant, are consistent with that expectation. Labor cost (ln_wage) is estimated to be negative and labor productivity (ln_labpro) to be positive with strong statistical significance as expected. The provinces with lower labor costs and higher labor productivity can attract more Japanese firms in the manufacturing industry invest in those provinces. But the estimated coefficient on human capital (edu), which is found to be negative and statistically significantly, is not as expected. High human capital may reflect high wages and high labor costs. Compared to the low costs or lower educated workers, the highly educated worker may not be necessary in the manufacturing industry. This is why the coefficient of labor costs may be negative and labor productivity is positive. The three variables about labor have a correlative relationship but different means. The estimated results on the dummy of middle region and western region are negative as expected, although the coefficients are not statistically significant.

Turning to the results on the agglomeration effect variables, we see positive impacts that are statistically significant. The coefficient of the agglomeration effect with Chinese firms (ln_agglo1)(1.09) is higher than those with Japanese affiliates (ln_agglo3)(0.94) and with other countries' affiliates (ln_agglo2)(0.29). This may reflect the fact that Japanese affiliates, while facing on the pressure on cost-cutting, depend on Chinese local firms for the supply of parts and components, instead of depending only on Japanese affiliates, as they had before. Japanese manufacturing affiliates have a complementary relationship with Chinese industrial firms on the vertical specialization based on the production network, while others have competitive problems with other countries' affiliates in China market.

The examination of the results by different industries brings out some interesting trends in the loactional determinants.

In the electric and electronics industry (Table5), and the transportation equipment/machinery industry (Table6), the traditional variables, such as market size, infrastructure, labor cost, labor productivity, and human capital show similar trends as whole. On the other hand, the agglomeration effect variables have different results. For the agglomeration effect variables, unlike the electric and electronics industry, there are negative impacts with Japanese affiliates in the same industry (ln_agglo5) in the transportation equipment/machinery industry, while both have positive effect with Japanese affiliates (ln_agglo3), especially with Japanese manufacturing affiliates (ln_agglo4). This appears to reflect the fact that the *keiretsu product network*, which is a grouping product network in the Japanese transportation equipment/machinery industry, is not only in Japan, but also in China.

In the metal products industry (Table 7), the regional dummies (dmid, dwest) turn to negative in the transportation equipment/machinery industry, although the coefficient is not statistically significant. For the agglomeration effect variables, there are positive impacts with Chinese firms (ln_agglo1), Japanese affiliates (ln_agglo3), and Japanese manufacturing affiliates (ln_agglo4). These results are similar to those from the electric and electronics industry. The results of these four kinds of agglomeration effects are shown to be statistically significant as well. From among these effects, the coefficient of agglomeration effect with Chinese firms (1.88) is higher than in the electric and electronics industry (0.89) and the transportation equipment/machinery industry (0.53). This may reflect the fact that Japanese metal products affiliates are likely to get together with Chinese firms than the two industries are, although they are likely to get together with others Japanese and Japanese origin manufacturers (ln_agglo3, ln_agglo4) in order to gain an agglomeration economy.

In the chemical sector (Table 8), the results of labor cost (ln_wage) turn positive, and labor productivity turns negativity with statistical significance, which is unexpected. Japanese chemical affiliates are centered on capital-intensive industries such as petroleum chemistry, drugs and medicines. The quantity of capital input is more important than the labor input. Lower labor costs and higher labor productivity are not as favorable in other labor-intensive industries. For the agglomeration effect variables, there are positive impacts with Chinese firms (ln_agglo1), Japanese affiliates (ln_agglo3), Japanese manufacturing affiliates (ln_agglo4) and with Japanese affiliates in chemicals industry (ln_agglo4), with statistical significance. These results are similar with the electric and electronics industry and the metal products industry.

