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Location Choices of Japanese Firms in the Asian Automobile Industry

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บทคัดย่อ

งานศึกษาฉบับนี้มุ่งที่จะศึกษาปัจจัยกำหนดการตัดสินใจเลือกสถานที่การลงทุนของบริษัทญี่ปุ่นในอุตสาหกรรมรถยนต์ในประเทศไทย มาเลเซีย อินโดนีเซีย ฟิลิปปินส์ จีน อินเดีย เกาหลี และไต้หวัน งานศึกษาได้ใช้ตัวอย่างจากข้อมูลการลงทุนในช่วงปี ค.ศ.1980-2004 จากวารสารโตโย เคไซ ผลการศึกษาพบว่าอุปสงค์ในประเทศ ต้นทุนค่าแรงที่ต่ำ ความพร้อมทางด้านแรงงานที่มีทักษะ การกระจุกตัวของกลุ่มบริษัทและการรวมกลุ่มทางเศรษฐกิจมีส่วนช่วยเพิ่มโอกาสที่จะได้รับการลงทุนจากบริษัทญี่ปุ่น นอกจากนี้งานศึกษายังพบว่าโครงสร้างการตัดสินใจการลงทุนของบริษัทญี่ปุ่นได้เปลี่ยนไปตั้งแต่ปี พ.ศ.2540 ประการสุดท้ายงานศึกษาได้ตรวจสอบผลของความเชื่อมโยงทางอุตสาหกรรม ผลการศึกษาบ่งชี้ว่าการตัดสินใจเลือกสถานที่ประกอบการของผู้ผลิตชิ้นส่วนรถยนต์ญี่ปุ่นได้มีการคำนึงถึงการกระจุกตัวของผู้ประกอบรถยนต์และผู้ผลิตชิ้นส่วนดั้งเดิมในประเทศนั้นๆ ซึ่งแสดงถึงความเชื่อมโยงในอุตสาหกรรม

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Abstracts

This paper aims to investigate the determinants of Japanese automotive firms' location choices in ASEAN4 countries (Thailand, Malaysia, Indonesia and the Philippines), China, India, Korea and Taiwan. Using the conditional logit and 989 Japanese investment data from 1980-2004 from the *Toyo Keizai.* The paper finds that domestic demand, low wage availability of skilled labor, agglomeration and the level of economic integration enhance the probability of investment. In addition, the results reveal that the location decision of Japanese automotive firms significantly changed after 1997 even though the paper has controlled for the Asian crisis effect. Finally, the paper examines the vertical linkage between auto-parts firms and assemblers. The agglomeration of automobile manufacturers and auto-parts firms statistically enhance the probability to be invested by Japanese auto-parts firms.

Keywords: Automotive Industry, International Investment, Economic Integration, Location Choices.

JEL classification: F15; F21; R11

1. Introduction

The automotive industry is an industry that gains enormous advantages from the Asia production network because of the possibility to split its parts and components production processes to many countries in the region. Even though many Asian countries, such as China and Thailand, have the automobile industry as their major strategic industry, the industry in these countries still relies heavily on foreign technology and capital. This leads the development of the automotive industry in the region to depend largely on FDI and/or Joint Venture, which carry financial resources, management know-how and other externalities such as knowledge spillovers to recipient countries (Markusen and Venables, 1997; Urata, 2002).

It is noteworthy that most of FDI and production technologies in the Asian automotive industry are from Japanese assemblers. It can be said that Japanese vehicle manufacturers are the main players in the ASEAN4 automotive industry. Nearly 90% of market share in ASEAN4 except Malaysia is occupied by Japanese assemblers (Japanese Automotive Parts Industry, 2005).

Moreover, technological assistance from Japanese firms is also vital to the Taiwanese, Chinese and Indian automotive industries. The top assemblers in these countries mostly have business relationship with Japanese firms. For instance, Suzuki is the main shareholder of the Maruti Udyog, who occupies the largest market share in India while the two top market shares in Taiwan, China Motor Co., Ltd and Kuozui Motors, have received technical assistance and have relationship respectively with Mitsubishi and Toyota. It can be said that Japanese firms are leading in technology in the automotive industry among Asian countries. This indicates that the location choices of Japanese firms are crucial for the technology transfer and the automotive industry development.

Even though location choices of Multinational Enterprises (MNEs) have been widely studied, the empirical studies on location choices in Asia are still limited and most of them focus on location choices in China provinces. To fill this gap, the paper investigates the determinants of Japanese firms' location choices in ASEAN4 countries, China, India, Korea and Taiwan. Using the conditional logit model and 989 Japanese investment data from 1980-2004 from the Kaigai Shinshutsu Kigyou Souran, Toyo Keizai 2005, the paper examines how economic integration especially from the ASEAN Industrial Cooperation (AICO) scheme affects the location choices of Japanese MNEs. In addition, the production scale, firm agglomeration, labor costs, skill labors as well as the market potential in the region are also employed to study the location decision of Japanese MNEs in the Asian automotive industry.

In the following section, the paper summarizes the automobile industry situations and economic integration of countries in consideration. Then, the section 3 gives an overview of the

related literature and theories. Section 4 presents the conditional logit model and results. Section 5 concludes.

