Exchnage Rates and Competition for FDI

Yuqing Xing*

International University of Japan

Guanghua Wan**

World Institute for Development Economics Research

Abstract

This paper analyses the role of exchange rates in the competition for FDI. Based on the assumption that two countries compete for FDI from the same source country, the paper shows explicitly that the relative FDI of one country is determined by the relative real exchange rate between its currency and that of the source country. The theoretical result suggests that, if the currency of one FDI recipient country appreciates against the source country more than that of its rival, its FDI inflows will decrease while the competing country's FDI will increase. Using data on Japan's FDI in nine Asian manufacturing sectors from 1981 to 2002, the paper also examines the theoretical conclusion in the context of the competition between China and ASEAN-4 (Indonesia, Malaysia, the Philippines and Thailand). Empirical results show that the relative exchange rate is a statistically significant factor determining the relative inflows of Japanese FDI for manufacturing as a whole and for such sub-sectors as textiles, food, electronics, transportation equipment, and others. Exchange rate polices of the ASEAN-4 countries played a critical role in dynamically reshaping the geographic distribution of Japan's FDI in Asia.

Keywords: FDI, exchange rate, China, ASEAN-4

JEL classification: F14, F23, F31

*International Development Program, International University of Japan, 777 kukusai-cho, Minami Uonuma-shi, Niigata-ken, 949-7277, Japan. Phone: 81-25-779-1424, fax: 81-25-779-1187, email: xing@iuj.acjp.

**Senior Research Fellow, World Institute for Development Economics Research (WIDER), Helsinki, Finland. Phone: phone: 358-9-6159-9218, fax: 358-9-6159-9333, email: wan@wider.unu.edu.

1 Introduction

The geographic distribution of Japanese foreign direct investment (FDI) in Asia has changed dramatically in the last decade. In particular, the traditionally popular destinations of Japanese FDI, such as the NICs (Hong Kong, Singapore, South Korea and Taiwan) and ASEAN-4 (Indonesia, Malaysia, the Philippines and Thailand), have been replaced by emerging China. In 1990, Japanese FDI in China's manufacturing sector accounted for a mere 5 per cent of its total in Asia, whereas by 1995 China's share had risen to 43 per cent. According to a survey by the Japan External Trade Organization (JETRO 2001), 54.4 per cent of Japanese firms with overseas production have facilities in China, the highest ratio among all countries receiving Japanese FDI.

The shift of Japanese FDI from other Asian countries to China is usually interpreted with the flying-geese theory, with Japan at the highest level of economic development, followed by the NICs, ASEAN-4, and China. High economic development results in the migration of mature industries, especially those in which labour costs are critical for competitiveness, to less developed economies (Kwan 2001; Edginton and Hayter 2000). The flying-geese theory, on the other hand, may not explain the whole story. For instance, after losing a significant share of Japan's FDI to China in the first half of 1990s, the NICs and ASEAN-4 regained their popularity after 1995. Even during the Asian financial crisis, these countries and regions experienced an increasing share of Japanese FDI. Furthermore, as the economic development of China's coastal regions, where Japan's FDI is mainly concentrated, was compatible with that of ASEAN-4, these areas of China cannot be classified as being less developed than ASEAN-4.

In the literature analysing foreign investment in China (e.g., Lardy 1995; Cheng and Kwan 2000; Zhang 2001), structure variables such as market size, economic growth, cheap labour, 'open door' policy, etc. are emphasized as the major factors that make the country attractive for FDI. Without a doubt, these factors have contributed significantly to China's FDI boom, during which its share of Japan's FDI earmarked for Asia surged from 5 per cent to 43 per cent, the highest among all Japanese FDI destinations. On the other hand, it needs to be mentioned that during the same period, the macro fundamentals in the NICs and ASEAN-4 (with the exception of the Philippines) showed no evidence of deterioration and were thus compatible with China.[1] Given the long history of these countries receiving Japanese FDI, the differences in macro fundamentals and investment environment may not be sufficient to determine why in the beginning of 1990, the ASEAN-4 countries suddenly began to lose their advantage in competing for FDI. To ascribe the shift in foreign investment simply to differences between the countries' macro fundamentals would be an under-estimation of the complexity of the competition for FDI.

This paper investigates the competition for FDI by examining factors beyond those structural variables usually emphasized in conventional literature. In particular, the study focuses on the role of exchange rates and analyses to what extent they may have altered the relative competitiveness of the recipient countries for FDI from the same source country. The importance of exchange rates in determining FDI has been

1 The economies of Indonesia, Malaysia, and Thailand grew 7.9 per cent, 9.5 per cent, and 8.6 per cent annually from 1991 to 1995, the fastest period of the last two decades.

emphasized in the literature (e.g., Froot and Stein 1991; Klein and Rosenger 1994; Blonigen 1997). Basically, a devaluation in the currency of the recipient country reduces production costs, measured in foreign currency, and increases the relative wealth of foreign investors, leading to an increase in FDI inflows. Previous research has primarily examined the changing comparative advantage induced by the currency devaluation between the source country and the recipient country, rather than the changing comparative advantage between the countries competing for FDI.