In the textiles industry (Table 9) and the food and beverage industry (Table 10), there are some differences in the agglomeration effect variables, although the results are not strong as other industries. In the textile industry, the agglomeration effect with Chinese firms (ln_agglo1) is higher than others. This may reflect the fact that Japanese textiles affiliates are likely to get together with Chinese firms than get together with others Japanese and Japanese origin manufacturers (ln_agglo3, ln_agglo4) even in the same (textiles) industry (ln_agglo5). In contrast, in the food and beverage industry, the agglomeration effects are weak with Chinese firms (ln_agglo1) and three kinds of Japanese affiliates because the results show no statistical significance or only significance at 0.1 levels. Unlike the textiles industry, completed products, which were made in China but by Japanese affiliates, are exported to Japan or another market like USA and European countries. Meanwhile most Japanese food and beverage affiliates make their products in China and sell them in China too. Those affiliates choose the location near the consumer market to establish business for reduce distribution costs.

VIIConcluding Remarks

This paper analyzed the locational determinants of JFDI in manufacturing in China based on the firm-level database by conditional model. The use of firm-level date also enabled me to focus on the differences in the determinate by industry. This paper obtained results similar to earlier studies and generally consistent with the prior expectations. The consistent finding was that provinces with a big market size, a good transportation infrastructure, low labor costs, high efficient labor productivity, and the agglomeration effect are shown to attract JFDI in manufacture industry. As for five-tier agglomeration effect tests, we found the agglomeration effect in Chinese firms (ln_agglo1), Japanese affiliates (ln_agglo3), Japanese manufacturing affiliates (ln_agglo4), and Japanese affiliates in same industry (ln_agglo5), but not for other foreign affiliates (ln_agglo2). These findings provide some useful policy implications. Provinces with a keen interest in attracting JFDI could make efforts to develop local firms, local manufacturing industry and local product networks.

This analysis would also be useful for the governments of other East Asian countries that are interested in attracting FDI. If the results of the analysis would be used effectively by these governments to attract FDI, I would expect that regional integration in East Asia could be promoted through the expansion of FDI and foreign trade.

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Table 1: Establishment of New JFDI in China in the manufacruing sector (2002-2005), by region and industry

	Province	Numbers of New Establishment						Share of New Establishment(%)					
	Industry	Electric and Electronics	Transportatio n Equipment/M	Metal products	Chemicals	Textiles	Food and Beverage	Electric and Electronics	Transportatio n Equipment/M	Metal products	Chemicals	Textiles	Food and Beverage
		23.93%	**32.13%**	**10.82%**	**19.84%**	**8.52%**	**4.75%**						
1	**Beijing**	4	2	0	3	1	1	2.74	1.02	0.00	2.48	1.92	3.45
2	**Tianjin**	8	18	1	3	1	3	5.48	9.18	1.52	2.48	1.92	10.34
3	**Hebei**	1	2	1	2	1	0	0.68	1.02	1.52	1.65	1.92	0.00
4	**Shanxi**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
5	**Inner Mongolia**	2	0	0	0	0	0	1.37	0.00	0.00	0.00	0.00	0.00
6	**Liaoning**	6	6	1	4	3	2	4.11	3.06	1.52	3.31	5.77	6.90
7	**Jilin**	0	1	0	0	1	1	0.00	0.51	0.00	0.00	1.92	3.45
8	**Heilongjiang**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
9	**Shanghai**	26	33	19	21	13	4	17.81	16.84	28.79	17.36	25.00	13.79
10	**Jiangsu**	48	53	14	32	12	4	32.88	27.04	21.21	26.45	23.08	13.79
11	**Zhejiang**	11	13	7	11	12	2	7.53	6.63	10.61	9.09	23.08	6.90
12	**Anhui**	0	0	0	1	0	0	0.00	0.00	0.00	0.83	0.00	0.00
13	**Fujian**	2	1	0	0	1	2	1.37	0.51	0.00	0.00	1.92	6.90
14	**Jiangxi**	1	0	0	0	0	0	0.68	0.00	0.00	0.00	0.00	0.00
15	**Shandong**	3	11	3	7	5	5	2.05	5.61	4.55	5.79	9.62	17.24
16	**Henan**	1	3	0	0	0	0	0.68	1.53	0.00	0.00	0.00	0.00
17	**Hubei**	1	6	0	1	0	1	0.68	3.06	0.00	0.83	0.00	3.45
18	**Hunan**	1	0	0	0	0	0	0.68	0.00	0.00	0.00	0.00	0.00
19	**Guangdong**	22	44	11	23	2	2	15.07	22.45	16.67	19.01	3.85	6.90
20	**Guangxi**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
21	**Hainan**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
22	**Chongqing**	0	1	0	0	0	0	0.00	0.51	0.00	0.00	0.00	0.00
23	**Sichuan**	0	2	0	3	0	0	0.00	1.02	0.00	2.48	0.00	0.00
24	**Guizhou**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
25	**Yunnan**	0	0	0	1	0	0	0.00	0.00	0.00	0.83	0.00	0.00
26	**Tibet**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
27	**Shaanxi**	0	0	0	0	0	2	0.00	0.00	0.00	0.00	0.00	6.90
28	**Gansu**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
29	**Qinghai**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
30	**Ningxia**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
31	**Xinjiang**	0	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00
	Tatal:	**146**	**196**	**66**	**121**	**52**	**29**						