2. The Asean4, Chinese, Indian, Korean and Taiwanese Automotive Industry

The automotive industry in this region was mostly developed by the government's investment promotion policies. The local auto-parts industry of countries in the study; however, were commonly faced with inefficiency problem due to small and fragmented market and the proliferation of vehicle models. To alleviate these problems, the governments introduced various measures such as restricting the number of models and assembly plants, banning on Completely Built-Up (CBU) vehicles imports, raising tariffs on CBU kits and launching local content ratios (Busser and Sadoi, 2004). On the contrary, some countries such as Malaysia adopted national car policy to mitigate fragmented production and to attain economies of scale. In 1983, Proton, the first national car assembler was established as a Joint Venture between Mitsubishi Motor Corporation (15%) and HICOM (70%), the Heavy Industry Corporation of Malaysia. Successively in 1993 the second national car, Perodua, was established to produce mini passenger cars with the assistance of Daihatsu, and a national truck project was set up in 1997 with the assistance of Isuzu Motors.

To nurture its national car industry, the Malaysian government provided a wide variety of preferential treatment measures to its national car, such as the reduction and waiving of import duties on imported parts, waiving of excise taxes on the sale of vehicles and low interest financing for public officials, were given to protect the local industry. In addition, the selling prices were regulated by Ministry of International Trade and Industry. National cars were able to be sold approximately 20 to 30% cheaper than Japanese cars, and rapidly expanded their market share during the second half of the 1980's (Bando, 2000; Fujita, 1998).

Moreover, to foster parts manufacturers, the government, cooperating with Proton and financial institutions, introduced the Vendor Development Program (VDP). Proton gave technical, financial and other assistance through the VDP and received some subsidies from the government. The national car manufacturer was obligated to prioritize the use of parts manufactured from local companies supported by the VDP[2]. Besides, Mandatory Deletion Program and the local content policy were launched to make it necessary for assemblers in Malaysia to procure parts locally. These protectionist policies cause foreign assemblers to lose competitiveness and market share to the national car. An apparent example is the low-price setting of the national car that helped to occupy the market during the crisis. The national car could raise its market share from 76% in 1997 to 89% in August 1998 (Mori, 1999).

Indonesia was another country that implemented national car policy. Indonesia cooperated with Kia and launched its national car, Timor, in 1996. Timor also received privileges such as the exemption of import tariff on Completely Knocked Down (CKD) vehicles while the other assemblers are imposed at 65 percent on passenger vehicles and 25 percent on commercial vehicles. However, with the pressure from IMF, the national car project was stopped in 1998. Similar to the ASEAN4, China, India, Taiwan and Korea also implemented the protectionist policies in the beginning of the industries such as import ban, local content policy as well as the entry restriction.

By these various protectionist policies of each country in the region, assemblers and auto-parts firms faced many constraints. High tariff rates, import limitation and local content policy made the automobile market fragmented and drove assemblers and auto-parts firms to focus on serving each individual market. However, TRIM (WTO) and the eruption of the Asian

[2] Proton has unofficially moved towards multi-sourcing since 1996, and become officially multi-sourcing in 2000.

crisis led the governments to relax their regulations[3]. This led Japanese MNEs to have a greater leeway in choosing their investment strategies, i.e., whether to invest and produce in a particular country or whether to use imported parts and components instead. The Japanese assemblers in Thailand, for example, shifted their strategies from focusing on domestic market to be export-oriented to solve the idle capacity problem from a sudden shrinkage in local demand from the Asian crisis. This included re-export to Japan and exports to the other third countries.

Since the crisis, Japanese parts manufacturers and assemblers have relocated and complementarily produced parts and vehicles to attain economies of scale. Mitsubishi, for example, stopped producing minivans and GALANT factory in Indonesia and imported them instead from Thailand while assigned Indonesia to primarily produce trucks minibuses and light commercial vehicles. In 2006, Toyota reduced production in Malaysia and chose to import CAMRY from Thailand instead (Fourin, 2007). Honda also made an active use of trade agreements within the Asian region such as the AICO scheme to raise its local procurement and its "inter-group complementary supply ratio" (http://world.honda.com/investors/annualreport/(2003/09.html). Honda used AICO and Common Effective Preferential Tariff (CEPT) scheme in exchanging Accord and City from Thailand for Stream from Indonesia.

These examples highlight a broader trend in which Japanese assemblers have been integrating production to build complementary production networks in the ASEAN4 countries not only assembly activities but also vehicle parts production. The following list, based on JETRO (2005) and Japanese Automotive Parts Industry (2005), shows how Japanese assemblers have distributed their production across the ASEAN4 countries:

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[3] For instance, Thailand removed foreign ownership restriction in 1997 (Kohpaiboon, 2008). By the force of WTO, the regulations on local content ratio of India were repealed in 2001.The accession to the WTO of China and Taiwan also pushed them to relax their regulations. The WTO accession forced Taiwan to liberalize its automobile industry by 2011 and reduce tariff on imported CBU (Fourin, 2003). Moreover, Thai, Indian and Malaysian government respectively abolished the local content policy in 2000, 2001 and 2003.

Toyota

Thailand: Diesel Engines, Steering Columns, Body Parts, Pressed and Resin Parts, and CBU Kits Assembling.

