# Agglomeration Effects and Japanese Food Industry Investment in China: Evidence from the Cities

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**Abstract**

This paper uses the data from *Chugoku Shinshutsu Kigyou Ichiran 2003-2004* (A View of Japanese Enterprises Investments in China 2003-2004) to study 1ocation choice of Japanese food industry investment in 231 Chinese cities from 1992 to 2001, paying a particular attention to agglomeration effects. A negative binominal model indicates that labor cost (WAGE) is the most important factor that deters Japanese food industry investment. Market size (GDP), raw material (MATER), port (PORT) and policy incentives (POLICY), however, have positive effects in Japanese food industry investment location choice in China. As for the three-tier agglomeration effects' test, the agglomeration effects of Japanese manufactures agglomeration (AG2) and Japanese food manufactures agglomeration (AG3) are confirmed, but not for foreign investment agglomeration (AG1).

**JEL Classification:** F21, Q13, Q18

**Keywords**: food industry, agglomeration, Japan, China, FDI

## 1. Introduction

Japan and China are the largest developed and developing economies in Asia. After Plaza Accord in 1985, a large number of Japanese manufactures invested in Asian countries, especially in China. At the same time, considerable research (e.g.: Tokunaga and Ishii, 2000; Belderbos and Carree, 2002; Akune and Tokunaga, 2003; Akune et al., 2003, Tokunaga and Akune, 2003) have been conducted to find the factors that affect location choice of Japanese investment abroad. Also, a lot of Japanese food manufactures invest in China to process agricultural products and reimport them to Japan, which have become an important food source for Japan. Therefore, China is now said to be the farm of Japan. From the view of China, investments from Japanese food industry contribute to the development of agricultural sector and improve local framers' income, as food industry takes raw materials from agriculture. Despite its importance, however, little has been done to know the issue of Japanese food industry investment in China.

As an important concept in the boom of new economic geography research led by Fujita et al.(1999) and Fujita and Thisse (2002), agglomeration effect is extensively applied in foreign direct investment (FDI) location choice literature and has received much more attention recently (e.g.: Head et al., 1999; Tokunaga and Ishii, 2000; Cheng and Kwan, 2000; Tokunaga and Akune, 2003, He, 2003; Ng and Tuan 2004). Japanese manufactures, however, are reported to be more likely to get clustered in order to gain agglomeration economy by sharing oversea experiences, facilities and so on with each other.

Based on the data from *Chugoku Shinshutsu Kigyou Ichiran 2003-2004* (A View of Japanese Enterprises Investments in China 2003-2004) and10 year (1992-2001) [2] panel data of 231 Chinese cities, this study aims to analyze location choice of Japanese food industry investment in China and to test the existence of three-tier agglomeration effects as follows: (1) Foreign investment agglomeration; (2) Japanese manufactures agglomeration; and (3) Japanese food manufactures agglomeration.

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[2] According to Ng and Tuan (2004), policy designs and implementations for FDI attraction were divided into three phases: the first stage (1979–1986), the second stage (1987–1991), and the third stage (since 1992). In 1992, Mr. Deng Xiaoping's talk during his tour to the south reconfirmed China's determination to establish a "socialist-market economy" as a national policy and become a landmark for the reform and opening up policy.

The remaining parts of this study are organized as follows. Following this introduction is an overview of Japanese food investment in China. Next is the explanation of methodology along with data description. Then, results and discussions are provided, followed by conclusions and implications in the last section.

## 2. Overview of Japanese Food Industry Investment in China

From 1985 to 2003, a total number of 310 Japanese food industry subsidiaries were set up in China. 20[3] out of 31 provinces or municipalities received investment from Japanese food industry. The distribution of Japanese food industry investment across China is showed in table 1. As is suggested in table 1, Japanese food investment in China concentrates in costal provinces such as Shandong, Shanghai, Jiangsu and Liaoning. 66 subsidiaries were set up in Shandong province which ranks the first among all provinces. We calculated location quotients to compare the general spatial patterns of Japanese food manufacturers in Chinese provinces (Table 1). From the results of quotient 1, it is reconfirmed that coastal provinces are the most favorable locations. Shanghai, Beijing, Tianjin and Shandong have a high density of Japanese food industry subsidiaries compared with domestic food manufactures' distribution, especially in Shanghai of which the quotient 1 value reaches as high as 7.01. We also compared location choice of Japanese food manufactures to that of other Japanese manufactures and find that Heilongjiang, Xingjiang, Hebei and Shandong have a higher share of Japanese food manufactures than other manufactures, with quotient 2 value higher than 4 in the former two provinces and larger than 3 in the last two provinces.