Table 2：Variable list

	Variable:		Contents	Date Source
1	**ln_gdp**	Market Size	Real GDP	*China Statistical Yearbook* 2002~2005 year
2	**infra**	Transportation Infrastructure	(Railway+Inland Sea Route+Road):km /Square:Km^2	as above
3	**ln_wage**	Labor cost	Average Wage	as above
4	**ln_labpro**	Labor Productivity	Real GDP/The Working Population	as above
5	**edu**	Human Capital	The Ration of high-school-educated	as above
6	**dmid**	Dummy of Middle Region	the 8 provinces in the middle of China	Administrative Division by China Government
7	**dwest**	Dummy of Western Region	the 10 provinces in the western of China	as above
8	**ln_agglo1**	Agglomeration Effect with Chinese Firms	the Number of industry Firms in China	*China Statistical Yearbook* 2002~2005 year
9	**ln_agglo2**	Agglomeration Effect with Other foreign	the Number of other Countries' Affiliates in China	as above
10	**ln_agglo3**	Agglomeration Effect with Japanese Affiliates	the Number of Japanese Affiliates in China	*the Survey of Overseas Japanese Companies* 2008 year
11	**ln_agglo4**	Agglomeration Effect with Japanese Manufacture Affiliates	the Number of Japanese Manufacture Affiliates in China	as above
12	**ln_agglo5**	Agglomeration Effect with Japanese Affiliates in same Industry	the Number of Japanese Affiliates in same Industry in China	as above

Table 3：Basic statistics and Correlations

Basic Statistics

Variable	Mean	Std.Dev	Min	Max
ln_gdp	8.068	1.013	5.110	9.910
infrarrl	0.452	0.325	0.030	1.710
edu3	0.195	0.086	0.030	0.490
ln_wage2	9.598	0.303	9.120	10.440
ln_labpro	0.366	0.525	−0.710	1.760
dmid	0.226	0.418	0.000	1.000
dwest	0.387	0.487	0.000	1.000
ln_agglo1	8.377	1.246	5.230	10.630
ln_agglo2	5.970	2.003	0.000	9.660
ln_agglo3	2.900	1.972	0.000	7.280
ln_agglo4	2.612	1.924	0.000	6.390
ln_agglo5	1.136	1.440	0.000	4.950