As a matter of fact, the relative comparative advantage between potential recipient countries is a critical factor when multinational enterprises (MNEs) consider the relocation of facilities or outsourcing production, particularly if the technology involved is mature and production is oriented towards exports rather than local markets. Currency devaluation can change the relative competitiveness of an FDI recipient country, and divert investments to the country that has devalued its currency. Given that the exchange rate regimes in both China and ASEAN-4 have changed substantially and that the Chinese yuan had been on a devaluating track since prior to 1995, the relative competitiveness for FDI among these countries must have varied accordingly. Hence, the relative exchange rates are likely to have been the driving force behind the dynamic change in the geographic distribution of Japanese FDI. The rising FDI into China might crowd out the FDI in ASEAN-4 countries.

To examine this hypothesis, we first model the decision of a MNE planning to invest for export purposes in two countries with similar technology, then derive explicitly that the relative FDI inflow of the two recipient countries is a function of the relative real exchange rates. After the theoretical analysis, we conduct empirical analysis in the context of Japanese FDI in China and ASEAN-4 from 1981 to 2002.

This paper contributes to the literature in three aspects. Unlike existing literature, it studies the nexus of FDI and exchange rates in the context of the competition between two recipient countries, rather than within a single country scenario. It examines how the relative exchange rates affect the relative FDI inflows between recipient countries. Second, it shows explicitly that relative FDI inflow is a decreasing function of the relative real exchange rate. The real exchange rate used in the model is based on the standard international economics definition widely adopted in empirical analyses. Finally, it is the first study that empirically investigates the issue within the manufacturing sectors in the context of Japanese FDI in China and ASEAN-4. The findings of the paper, on the shift of Japanese FDI from ASEAN-4 to China, go beyond the scope of existing literature.

The paper proceeds as follows. In the next section, we briefly review the literature on the nexus of exchange rates and FDI. Section 3 sets up a theoretical model and derives an explicit function between relative FDI inflows of a recipient country and its relative real exchange rate to its rival country. Following the theoretical analysis, in section 4 we outline some stylized facts of Japan's FDI in Asian manufacturing. The analysis examines FDI with regard to its dynamic geographic distribution across Asia, its export-oriented nature, and the correlation between exchange rates and FDI distribution. Section 5 presents an econometric model to test the theoretical result, and finally, section 6 summarizes the major findings of the paper.

2 Literature review

The mechanism through which exchange rates affect FDI flows has been modelled in several theoretical studies (e.g., Kohlhagen 1977; Cushman 1985; Froot and Stein 1991). Most of these studies conclude that a devaluation in the value of the recipient country's currency stimulates the inflows of FDI and conversely an appreciation leads to a reduction. Fundamentally, there are two channels through which exchange rates impact on FDI: the wealth effect and relative production costs. A devaluation in the currency of a country receiving FDIs induces a reduction in local production costs in term of foreign currency, raising the profits of export-oriented foreign investors accordingly. Higher returns naturally attract more FDI inflows. The wealth effect, which is the wealth of foreign investors relative to domestic investors, is also raised after devaluation, when all production inputs such as labour, land, machines, and assets become cheaper for the foreign investors whose capital is in a foreign currency, encouraging them to acquire more domestic assets.

Kohlhagen (1977) used a static model to analyse the effect of devaluation on the relocation decision of MNEs, and concluded that these enterprises tend to increase their production capacity abroad to meet domestic market needs, if the currency of the host country is devaluated against the domestic currency. Cushman (1985) considered a two-period dynamic model and found that the expected, risk-adjusted real depreciation would reduce the production costs of foreign investors, and thus enhance FDI inflows. Benassy-Quere (2001) examined the trade-off between exchange rate depreciation and its volatility in terms of their effects on FDI, and argued that the negative impact on FDI of excessive volatility could erode the apparent attractiveness resulting from a currency depreciation.

Assuming imperfect information on the return of firm-specific assets, Froot and Stein (1991) argued that the appreciation of foreign currency actually increases relative wealth of foreign investors, thus encouraging foreign investors to acquire more domestic assets. Blonigen (1997) believed that market segmentation provides an advantage to foreign investors acquiring firm-specific assets when the domestic currency depreciates. In testing the hypothesis on Japanese firms in the US, he found that the appreciation of the yen resulted in a significant increase in their acquisition activities.

Xing and Zhao (2003a) investigated systematic linkages among 'reverse imports', FDI, and exchange rates. They concluded that due to product differentiation and barriers in brand name recognition, MNEs engaging in 'reverse imports' usually benefit more from the currency devaluation of the recipient country than local firms, thus encouraging multinationals to expand their operations with additional direct investment. For empirical analyses on the relation between exchange rates and FDI, see Klein and Rosenger (1994), Dewenter (1995) and Bayoumi and Lipworth (1998).