**Table 1 Location quotients of Japanese food manufactures**

| | Number | Quotient 1 | Quotient 2 |
|---|---|---|---|
| Beijing | 20 | 4.17 | 0.86 |
| Tianjin | 17 | 3.89 | 0.96 |
| Hebei | 15 | 1.02 | 3.37 |

[3] Shanxi, Inner Mongolia, Jiangxi, Hubei, Chongqing, Guizhou, Yunnan, Tibet, Gansu, Qinghai and Ningxia received no investment from Japanese food industry.

| | | | |
|---|---|---|---|
| Liaoning | 31 | 2.58 | 1.17 |
| Jilin | 5 | 0.65 | 2.84 |
| Heilongjiang | 8 | 0.44 | 4.08 |
| Shanghai | 34 | 7.01 | 0.36 |
| Jiangsu | 32 | 1.73 | 0.71 |
| Zhejiang | 22 | 1.90 | 1.54 |
| Anhui | 2 | 0.07 | 0.95 |
| Fujian | 16 | 1.28 | 2.34 |
| Shandong | 66 | 3.16 | 3.76 |
| Henan | 5 | 0.27 | 2.64 |
| Hunan | 3 | 0.21 | 2.77 |
| Guangdong | 21 | 1.66 | 0.59 |
| Guangxi | 1 | 0.13 | 1.48 |
| Hainan | 1 | 0.80 | 1.06 |
| Sichuan | 7 | 0.25 | 2.75 |
| Shannxi | 2 | 0.23 | 0.92 |
| Xinjiang | 2 | 0.41 | 4.22 |

Source: *Chugoku Shinshutsu Kigyou Ichiran 2003-2004.*

Note: Location Quotient 1 = provincial percentage of Japanese food manufacturers / provincial percentage of all food manufactures

Location Quotient 2= provincial percentage of Japanese food manufacturers / provincial percentage of all Japanese manufactures

We will then check the relationship between Japanese food industry investment in China and the exchange rate between yen and yuan from a historical perspective. As is displayed in Fig. 1, Japanese food investment in China experienced two booms. The first one is a large boom from around 1992 to 1996, which may be led by Deng Xiaoping's talk. The other small boom is from 2001 which may be because of China's entry into World Trade Organization (WTO). Through a correlation analysis, we find that Japanese food industry investment in China is highly correlated with the real exchange rate, with a Pearson coefficient of 0.65 (significant at 0.01 level).