Correlations

	ln_gdp	infrarrl	edu3	ln_wage2	ln_labpro	dmid	dwest	ln_agglo1	ln_agglo2	ln_agglo3	ln_agglo4	ln_agglo5
ln_gdp	1.000											
infrarrl	0.513	1.000										
edu3	0.309	0.676	1.000									
ln_wage2	0.061	0.478	0.428	1.000								
ln_labpro	0.487	0.734	0.757	0.727	1.000							
dmid	0.127	−0.089	−0.061	−0.374	−0.212	1.000						
dwest	−0.601	−0.595	−0.412	−0.085	−0.545	−0.429	1.000					
ln_agglo1	0.956	0.579	0.311	0.125	0.523	0.064	−0.619	1.000				
ln_agglo2	0.902	0.682	0.456	0.167	0.644	−0.057	−0.656	0.935	1.000			
ln_agglo3	0.774	0.771	0.579	0.440	0.805	−0.241	−0.565	0.816	0.876	1.000		
ln_agglo4	0.771	0.748	0.518	0.404	0.770	−0.194	−0.610	0.835	0.877	0.979	1.000	
ln_agglo5	0.624	0.697	0.489	0.483	0.761	−0.288	−0.514	0.708	0.764	0.878	0.879	1.000

Table 4：Estimated result—Japanese manufurctry industry as Whole

Japanese manufurctry industry as Whole

	model1	model2	model3	model4	model5
ln_gdp	1.03 (7.88) ***	1.02 (7.69) ***	0.12 (0.59)	0.75 (3.96) ***	0.06 (0.35)
infra	1.54 (7.45) ***	1.57 (7.58) ***	1.13 (5.02) ***	1.47 (6.93) ***	0.28 (1.10)
ln_wage	−2.44 (−4.37) ***	−2.16 (−3.30) ***	−3.02 (−5.27) ***	−2.16 (−3.83) ***	−0.19 (−0.32)
ln_labpro	3.48 (7.62) ***	3.08 (5.27) ***	3.06 (6.43) ***	2.62 (4.21) ***	0.71 (1.27)
edu	−6.70 (−5.77) ***	−6.22 (−5.26) ***	−2.10 (−1.46)	−4.64 (−2.98) ***	−5.65 (−4.76) ***
dmid		−0.49 (−1.59)			
dwest		−0.10 (−0.25)			
ln_agglo1			1.09 (5.64) ***		
ln_agglo2fdi				0.29 (1.98) **	
ln_agglo3					0.94 (7.59) ***
ln_agglo4					
ln_agglo5					
Log likelihood	−1354.47	−1353.00	−1338.30	−1352.49	−1325.18
Pseudo R2	0.35	0.35	0.36	0.35	0.37
choices	31	31	31	31	31
Number of Firms	18910	18910	18910	18910	18910

＊、＊＊and＊＊＊ give the statistical significanece at 10%, 5% and 1%, respectivily.
The figures in parentheses expres t − statistics.

Table 5: Estimated result—Electric and Electronics

Electric and Electronics

	model1	model2	model3	model4	model5	model6	model7
ln_gdp	0.80	0.85	0.02	0.84	−0.11	−0.16	0.18
	(3.03)	(3.08)	(0.05)	(2.11)	(−0.28)	(−0.44)	(0.60)
	***	***		**			
infra	2.13	2.10	1.87	2.14	0.92	0.51	0.74
	(4.57)	(4.48)	(3.75)	(4.54)	(1.60)	(0.81)	(1.35)
	***	***	***	***			
ln_wage	−4.10	−4.61	−4.48	−4.14	−1.78	−0.94	−2.42
	(−3.15)	(−2.95)	(−3.40)	(−3.08)	(−1.28)	(−0.64)	(−1.91)
	***	***	***	***			*
ln_labpro	4.94	5.40	4.64	5.07	2.13	1.27	2.37
	(4.61)	(3.86)	(4.17)	(3.46)	(1.59)	(0.88)	(2.01)
	***	***	***	***			**
edu	−9.58	−9.74	−6.40	−9.88	−8.19	−4.17	−3.71
	(−3.83)	(−3.70)	(−2.17)	(−2.87)	(−3.15)	(−1.40)	(−1.29)
	***	***	**	***	***		
dmid		0.12					
		(0.17)					
dwest		0.71					
		(0.74)					
ln_agglo1			0.89				
			(2.05)				
			**				
ln_agglo2fdi				−0.04			
				(−0.13)			
ln_agglo3					0.87		
					(3.06)		
					***		
ln_agglo4						1.06	
						(3.52)	
						***	
ln_agglo5							0.80
							(3.98)
							***
Log likelihood	−305.80	−305.54	−303.67	−305.79	−300.99	−298.79	−297.08
Pseudo R2	0.39	0.39	0.39	0.39	0.40	0.40	0.41
choices	31	31	31	31	31	31	31
Number of Firms	4526	4526	4526	4526	4526	4526	4526