Malaysia: Engine Computers, Steering Linkages, and Wiper Arms and Blades

Indonesia: Gasoline Engines, Multi-Purpose Vehicle CKD, and Door Locks and Door Frames

Philippines: Transmissions, Drive Shafts (front wheel), and Switches

Honda:

Thailand: Pressed Parts, Meter Parts, and Cylinder Blocks

Malaysia: Bumpers, Dashboards, and Constant Velocity Joints

Indonesia: Cylinder Blocks and Heads, Engine Valves, and Automatic Transmissions

Philippines: Manual Transmissions, Exhaust Parts, and Pedals

Mitsubishi:

Thailand: Engines

Malaysia: Gears and Power Steering

Indonesia: Brakes, Pressed Parts, and Fuel Tanks

Philippines: Transmissions, Pressed Parts, and Locker Covers

Economic integration and trade agreements among countries in the region are another factor that allows firms to take advantage from complementary production network. The ASEAN began economic integration policies such as Brand–to-Brand Complementation (BBC) in 1988, which promoted intraregional automotive parts exchange within the same firms. However, the BBC scheme was not widely utilized. As of 1994, only Thailand, Philippines and Malaysia participated in the BBC scheme. In November 1996, the ASEAN Industrial Cooperation (AICO) scheme was launched to supersede the BBC scheme in enhancing ASEAN's industrial competitive edge and accelerating the effect of CEPT, designed to lower tariffs of inclusion list to 0-5% by 2003.

In contrast to the BBC scheme, the AICO scheme was designed to encourage technology-based investments in ASEAN and to promote resource sharing such as technology sharing, market sharing, and consolidated purchases of raw materials within the same companies and across companies. Two or more companies that are located in ASEAN with a minimum 30% ASEAN equity can enjoy 0-5% tariff and other non-tariff incentives such as local content accreditation if they trade components that are composed of at least 40% ASEAN content. Moreover, in 1999 the requirement of ownership status has specially exempted and the period of the exemption has been agreed to extend to 31 December 2009 at the 38th AEM Meeting at Kuala Lumpur on August 22, 2006 (http://www.aseansec.org/18692.htm).

The use of AICO scheme accelerated after 1998 when the ASEAN hit badly by the Asian crisis. Because of the AICO and CEPT scheme which was effective from 2003, the 2003 intra-ASEAN trade in auto-parts expanded substantially especially from Thailand and Indonesia where Japanese assemblers and auto-parts firms invested considerably (Kinoshita et al., 2004). As of April 2005, 129 projects valuing 1,560 million dollar were approved under the AICO scheme. Most of the projects approved under the AICO scheme belong to the automotive industry, which accounts for 89.15 percent of all approved projects. The product category details of approved projects related to the automotive industry are as follows. 97 approved projects relate to automotive CKD packs, 16 of which are automotive components and 1 of which is a project on automotive CKD and CBU. These figures suggest that a large number of manufacturers in the automotive industry have taken advantage of the AICO scheme. Table 1 summarizes the approved projects under the AICO scheme.

In addition to trade agreements within Southeast Asia, the ASEAN concluded trade agreements with China, Japan, Korea and India aggressively since the end of the 1990s. ASEAN began to initiate FTA with China, ACFTA (ASEAN China Free Trade Area), in 2000. Products that are originated or employed more than 40% ASEAN and China content will receive the privileges of the agreement. In addition, ASEAN started to initiate FTA with India in 2002

and agreed to initiate FTA with Japan in 2003 and with Korea in 2004. The FTA will gradually reduce tariff rates which will be near to zero in 2010 for China and in 2011 for India and 2012 for Japan. Thus, it is likely that ASEAN will be the center of trade and gaining the most benefits of trade agreements.

Table 1

Approved projects under the AICO scheme as of April 21, 2005, by product category

Product category	The number of Approved Project	Share
Agricultural machinery	1	0.78%
Air conditioning products	1	0.78%
Automotive CBUs	1	0.78%
Automotive CKD packs	97	75.19%
Automotive CKD packs & CBUs	1	0.78%
Automotive components	16	12.40%
Electrical products	1	0.78%
Electronic products	5	3.88%
Food processing	5	3.88%
Safety glass	1	0.78%
Total	129	100.00%

Source: ASEAN Secretariat website: http://www.aseansec.org/6398.htm accessed on 28/04/08

3. Theoretical and Literature Reviews

Location decisions of firms are usually explained by the following concepts. The first concept is endowment-driven localization. Under this idea, the location of industries and

economic activities will be determined by factor endowments of natural resources, labor, infrastructures, and technology.

Another concept is known as New Economic Geography (NEG). It is rather a novel approach regarding location determination for economic activities. The NEG allows for the increasing returns and the possibility that historical accidents shape economic geography (Krugman, 1980). NEG argues that agglomeration of activities, which also means the location of activities, is endogenously determined thorough the interaction of centrifugal (dispersion) and centripetal (agglomeration) forces. However, these two forces, which form a particular mechanism of agglomeration, are variously defined, depending on the particular model (see, e.g., Ottaviano and Puga, 1997; Fujita et al., 1999; Neary, 2001; and Fujita and Thisse, 2002).

Krugman (1991), for example, develops a theoretical model in which the interaction of labor migration with increasing returns and trade costs bring about a tendency for firms and workers to cluster. On the other hand, Venables (1996) builds backward and forward linkage model and finds that positive externalities generate when the producers of intermediate goods locate close to the buyers of their products and final goods. In other words, positive externalities from the close proximity entice new firms to locate in. Moreover, the two industries vertical linked model by Krugman and Venables (1996) also suggests that industry agglomeration will be encouraged by lower trade barriers. This implies that economic integration promotes more agglomerations. Nevertheless, locating in agglomeration economies is pertinent to some high costs such as high rents, wages as well as transportation costs. Therefore, a trade-off decision must be made to determine whether a firm will locate in the agglomeration economies or not.