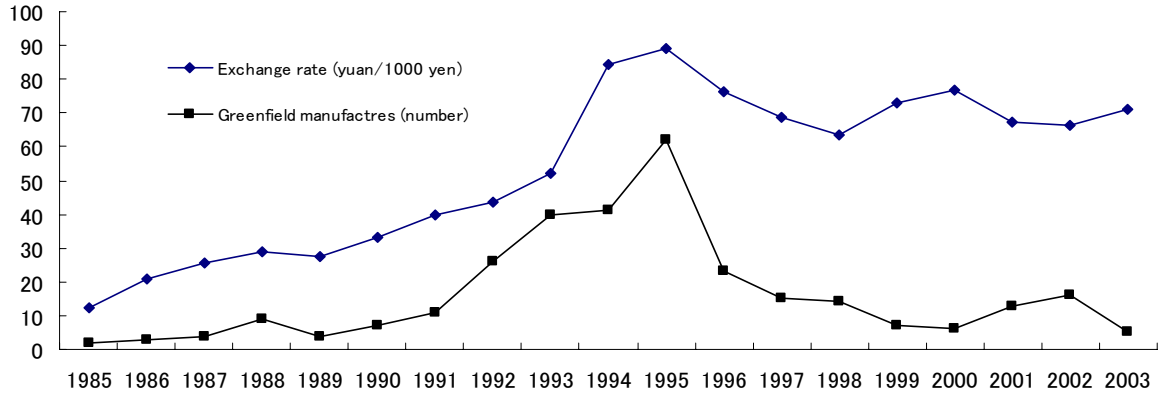


**Fig. 1　Japanese food industry investment in China and exchange rate**

Next, we take a close look at the Japanese food industry in Chinese cities. Up to 2003, a total of 68 cities received investments from Japanese food industry. Table 2 reports the number and share of top 20 cities that received investments. As is depicted in table 2, costal cities such as Shanghai, Qiangdao and Dalian etc. are the most favorable places for Japanese food industry. The number of Japanese food manufactures in top 20 cities is reached as many as 235, which accounts for 75.8% of total investment. From table 2, we can also learn that investments from Japanese food industry clusters in costal cities.

**Table 2　Japanese food investment in Chinese cities (top 20)**

| Province | City | Number | Percentage |
|---|---|---|---|
| Shanghai | Shanghai | 32 | 10.32% |
| Shandong | Qingdao | 30 | 9.68% |
| Liaoning | Dalian | 25 | 8.06% |
| Beijing | Beijing | 20 | 6.45% |
| Tianjin | Tianjin | 17 | 5.48% |
| Shandong | Yantai | 14 | 4.52% |
| Jiangsu | Lianyungang | 11 | 3.55% |
| Zhejiang | Ningbo | 9 | 2.90% |
| Fujian | Fuzhou | 9 | 2.90% |
| Shandong | Weihai | 9 | 2.90% |
| Jiangsu | Suzhou | 8 | 2.58% |

| | | | |
|---|---|---|---|
| Zhejiang | Huzhou | 8 | 2.58% |
| Shandong | Weifang | 8 | 2.58% |
| Heilongjiang | Haerbin | 6 | 1.94% |
| Guangdong | Guangzhou | 6 | 1.94% |
| Jiangsu | Nantong | 5 | 1.61% |
| Fujian | Xiamen | 5 | 1.61% |
| Sichuan | Chengdu | 5 | 1.61% |
| Zhejiang | Hangzhou | 4 | 1.29% |
| Zhejiang | Zhoushan | 4 | 1.29% |
| Total | | 235 | 75.8% |

Source: *Chugoku Shinshutsu Kigyou Ichiran 2003-2004.*

According to the results of surveys conducted by the Ministry of Economy, Trade and Industry (METI), Japan in 1996 and 1999, the main motivations for Japanese food industry investment in China are to expand market size, keep low production cost, insure raw materials, decrease production cost and reimport to Japan, among which expanding market size and keeping low production cost are the most important motivations. Fig. 2 provides details of the survey results.