＊、＊＊and＊＊＊ give the statistical significanece at 10%, 5% and 1%, respectivily.
The figures in parentheses expres t − statistics.

Table 6: Estimated result—Transportation Equipment/Machinery

Transportation Equipment/Machinery

	model1	model2	model3	model4	model5	model6	model7
ln_gdp	0.98	0.98	0.51	0.58	0.04	−0.09	1.19
	(4.27)	*(4.10)*	*(1.32)*	*(1.73)*	*(0.14)*	*(−0.30)*	*(4.91)*
	***	***		*			***
infra	1.90	1.88	1.77	1.84	0.71	0.26	2.32
	(5.27)	*(5.17)*	*(4.73)*	*(4.96)*	*(1.62)*	*(0.55)*	*(5.56)*
	***	***	***	***			***
ln_wage	−2.59	−2.83	−2.72	−2.17	−0.75	0.25	−3.33
	(−2.66)	*(−2.34)*	*(−2.80)*	*(−2.20)*	*(−0.73)*	*(0.23)*	*(−3.19)*
	***	**	***	**			***
ln_labpro	3.41	3.74	3.11	2.13	0.95	−0.10	4.32
	(4.33)	*(3.47)*	*(3.83)*	*(1.96)*	*(0.98)*	*(−0.10)*	*(4.90)*
	***	***	***	**			***
edu	−7.82	−8.23	−5.93	−4.98	−6.83	−2.83	−9.10
	(−3.77)	*(−3.77)*	*(−2.42)*	*(−1.83)*	*(−3.24)*	*(−1.21)*	*(−4.22)*
	***	***	**	*	***		***
dmid		0.33					
		(0.66)					
dwest		0.09					
		(0.11)					
ln_agglo1			0.53				
			(1.49)				
ln_agglo2fdi				0.43			
				(1.61)			
ln_agglo3					0.88		
					(4.01)		
					***		
ln_agglo4						1.14	
						(4.85)	
						***	
ln_agglo5							−0.28
							(−2.28)
							**
Log likelihood	−434.12	−433.88	−433.01	−432.81	−425.88	−420.91	−431.51
Pseudo R2	0.36	0.36	0.36	0.36	0.37	0.37	0.36
choices	31	31	31	31	31	31	31
Number of Firms	6076	6076	6076	6076	6076	6076	6076

＊、＊＊and＊＊＊ give the statistical significanece at 10%, 5% and 1%, respectivily.
The figures in parentheses expres t − statistics.