Other than these factors, recent FDI studies began to emphasize more on the role of endowments as well as trade and investment costs in the third countries, neither host nor home countries, or the so-called *third-country effect*. They argue that the decision to invest not only depend on host and home countries' attributes but also rely on third-country. The strength of third-country effect depends on distance between host country and third-country' attributes. In

literature, the third-country effect is capture by the *market potential*, which is defined as the weighted average of the neighboring countries' market size using distances as the weights. This kind of FDI study can be found in Yeaple (2003); Ekholm et al. (2003); Grossman et al. (2003), Egger et al. (2004), and Baltagi et al. (2007).

Moving to the empirical studies, numerous papers examine the location decision by using the conditional logit model and employing location characteristics suggested above as the explanatory variables. Since the potential profit cannot be observed, preceding literature generally relies on the assumption that firms consider location characteristics and choose the country that yields the highest profits. Disdier and Mayer (2004) regard location characteristics as components that determine firms' profits. To examine the French firms location choices in the European region, they include the number of French firms in the country (agglomeration effect), wage rates, GDP per capita, distance, unemployment rate, and liberalization index in their firms' profit function. The results show that market size and agglomeration effects are key determinants of a country's attractiveness.

The positive effect of agglomeration is also found in Wakasugi (2005). His study uses the conditional logit model to examine the effect of regional heterogeneity among 25 provinces in China on the investment decision of Japanese firms. The regional heterogeneity are educated human resources, wage costs, increasing numbers of special economic zones, industrial agglomeration and the enrichment of social infrastructure. The study reveals that other than agglomeration, the abundance of higher-educated human resources and the increase in the number of the economic zones are largely responsible for an increase in the probability of choosing a region and factors related to human resources are more important than social infrastructure in attracting foreign firms. Another study to examine location decision in China is that by Cheng and Stough (2006), who uses similar hypotheses. They find that the market size of a province, its infrastructure, labor, land, and energy costs, labor quality, and policy incentives, as well as agglomeration effects, are all factors that determine the location decision of foreign investors.

In conclusion, preceding empirical studies on the location choices of MNCs show that a variety of location characteristics affecting production costs and the demand that firms face in a particular destination are all important determinants.

4. Data Sources, Methodology and Results

4.1 Data Sources

This paper aims to analyze location decision of Japanese automotive firms in ASEAN-4, China, India, Korea and Taiwan from 1980 to 2004. The data used for the analysis are from a variety of sources. First, the dependent variable, that is, the data on the investment location of Japanese automotive firms in each year, is obtained from the *Kaigai Shinshutsu Kigyo Soran 2005* (referred to as *KSKS* hereafter) by Toyo Keizai. However, investment data of firms whose operation are related to automotive industry, such as windshield glasses and car air-conditioners, are classified by Toyo Keizai respectively as glass and electronic equipment industries. These data are included into the sample data by matching data from the *KSKS* with the data from *Japanese Automotive Parts Industry* 2003/2004 and 2005, published by the Japan Auto Parts Industries Association and Automotive Parts Publishing Company.

To ensure that the data set is as complete as possible, firms that were active at some point during 1980-2003 but ceased operating are also included, using earlier editions of the *KSKS*. Finally, to ensure that the data set consists only of investments in production operations, the investment data of affiliates that only function as sales offices, and data of affiliates whose year of establishment is missing, are excluded. The number of investments by automobile-industry related firms, classified by industry and destination country is shown in Table 2. As can be seen, the country with the largest number of investments is China, followed by Thailand. China and Thailand together account for more than 50 percent of the total number of investments by Japanese automotive firms in these eight countries.

Table 2.

Number of Japanese investments in the automotive industries,

by destination country, 1980-2004

Country / Type of part or activity	China	India	Indonesia	Korea	Malaysia	Philippines	Taiwan	Thailand	Total
Information and software services	2	0	0	0	0	1	0	0	3
Precision instruments	0	0	0	1	0	0	0	1	2
Fabrics	6	0	1	2	0	1	0	5	15
Steel	3	0	0	0	0	0	0	7	10
Electronics	43	8	15	4	8	9	4	32	123
Nonferrous metals	5	0	0	0	3	1	0	5	14
Glass and mirrors	4	0	2	0	0	0	0	3	9
Other manufacturing work	0	0	0	0	0	0	0	1	1
Rubber	18	0	5	5	3	3	2	18	54
Paper and pulp	0	0	0	0	0	0	0	1	1
Chemicals	19	0	0	6	2	1	3	27	58
Holding company	0	0	0	0	3	0	0	3	6
Research and development	6	0	0	2	0	1	0	5	14
Machinery	14	1	2	5	0	0	1	27	50
Metal and pressed parts	8	0	2	1	1	1	1	16	30
Automobile/Auto-parts	231	36	70	27	27	37	36	135	599
Total	359	45	97	53	47	55	47	286	989

Source: Kaigai Shinshutsu Kigyou Soran 2005, Toyo Keizai.