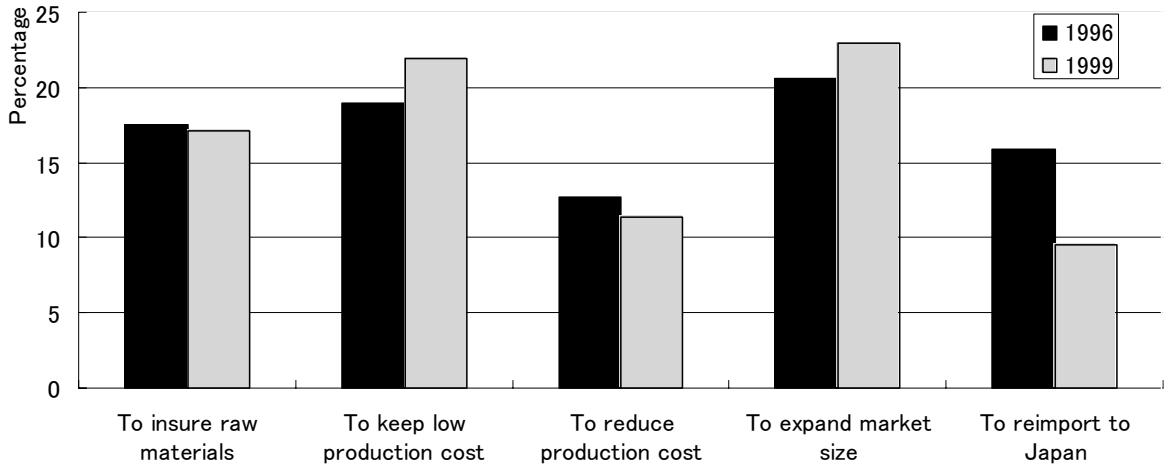


**Fig. 2 Motivations of Japanese food industry investment in China**

Source: Basic Survey of Foreign Business Activity, NO.6 and NO.7, by the Ministry of Economy, Trade and Industry (METI), Japan.

## 3. Methodology and Data

The fact that Japanese food manufactures concentrate in costal areas and only 68 of 231 cities received investment up to now means a preponderance of zero and small values and clearly discrete nature of the dependent variable. In order to improve on least squares and the linear model fit, this paper, therefore, adopts negative binomial model[4] to analyze Japanese food industry investment in Chinese cities.

We assume that a rational Japanese food manufacturer $i$ would choose a Chinese city $j$ for its branch only if this city could maximize its profits and the location behavior is based on the characteristics of a city. As we cannot observe the profit directly, we further assume that the number of greenfield manufactures in a city is a function of the observable location characteristics of that city. Following Tokunaga and Akune (2003), this paper assumes that $y_j$ is draw from a negative binomial distribution and uses negative binomial model, an extension of Poisson model, to analyze the location choices of Japanese food industry investment in China. After introducing an individual, unobserved effect, $\varepsilon_j$, into the conditional mean, $\mu_j$, which can be expressed as:

$$\ln \mu_j = \beta' x_j + \varepsilon_j \tag{1}$$

where $\beta'$ is the parameter vector to be estimated,
$x_j$ is a provincial characteristics vector, and
$\varepsilon_j$ is a disturbance vector.

So the density for $y_j$ is:

$$f(y_j \mid x_j) = \frac{\theta^{\theta}(e^{\beta' x_j})^{y_j}\Gamma(\theta + y_j)}{\Gamma(y_j + 1)\Gamma(\theta)(e^{\beta' x_j} + \theta)^{\theta + y_j}} \tag{2}$$

which is one form of negative binomial distribution. We will estimate the coefficient vector $\beta$ based on equation (2). As negative binomial model is a non-linear model, maximum likelihood will be employed in estimation. A test of the Poisson distribution is carried out by testing the hypothesis $\theta = 0$ using the likelihood ratio test.

In this research, we consider the core factors in the location decision

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[4] See Tokunaga and Akune (2003) for a recent case.

literatures[5] such as GDP, wage, policy incentives and sea port. Another factor that we will include in our model is raw material factor, although it was rarely appeared in traditional literalities, because according to our interview to Japanese origin food companies in Qingdao, Shandong province in 2005, the abundance of agricultural products was mentioned to be a key factor considered in their location choice decision. Based on the basic factors mentioned above, we will specially test three kinds of agglomeration effects: (1) Foreign investment agglomeration, (2) Japanese manufactures agglomeration, and (3) Japanese food manufactures agglomeration at city level.

Our database of Japanese food manufactures investment in China is from *Chugoku Shinshutsu Kigyou Ichiran 2003-2004* (A View of Japanese Enterprises Investments in China 2003-2004) which is compiled by the 21st Century China Research Institute, Japan through an annual survey. The dependent variable, Japanese manufactures agglomeration variable, and Japanese food manufactures agglomeration variable are all from it. Data of main independent variables, that is, GDP variable, wage variable, raw material variable and foreign investment agglomeration variable, are from *Urban Statistical Yearbook of China (SSB 1993-2002).* Policy incentives variable and port variable are from *Statistical Yearbook of China (SSB 2000).* In this study, we transform the quantitative variables into their logarithmic forms. The descriptions of variables and expected signs are reported in table 3.