Table 7: Estimated result—Metal products

Metal products

	model1	model2	model3	model4	model5	model6	model7
ln_gdp	1.34	1.21	-0.11	1.20	-0.76	-0.75	0.37
	(3.16) ***	(2.89) ***	(-0.15)	(1.97) **	(-1.13)	(-1.09)	(0.71)
infra	0.38	0.57	-0.64	0.32	-2.30	-3.34	-1.05
	(0.53)	(0.80)	(-0.71)	(0.44)	(-2.69) ***	(-3.22) ***	(-1.28)
ln_wage	-7.31	-5.59	-9.82	-7.13	1.36	2.16	-7.14
	(-2.93) ***	(-2.09) **	(-3.27) ***	(-2.80) ***	(0.49)	(0.67)	(-2.53) **
ln_labpro	7.82	6.04	9.14	7.32	-1.15	-2.03	8.57
	(3.57) ***	(2.46) **	(3.39) ***	(2.77) ***	(-0.43)	(-0.65)	(3.20) ***
edu	-5.38	-4.57	0.82	-4.12	-2.39	7.04	-8.23
	(-1.50)	(-1.30)	(0.19)	(-0.79)	(-0.53)	(1.38)	(-2.04) **
dmid		-15.62					
		(-0.01)					
dwest		-12.82					
		(-0.01)					
ln_agglo1			1.88				
			(2.45) **				
ln_agglo2fdi				0.16			
				(0.33)			
ln_agglo3					2.34		
					(4.37) ***		
ln_agglo4						2.76	
						(4.25) ***	
ln_agglo5							0.85
							(3.27) ***
Log likelihood	-134.53	-132.95	-131.15	-134.48	-121.60	-120.42	-128.08
Pseudo R2	0.41	0.41	0.42	0.41	0.46	0.47	0.43
choices	31	31	31	31	31	31	31
Number of Firms	2046	2046	2046	2046	2046	2046	2046

＊、＊＊and＊＊＊ give the statistical significanece at 10%, 5% and 1%, respectivily.
The figures in parentheses expres t – statistics.

Table 8: Estimated result—Chemicals

Chemicals

	model1	model2	model3	model4	model5	model6	model7
ln_gdp	1.64	1.63	0.64	1.15	0.66	0.61	1.02
	(4.75)	*(4.67)*	*(1.40)*	*(2.23)*	*(1.66)*	*(1.59)*	*(2.89)*
	***	***		**	*		***
infra	1.53	1.61	0.79	1.44	0.10	-0.14	0.40
	(3.35)	*(3.64)*	*(1.55)*	*(3.07)*	*(0.16)*	*(-0.22)*	*(0.74)*
	***	***		***			
ln_wage	1.63	2.51	0.76	1.80	3.58	4.10	2.11
	(1.38)	*(1.91)*	*(0.60)*	*(1.55)*	*(2.83)*	*(3.10)*	*(1.87)*
		*			***	***	*
ln_labpro	0.34	-1.01	-0.35	-0.67	-2.13	-2.70	-0.71
	(0.35)	*(-0.87)*	*(-0.34)*	*(-0.53)*	*(-1.76)*	*(-2.09)*	*(-0.72)*
					*	**	
edu	-4.33	-2.64	3.06	-1.92	-3.47	-0.14	-1.72
	(-1.62)	*(-1.00)*	*(0.86)*	*(-0.57)*	*(-1.35)*	*(-0.05)*	*(-0.64)*
dmid		-2.45					
		(-2.28)					
		**					
dwest		-0.81					
		(-1.04)					
ln_agglo1			1.37				
			(3.48)				
			***				
ln_agglo2fdi				0.44			
				(1.22)			
ln_agglo3					1.00		
					(3.38)		
					***		
ln_agglo4						1.12	
						(3.56)	
						***	
ln_agglo5							0.65
							(3.30)
							***
Log likelihood	-262.71	-258.30	-256.27	-261.96	-257.00	-255.86	-257.07
Pseudo R2	0.37	0.38	0.38	0.37	0.38	0.38	0.38
choices	31	31	31	31	31	31	31
Number of Firms	3751	3751	3751	3751	3751	3751	3751

＊、＊＊and＊＊＊ give the statistical significanece at 10%, 5% and 1%, respectivily.
The figures in parentheses expres t - statistics.