Data for the explanatory variables come from a number of sources. To begin with, monthly manufacturing wage rates are compiled from *LABORSTA* by the International Labor Organization (ILO). The monthly wage rates are converted into the Yen to reconcile currency unit and to better reflects labor costs from the viewpoint of Japanese firms investing in the region. Next, the number of student enrollment in the tertiary level are collected from the various issues of the Statistical Yearbook for Asia and the Pacific, UNESCAP. Since UNCESCAP does not provide data for Taiwan, Taiwan wage and exchange rate are collected from the Statistical Yearbook of ROC, 2004.

Total automobile sales in units of each individual country are collected from various issues of the Automotive Yearbook, Japan Auto Parts Industries Association, Thai Automotive Directory, the Thailand Automotive Institute online: www.thaiauto.or.th and The Malaysian Motor Vehicle Assemblers Association (MMVAA) online: http://www.maa.org.my/info_summary.htm.

To compute market potential, defined as the sum of the distance weighted GDP at constant (2000) market prices of all neighboring countries in the region, GDP and exchange rate are retrieved from the International Monetary Fund's *International Financial Statistics* (http://imfstatistics.org). Data on the distance between countries are collected from Jon Haveman's International Trade Data (http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/TradeData.html). Lastly, the investment data of Japanese assemblers and auto-parts firms used in calculating the agglomeration of assemblers and auto-parts firms is from the *KSKS*.

4.2 Methodology and Hypotheses

4.2.1 The Conditional Logit Model and Variable Description

Location decision of the Japanese automotive investors is examined by using the conditional logit model. Investment data of 989 Japanese firms during 1980-2004 are collected.

The observations in the conditional logit models, therefore, equals 7,912 observations (= 989*8: the number of firms * the number of countries). However, due to the missing value of some variables, the real observation number in model will be lower than this. The dependent variable is a dummy that will be 1 if Japanese assemblers decide to invest in ASEAN4, China, India, Korea and Taiwan and 0 otherwise.

Turning to explanatory variables, the paper creates conditional logit model based on the firm's profit maximization assumption as suggested in Mcfadden (1984)'s choice model[4]. The deterministic part of the profit function is influenced by various attributes of locations, as suggested in the theory section. The paper considers the location attributes from both supply and demand point of view. Regarding supply-side factors, monthly manufacturing wage rate in the Yen and the number of student enrollment in the tertiary education in thousands are used to capture labor costs and the availability of skilled labor. This will account for production costs of Japanese automotive firms who decide to invest in the region. Regarding demand-side factors, the number of vehicle sales and market potential are introduced into models as proxies for domestic and regional market size. The market potential will help us account for the third market effect. Furthermore, one period lag of the cumulative number of Japanese auto-parts makers and assemblers in each country is also included into the model to represent the externalities from agglomeration economies of assemblers and auto-parts manufacturers. To avoid non-normal and skewed distribution of the number of agglomerate firms, the paper uses natural logarithm of one plus the agglomeration in the year before in the year before, $\ln(1+\text{agglomeration}_{t-1})$, is used, following Head et al. (1995) and Disdier and Mayer (2004). To alleviate skewed distribution, the independent variables described above are all transformed into natural log before introduce into the models. Consequently, all marginal effects can be interpreted as the probability change of a 1 percent change in the value of the variable concerned.

[4] For more details, please see Disdier and Mayer (2004).

Three dummy variables used in this paper are as follows. The *AICO* dummy will be 1 for the ASEAN4 countries since 1996 when the AICO scheme was established while the *crisis* dummy will be 1 in 1997 for ASEAN4 countries and Korea; 0 otherwise. The last dummy variable is the *after 1997* dummy, which will be one for 1997 to 2004. This dummy is added to test whether there has been a structural change as a result of the increasing use of complementary production following the 1997 financial crisis.

4.2.2 Hypotheses and Model Specifications

There are four hypotheses in this paper. The first hypothesis is that the large domestic demand, high market potential, large size of agglomeration, low labor costs, and abundant availability of skilled labors help attract Japanese investment into the region. (specification 1).

Second, the paper would like to examine the effect of the crisis and economic integration on the location decisions. After the crisis, many countries in the study such as Thailand abolished the local content policy and foreign ownership control regulation following TRIM. The paper hypothesizes that economic integration and the change in the government policies helps attract more investment since the economic integration and the relaxed regulations could reduce trade costs and strengthen the degree that market potential can affect the location decision of Japanese automotive firms.

Two following approaches are used to test the effect of economic integration. First, the paper uses the AICO dummy to examine the effect of the AICO scheme, a scheme introduced in November 1996 to reduce tariff among ASEAN countries to 0-5 % (specification 2). Second, structural stability test is conducted to see how effects of each explanatory variable, especially market potential of countries in the region, have been changed after the crisis. It should be noted that the Asian crisis drove Japanese assemblers to shift their strategy to export-oriented strategy. The crisis dummy is used to purge the Asian crisis effect from the model results. The cross-terms between the variables in specification 2 and the after 1997 dummy are added into specification 3

to test the structural stability. The location choices decision of Japanese MNEs will not significantly change after the crisis if all cross-terms variables jointly show insignificant effect on Japanese investment inflow (specification 3).