**Table 3 Descriptions of variables and expected signs**

| Variables | Descriptions | Expected Signs |
|---|---|---|
| Location choice | Number of greenfield manufactures in a city | |
| GDP (GDP) | Logarithm of (GDP), ($10^4$ yuan) | + |
| Wage(WAGE) | Logarithm of (real wages of staff and workers), (yuan) | - |
| Raw material (MATER) | Logarithm of (total agricultural output/ area) , ($10^4$ yuan) | + |
| Policy incentives (POLICY) | 1 for open coastal city,0 for otherwise | + |

[5] Actually, another important factor that may affect location choice of FDI is infrastructure variable. The reason why we do not consider in our model is that the consistent data at city level for 10 years is not available.

| | | |
|---|---|---|
| Port (PORT) | Number of sea port in a city | + |
| Foreign investment agglomeration (AG1) | Logarithm of (total inward FDI to previous year in a city + 1) | + |
| Japanese manufactures agglomeration (AG2) | Logarithm of (number of Japanese manufactures to previous year in a city + 1) | + |
| Japanese food manufactures agglomeration (AG3) | Logarithm of (number of Japanese food manufacturers up to previous year in a city + 1) | + |

Note: GDP, wage and raw material are at comparable price, 1992 =100.

## 4. Results and discussion

Totally we considered seven different models to estimate location choice and test agglomeration effects of Japanese food industry investment in China. The first three models are to establish a baseline model that can not only connect previous similar studies but also work as a benchmark to test the three agglomeration effects of this paper. The three-tier agglomeration effects are tested in the rest models one by one. In all specifications, the coefficients of all basic factors are stable and statistically significant, which indicates the high reliability of our model. Table 4 reports the statistical results of negative binominal model estimation.

Specification (1) contains all basic variables that have been frequently used in FDI location literatures. The estimation results are highly consistent with the hypotheses formulated in section 3. The variable WAGE is correctly signed and significant at 1% level. Our results imply that WAGE variable is the most important factor deters Japanese food industry investment. Results also suggest that GDP and POLICY are important factors appealing to Japanese food industry investment in Chinese cities, which highly agrees with previous research results (Head and Ries 1996; Cheng and Kwan, 2000; Belderbos and Carree, 2002; He, 2003).

As for the specific variable MATER, we find a positive effect in Japanese food manufacture location choice. The more abundant the raw materials are in a city, the higher possibility the city is selected by Japanese food manufactures.

## Table 4　Statistical results of negative binominal model

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| C | −7.9525*** | −8.2899*** | −8.5599*** | −5.9668** | 7.5201** | −2.4992 | 6.8891** |
| | (−3.9003) | (−4.0886) | (−4.2613) | (−2.2375) | (2.5739) | (−1.0983) | (2.3270) |
| GDP | 1.2241*** | 1.2367*** | 1.2554*** | 1.1254*** | 0.3569** | 0.8626*** | 0.3757** |
| | (9.0522) | (9.1353) | (9.4852) | (7.1856) | (2.1269) | (5.9346) | (2.2240) |
| WAGE | −1.7168*** | −1.6949*** | −1.7136*** | −1.8876*** | −2.2224*** | −1.7700*** | −2.1654*** |
| | (−5.2679) | (−5.2099) | (−5.3483) | (−5.2927) | (−6.7039) | (−5.3641) | (−6.4635) |
| MATER | 0.4643*** | 0.4593*** | 0.5118*** | 0.4325*** | 0.4722*** | 0.4240*** | 0.4617*** |
| | (3.6343) | (3.6075) | (4.0117) | (3.3286) | (3.7478) | (3.3834) | (3.6811) |
| POLICY | 0.9773*** | 1.5402*** | | 1.4912*** | 0.9134*** | 0.9132*** | 0.7859*** |
| | (2.9263) | (8.6389) | | (8.2145) | (4.5817) | (4.3437) | (3.6661) |
| PORT | 0.6954** | | 1.5443*** | | | | |
| | (2.0404) | | (8.5086) | | | | |
| AG1 | | | | 0.0935 | | | |
| | | | | (1.3071) | | | |
| AG2 | | | | | 0.6794*** | | 0.5675*** |
| | | | | | (7.3032) | | (4.9316) |
| AG3 | | | | | | 0.7030*** | 0.2464** |
| | | | | | | (5.8885) | (1.6686) |
| Observations | 2309 | 2309 | 2309 | 2309 | 2309 | 2309 | 2309 |
| Log likelihood | −578.552 | −580.703 | −582.485 | −579.767 | −552.054 | −562.751 | −550.647 |