Table 9: Estimated result—Textiles

Textiles

	model1	model2	model3	model4	model5	model6	model7
ln_gdp	1.14	0.96	-1.69	0.89	0.80	0.39	0.70
	(2.62) ***	*(2.25)* **	*(-2.44)* **	*(1.37)*	*(1.25)*	*(0.68)*	*(1.43)*
infra	0.71	0.96	-2.01	0.62	0.30	-0.31	-0.11
	(1.05)	*(1.44)*	*(-2.04)* **	*(0.88)*	*(0.35)*	*(-0.35)*	*(-0.15)*
ln_wage	-2.18	-0.16	-8.12	-1.93	-1.34	-0.01	-0.53
	(-1.12)	*(-0.07)*	*(-2.82)* ***	*(-0.98)*	*(-0.61)*	*(-0.01)*	*(-0.27)*
ln_labpro	3.59	1.42	3.94	2.83	2.64	1.21	1.80
	(2.21) **	*(0.77)*	*(1.75)* *	*(1.31)*	*(1.30)*	*(0.59)*	*(1.02)*
edu	-3.82	-2.87	21.30	-1.93	-3.71	-1.45	-1.77
	(-1.03)	*(-0.79)*	*(3.23)* ***	*(-0.37)*	*(-0.99)*	*(-0.36)*	*(-0.46)*
dmid		-1.53					
		(-1.30)					
dwest		-15.35					
		(-0.01)					
ln_agglo1			4.47				
			(4.75) ***				
ln_agglo2fdi				0.26			
				(0.52)			
ln_agglo3					0.31		
					(0.72)		
ln_agglo4						0.74	
						(1.74) *	
ln_agglo5							0.60
							(2.33) **
Log likelihood	-116.75	-114.77	-102.38	-116.62	-116.50	-115.22	-113.84
Pseudo R2	0.35	0.36	0.43	0.35	0.35	0.35	0.36
choices	31	31	31	31	31	31	31
Number of Firms	1612	1612	1612	1612	1612	1612	1612

＊、＊＊and＊＊＊ give the statistical significanece at 10%, 5% and 1%, respectivily.
The figures in parentheses expres t－statistics.

Table10: Estimated result—Food and Beverage

Food and Beverage

	model1	model2	model3	model4	model5	model6	model7
ln_gdp	0.60	0.69	−0.50	−0.06	−0.05	−0.02	0.62
	(1.37)	*(1.51)*	*(−0.61)*	*(−0.10)*	*(−0.08)*	*(−0.04)*	*(1.20)*
infra	0.65	0.79	−0.25	0.25	−0.01	−0.13	0.69
	(0.74)	*(0.88)*	*(−0.22)*	*(0.26)*	*(−0.01)*	*(−0.13)*	*(0.68)*
ln_wage	−5.44	−5.94	−6.27	−4.67	−3.88	−3.57	−5.48
	(−2.35) **	*(−2.28)* **	*(−2.63)* ***	*(−2.07)* **	*(−1.68)* *	*(−1.49)*	*(−2.28)* **
ln_labpro	4.41	4.46	3.97	1.99	2.29	2.11	4.46
	(2.68) ***	*(2.15)* **	*(2.45)* **	*(0.91)*	*(1.20)*	*(1.04)*	*(2.51)* **
edu	−1.90	−1.21	4.43	4.95	−1.01	0.59	−1.95
	(−0.41)	*(−0.25)*	*(0.68)*	*(0.76)*	*(−0.21)*	*(0.12)*	*(−0.42)*
dmid		−0.45					
		(−0.46)					
dwest		0.62					
		(0.54)					
ln_agglo1			1.46				
			(1.48)				
ln_agglo2fdi				0.77			
				(1.48)			
ln_agglo3					0.64		
					(1.71) *		
ln_agglo4						0.65	
						(1.65) *	
ln_agglo5							−0.02
							(−0.07)
Log likelihood	−78.44	−77.95	−77.29	−77.29	−77.01	−77.08	−78.44
Pseudo R2	0.21	0.22	0.22	0.22	0.23	0.23	0.21
choices	31	31	31	31	31	31	31
Number of Firms	899	899	899	899	899	899	899

＊、＊＊and＊＊＊ give the statistical significanece at 10%, 5% and 1%, respectivily.
The figures in parentheses expres t − statistics.