Another change during the end of the 1990s is a rapid growth of China and India. Noble (2006) and Kinoshita et al. (2004), for example, argue that after the Asian crisis, Japanese firms shift their focus from Southeast Asia to China who relatively unaffected. The paper tests the third hypothesis whether a rapid growth of China and India during the end of the 1990s would significantly detract investment inflow from the other countries in the study, especially after the crisis. Thereafter the paper will refer this effect as the crowding-out effect from China and India. The sample data under this model will be narrowed to the Japanese investment data in ASEAN4, Korea and Taiwan. The coefficient of the China and India market potential (the sum of distance weighted GDP at constant (2000) market prices of China and India) is employed to test the hypothesis (specification 4).

The fourth hypothesis is that the location choice of Japanese assemblers and auto-parts firms has an influence on the location choice of Japanese auto-parts firms. A higher possibility for an auto-parts firm to be located if there exists a large number of assemblers and auto-parts firms in the location. In contrast to the previous specifications, the agglomeration variable in this model subdivides agglomeration into agglomeration of Japanese auto-parts firms and assemblers to examine the vertical linkage between the auto-parts industry and assembling activity in this region (specification 5). Besides, the scope of data used in this specification also limit only to investment data of Japanese auto-parts firms.

This hypothesis is built based on the characteristic of the automotive industry in which assemblers and auto-parts firms have strong linkages to each other. There are several benefits for auto-parts firms to locate near cluster of vehicle manufacturers. First, a large existence of assemblers means a lot of order and technological knowledge/assistance that auto-part firms can obtain. Second, the close proximity helps cooperation and communication between auto-parts and

assembler become more effective and helps reduce the transaction costs that might occur during the supplier selection. Furthermore, since the automotive parts are bulky, the close proximity between auto-parts and assemblers can help reduce considerable amount of transportation costs. This is especially true for the Japanese firms who apply Just-In-Time system that require suppliers to deliver the necessary volume of parts at the necessary time. The specifications and explanatory variables used in the paper are summarized in Table 3.

Table 3. Specifications and Explanatory Variables

Explanatory Variables	Definition	Specification					
		1	2	3	4	5	6
lnsales	ln (Sales)	*	*	*	*	*	*
ln Japanese agglomeration	ln (1+the number of Japanese firms in the country in previous year)[1]	*	*	*	*		*
lnwage	ln wages (in yen)	*	*	*	*	*	*
lntertiary enrollment	ln (tertiary enrollment)	*	*	*	*	*	*
lnconstant market potential (in yen)	lnconstant market potential (in yen)	*	*	*		*	*
lnmarket potential of China and India (in yen)	lnmarket potential of China and India (in yen)				*		
crisis dummy	1 in 1997 for ASEAN4 and Korea; 0 otherwise	*	*	*	*	*	*
AICO dummy	1if year>=1996 for ASEAN4; 0 otherwise		*				
lnvehicle exports	ln (Exports ofvehicles other than railway, tramway); 87 Heading HS1992 from the COMTRADE database, United Nations						*
lnsales*after 1997 dummy	lnsales*after 1997 dummy (1 if year>=1997; 0 otherwise)			*	*		
lnagglomeration*after 1997 dummy	lnagglomeration*after 1997 dummy			*	*		
lnwage*after 1997 dummy	lnwage*after 1997 dummy			*	*		
ln tertiary enrollment*after 1997 dummy	ln tertiary enrollment*after 1997 dummy			*	*		
lnconstant market potential (in yen)*after 1997 dummy	lnconstant market potential (in yen)*after 1997 dummy			*			
lnmarket potential of China and India*after 1997 dummy	lnmarket potential of China and India*after 1997 dummy				*		
lnvehicle exports*after 1997 dummy	lnvehicle exports*after 1997 dummy						*
lnJapanese parts supplier agglomeration	lnJapanese parts supplier agglomeration					*	
lnJapanese assembly plants agglomeration	lnJapanese assembly plants agglomeration					*	

Note: * refers to the variable is included in the model; [1]ln (1+the number of Japanese firms in the country in previous year) is used to avoid ln (0) which is undefined.

4.3 Results

The odds ratios of the explanatory variables from the conditional logit models are shown in Table 4. The odds ratio here is the ratio of the probability of Japanese automotive firms deciding to invest in a particular country in the region to the probability that they do not. An explanatory variable helps to raise the probability of Japanese automotive firms investing in a country if the odds ratio of the variable is larger than 1 and vice versa[5].

The results for Specification1 suggest that large domestic demand, the availability of skilled labor, cheap labor costs, high market potential and firm agglomeration increase the probability that Japanese automotive firms invest in a particular country, as hypothesized. Only one unexpected result is the positive effect of the crisis dummy. This positive effect of the crisis dummy could represent the regional attractiveness from the rapid vehicle export growth after the crisis.

The empirical study suggests there is a rapid growth in exports after the crisis. In addition, Kohpaiboon (2008) suggests that a consistently increase in exports of Thailand could be regarded as a structural change. To test whether exports have significantly increased the attractiveness of the region since the crisis period or not, the paper adds the vehicle exports[6] and exports after 1997 into the model to see the effect of exports on the structural change of location choices (specification 6). The result reveals that exports after 1997 significantly increase the attractiveness of the region, but the crisis dummy still shows a significant positive effect even controlling for the exports. Exports, thus, cannot fully explain the unexpected positive effect of the crisis dummy.