Note: 1. Numbers in parentheses are z-values.

2.* significant at 0.1 level, ** significant at 0.05 level and *** significant at 0.01 level.

3. In each specification, there is one missing value among independent variables.

The result of PORT is correctly signed but the effect is smaller compared with other variables. The low z-statistic variable on PORT could also be the consequence of multicollinearity with other variables. In specification (2) and (3), the POLICY and PORT are taken into the model one by one. To our surprise, almost same results are got. The coefficients of POLICY and PORT are 1.5402 and 1.5443 respectively. Thus, PORT is proved to be an important determinate in Japanese food industry location choice in Chinese cities, which is in line with the result of He (2003) that states Japanese manufactures tend to prefer port cities. Furthermore, we checked the data source of POLICY and PORT and find that at the city level 96.2% of the data is overlapped. We then drops PORT variable and take specification (2) as the final baseline model.

From specification (4) to (6), we turn to the results of three kinds of agglomeration tests. According to the estimation results, the coefficients of Japanese manufactures agglomeration (AG2) and Japanese food manufactures agglomeration (AG3) are positive and significant at 1% level. This not only means that Japanese food manufactures are likely to become clustered with Japanese origin food manufactures but also indicates that Japanese food manufactures are likely to get together with other kinds of Japanese origin manufactures in order to gain agglomeration economy. In specification (4), we put foreign investment agglomeration (AG1) into the baseline model and find the effect of foreign investment agglomeration (AG1) is positive but not statistically significant. This implies that the agglomeration effect of total inward FDI of China does not exist for Japanese food industry investment in Chinese cities. In order to understand the reason, we again compared the top 20 of total inward FDI and that of Japanese food industry investment and found that only 9 cities ranked in the top 20 of Japanese food industry are in the top 20 of accumulated total FDI indicates the location of Japanese food industry manufactures in Chinese cities is different from that of accumulated FDI location[6]. In specification (7), we only take AG2 and AG3 into the base model, positive effects are found in both cases, with statistical significance at 0.01 level and 0.05 level, respectively.

[6] The top 20 cities of Japanese food industry investment are mainly from Shandong province (4 cities), Jiangsu province (3 cities) and Zhejiang province (3 cities). In contrast, 8 of top 20 cities of inward FDI are from Guangdong province, followed by Fujian province and Jiangsu province, where there are 3 cities entering top 20, respectively.

## 5. Conclusion

Using the data from *Chugoku Shinshutsu Kigyou Ichiran 2003-2004* (A View of Japanese Enterprises Investments in China 2003-2004), this study has shown a skewed spatial distribution of Japanese food industry in 231 Chinese cities for 1990-2001. Japanese origin food manufactures in China are concentrating in costal areas. Japanese origin food manufactures in China are concentrating in the cities of costal areas and top 20 cities account for as much as 76% of total Japanese food industry investment in China. High correlation was found between Japanese food industry investment in China and the exchange rate between Japaneses yen and Chinese yuan. Japanese food manufactures are more likely to produce in China when yen appreciates against dollar.

Based on the 10 years panel data of 231 Chinese cities, we found market size (GDP), labor cost (WAGE), raw material (MATER), port (PORT) and policy incentives (POLICY) affect Japanese food industry investment location choice in China by estimating negative binomial models. As for three-tier agglomeration effect tests, we found that agglomeration effects for Japanese manufactures agglomeration (AG2) and Japanese food manufactures agglomeration (AG3), but not for foreign investment agglomeration (AG1).

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