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[5] For more details on the conditional logit model, see Train (2003) and Long, J.S. and Freese, J.(2003)

[6] Vehicles exports data is collected from the UN, COMTRADE database; 87 classification (vehicles other than railway, tramway) HS-1992. However, Taiwan is excluded from the model due to the unavailability of exports data in COMTRADE database.

Table 4 Estimation results

Explanatory Variables	specification 1			specification 2			specification 3		
	The odds ratio	Z	P-value	The odds ratio	Z	P-value	The odds ratio	Z	P-value
lnsales	1.196 ***	4.14	0	1.371 ***	5.96	0	1.13 **	2.14	0.032
ln Japanese agglomeration	2.959 ***	19	0	2.877 ***	19	0	2.614 ***	12.6	0
lnwage	0.5527 ***	-12.1	0	0.5437 ***	-12.6	0	0.503 ***	-12.7	0
lntertiary enrollment	1.277 ***	3.66	0.0003	1.391 ***	4.32	0	1.081	1.08	0.2815
lnconstant market potential (in Yen)	2.525 ***	4.72	0	2.981 ***	5.43	0	3.849 ***	5.3	0
crisis dummy	2.493 ***	3.81	0.0001	1.832 **	2.43	0.0149	0.9986	-0.00538	0.9957
AICO dummy				1.88 ***	4.3	0			
lnsales*after1997 dummy							1.035	0.286	0.7748
lnagglomeration*after1997 dummy							1.835 ***	4.59	0
lnwage*after1997 dummy							2.442 ***	6.42	0
ln tertiary enrollment*after1997 dummy							2.018 ***	3.84	0.0001
lnconstant market potential (in Yen)*after1997 dummy							0.07964 ***	-4.7	0
Number of Observations	7872			7872			7872		
Adj. R-Square	0.2306			0.2353			0.2471		
Chi Square	833.7181			739.98			715.8623		
P-value	0			0			0		

- p<.1, ** p<.05, *** p<.01

Explanatory Variables	specification4			specification5			specification6		
	The odds ratio	Z	P-value	The odds ratio	Z	P-value	The odds ratio	Z	P-value
lnsales	1.214 *	1.91	0.0557	1.235 ***	3.92	0.0001	1.2602 ***	2.73	0.006
ln Japanese agglomeration	2.659 ***	8.11	0				2.9418 ***	15.75	0
lnwage	0.1939 ***	-6.43	0	0.6328 ***	-5.65	0	0.5926 ***	-7.56	0
lntertiary enrollment	0.6855 ***	-3.48	0.0005	1.319 ***	4.01	0.0001	1.3764 ***	3.47	0.001
lnconstant market potential (in Yen)				3.044 ***	5.35	0	3.5926 ***	4.08	0
ln market potential of China and India(in Yen)	8.607 ***	4.69	0						
crisis dummy	3.284	1.16	0.2462	2.474 ***	3.72	0.0002	2.2839 ***	3.26	0.001
lnvehicle exports							0.7563 ***	-2.71	0.007
lnsales*after1997 dummy	1.066	0.294	0.7689						
lnagglomeration*after1997 dummy	1.501 **	2.09	0.0366						
lnwage*after1997 dummy	6.583 **	2.35	0.0189						
ln tertiary enrollment*after1997 dummy	3.445 ***	3.09	0.002						
lnconstant market potential(in Yen)*after1997 dummy									
ln market potential of China and India*after1997 dummy	0.03962 **	-2.5	0.0123						
lnvehicle exports*after1997 dummy							1.2060 **	2.26	0.024
lnJapanese parts supplier agglomeration				2.416 ***	10.1	0			
lnJapanese assembly plants agglomeration				1.437 ***	2.93	0.0034			
Number of Observations	3510			7432			5474		
Adj. R-Square	0.195			0.2427			0.2571		
Chi Square	357.4639			854.913			717.62		
P-value	0			0			0		

* p<.1, ** p<.05, *** p<.01

Next, Specification 2 shows that the AICO dummy is positive and significant even the regional market potential effect is controlled for. So, it suggests that the AICO scheme helps raise the probability that Japanese automotive firms will invested in a particular country in ASEAN4 countries even we purged the influence from market potential of studied countries group.

Moving to specification 3, where the various cross-terms of the after 1997 dummies are added to conduct a structural stability test of Japanese automotive firm location decision in the region. To confirm that the location decision has changed statistically, a joint test that cross-terms are simultaneously equal to zero is conducted. The null hypothesis that all cross-terms variables do not have any effect on location choice was statistically rejected at 1%. It suggests that the structure of Japanese firms' location choice decision statistically changed at the 1 % significant level. Table 5 shows the joint test of specification 3 and 4.

Considering the results of cross-term variable of Specification 3 in detail, the result shows that economic integration enhances the importance of agglomeration and skilled labor in attracting Japanese auto-parts firms into the region but the effect of the domestic demand (ln sales*after1997) remains essentially unchanged. In contrast, the effect of the market potential weakens after 1997 even the effect of the crisis is purged. This was suggested by the odds ratio of (ln constant market potential * after 1997 dummy) that are less than 1.

Two likely reasons can be given to explain this result. First, most countries in the study especially in ASEAN4 simultaneously raised their vehicle export volumes to counter the large drop in domestic vehicle demand. This led the market potential did not work effectively as it should have been. Another reason is that the economic integration and deregulation allowed Japanese automotive firms to restructure and/or integrate their production bases across countries in the region. This promoted the international division of labor across countries in the region and helped increase the production efficiency. Japanese firms, therefore, were able to respond to the expansion in the vehicle market simply by using the existing plants. This means that even when the regional market potential size expands, the likelihood that Japanese will invest is not necessary to increase.

Table 5: The Wald Statistics test for Specification 3

H0: The coefficients of lnsales * after1997 dummy, lnagglomeration * after1997 dummy, lnwage* after1997 dummy, ln tertiary enrolment* after1997 dummy and ln constant market potential * after1997 dummy are all equal to zero

H1: not Ho

chi2 (5) = 58.99

Prob > chi2 = 0.0000

The Wald Statistics test for Specification 4

H0: The coefficients of lnsales * after1997 dummy, lnagglomeration * after1997 dummy, lnwage* after1997 dummy, ln tertiary enrolment* after1997 dummy and lnChina and India market potential * after1997 dummy are all equal to zero

H1: not Ho

chi2(5) = 14.64

Prob > chi2 = 0.0120

Next, Specification 4 examines the crowding out effect from a rapid growth of China and India on the investment toward the other countries in the study after the 1997 financial crisis. The paper tests this possibility by analyzing the market potential effect after 1997 of China and India toward ASEAN4, Taiwan and Korea. Specification 4 shows that the odds ratio for the market potential of China and India is highly significant, showing that the market potential of these two countries helps to attract Japanese investment to the ASEAN4, Taiwan and Korea. However, the odds ratio of the cross-term of the market potential of China and India and the after 1997 dummy is less than 1, implying that the effect of the market potential of China and India became weaker as a result of economic integration. However, because the effect of market potential after 1997 in

Specification 3 is also negative effect, it cannot explicitly conclude that the crowding out effect exists or not.

Lastly, to examine the effect of vertical linkages in the automotive industry, the effects of agglomeration of auto-parts firms and assemblers on the location decision of Japanese auto-parts manufacturers is investigated. The result in Specification 5 shows that the odds ratio for the agglomeration variable is highly significant, indicating that agglomeration of automobile and auto-parts manufacturers raises the probability that Japanese auto-parts firms invest in a particular country. This result would indicate the existence and significance of linkages in the automotive industry.

As pointed out by Techakanont (2008), agglomeration of firms will develop to be a cluster if firms in a particular location are interconnected. Rosenfeld (1997) argues that a cluster is more than a network in that a cluster is a system which membership is interdependent and mutually generates contributions to the system such as by enticing specialized service or generating demand for more firms with similar and related capabilities. Therefore, it is clear that the result significantly indicates the linkage between assembling activity and auto-parts industry and suggests the important existence of cluster.

5. Conclusions

The paper aims to study the determinants of Japanese automotive firms' location choices in the Asia countries, focusing on ASEAN4, China, India, Korea and Taiwan. Japanese investment data from Kaigai Shinshutsu Kigyou Souran 2005, Toyo Keizai and the conditional logit model are used. The results indicate the positive influences of the agglomeration effect, domestic demand, the availability of skilled labors, market potential and cheap labor costs. In addition, the location decision of Japanese automotive firms significantly changes after 1997. The findings suggest that economic integration such as the AICO enhances the importance of

agglomeration and skilled labor in attracting Japanese auto-parts firms into the region but the effect of the domestic demand remain unchanged. Regarding the vertical linkage between auto-parts firms and assemblers on the location decision of auto-parts firms, it finds that the agglomeration of automobile manufacturers and of auto-parts firms statistically enhances the probability to be invested by Japanese auto-parts firms. Hence, the result indicates an existence of the linkage between assembling activity and auto-parts industry in the region.

There are some implications from the study. First, the results suggest the effect of agglomeration and skilled labor become more crucial and strengthen even facing with the severe competition from the economic integration. The relocation of Japanese investors could be happened especially during model change and/or economic shock. The relocation of investors could bring a loss. To sustain the attractiveness in the long-run, the government should promote training and prepare skilled labors in engineering field. Second, the paper also suggests that there exists the vertical linkage between assembling activity and auto-parts industry. The close proximity between vehicle manufacturers and auto-parts firms would promote the collaboration in product development and technology transfer. Therefore, the governments should promote the agglomeration of firms by providing infrastructure and facilities such as establishing Industrial Estates. What's more important is to promote the collaboration and exchange knowledge among firms in the area.

Third, significance of the AICO dummy and of the market potential from China and India implies that the trade liberalization and FTA with China and India would be important. Since the individual market in ASEAN is relatively small, reaching the economies of scale would be difficult[7]. The economic integration thus becomes important in helping stabilize demand fluctuation and expand the market size. The government, therefore, should encourage the use of the AICO and regional FTAs while being kept in readiness for the international competition. For

[7]There are scale economies in producing a vehicle model approximately at 40,000–50,000 units/a model (Kohpaiboon, 2008).

instance, the government could promote research and development (R&D) and build the capacity to absorb the technology transfer by establishing R&D center, nurturing technicians and skilled labors, and developing and integrating supporting industries into the automotive industry.

However, this paper still has some limitations. Even though the paper considers location characteristics, the paper has not included firm characteristics and its prior investment as the determinants because data is unavailable. Knowing its previous location or its affiliated locations could allow us to have a deeper understanding of the agglomeration behavior. These problems should be examined in further study.

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