3 The model

Consider that a Japanese MNE has one factory in country A, and another in country B, both producing the same products for export back to Japan.[2] Assuming that the production technology employed in these two factories is identical and is defined by a standard Cobb-Douglas production function as

$$y = \gamma K^{\alpha} L^{\beta}$$

where *y* denotes output, *K* and *L* capital and labour inputs respectively, $(\alpha + \beta) < 1$. The assumption on the elasticities of capital and labour implies that the technology shows decreasing return to scale. Usually MNEs relocate their production facilities with mature technology to developing countries to benefit from the low production costs. Mature technologies in manufacturing industries generally fit the technology category with decreasing return to scale.

The profit function of the Japanese MNE in country A can be written as

$$\pi_A = p(\gamma K_A^{\alpha} L_A^{\beta}) - e_{yen/\$A}(r_A K_A + w_A L_A) \quad (1)$$

where *p* is the price of the product, measured in yen; r_A and w_A are capital rent and labour wage, respectively, both measured in local currency \$*A*; $e_{yen/\$A}$ denotes nominal exchange rate, the value of the local currency \$*A* given in yen. Higher/lower $e_{yen/\$A}$ indicates an appreciation/depreciation of the local currency \$*A*. In the context, K_A actually represents Japan's direct investment in country A.

The combined profit of the Japanese firm from its two overseas subsidiaries can be written as

$$\pi = p(\gamma K_A^{\alpha} L_A^{\beta} + a K_B^{\alpha} L_B^{\beta}) - e_{yen/\$A}(r_A K_A + w_A L_A) - e_{yen/\$B}(r_B K_B + w_B L_B) \quad (2)$$

where \$*B* symbolizes the currency of country B, r_B and w_B the capital rent and wage in country B; $e_{yen/\$B}$ denotes the nominal exchange rate between the yen and \$*B*. Maximizing the profit with respect to *K* and *L* yields the following first order conditions (FOC):

$$p\gamma\alpha K_A^{\alpha-1} L_A^{\beta} - e_{yen/\$A} r_A = 0$$

$$p\gamma\alpha K_B^{\alpha-1} L_B^{\beta} - e_{yen/\$B} r_B = 0$$

$$p\gamma\beta K_A^{\alpha} L_A^{\beta-1} - e_{yen/\$A} w_A = 0$$

$$p\gamma\beta K_B^{\alpha} L_B^{\beta-1} - e_{yen/\$B} r_B = 0$$

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2 The assumption of exports to other overseas market such as the USA or EU does not change the results.

From the above FOCs, we derive

$$(1-\alpha-\beta)\log K_A = -[(1-\beta)\log(e_{yen/\$A} r_A) + \beta \log(e_{yen/\$A} w_A)] + M \quad (3)$$

$$(1-\alpha-\beta)\log K_B = -[(1-\beta)\log(e_{yen/\$B} r_B) + \beta \log(e_{yen/\$B} w_B)] + M \quad (4)$$

where $M = \log(p\gamma) + (1-\beta)\log\alpha - \beta\log\beta$. Subtracting equation (4) from equation (3) yields

$$(1-\alpha-\beta)\log(\frac{K_A}{K_B}) = -\{(1-\beta)\log(\frac{e_{yen/\$A} r_A}{e_{yen/\$B} r_B}) + \beta \log(\frac{e_{yen/\$A} w_A}{e_{yen/\$B} w_B})\} \quad (5)$$

The above equation can be re-written as

$$(1-\alpha-\beta)\log(\frac{K_A}{K_B}) = -\{(1-\beta)\log(\frac{e_{yen/\$A} r_A / r_J}{e_{yen/\$B} r_B / r_J}) + \beta \log(\frac{e_{yen/\$A} w_A / w_J}{e_{yen/\$B} w_B / w_J})\} \quad (6)$$

where r_J and w_J denote capital rent and labour wage in Japan, respectively. In equation (6), $(e_{yen/\$A} r_A / r_J)$ actually stands for the relative price of capital in country A in terms of the capital in Japan. It is also the real exchange rate between the yen and \$*A* defined with capital prices. Similarly, $(e_{yen/\$A} w_A / w_J)$ represents the wage in country A relative to the wage of Japanese workers. It represents a real exchange rate between the yen and \$*A*, but defined with wages. Therefore, $(\frac{e_{yen/\$B} r_B / r_J}{e_{yen/\$A} r_A / r_J})$ is essentially the ratio of real exchange rate between the yen and \$*A* to the real exchange rate between the yen and \$*B*.[3] Rearranging equation (6) yields an explicit function for relative FDI into country A:

$$\log(\frac{K_A}{K_B}) = -(1-\alpha-\beta)^{-1}\{(1-\beta)\log(\frac{e_{yen/\$A} r_A / r_J}{e_{yen/\$B} r_B / r_J}) + \beta \log(\frac{e_{yen/\$A} w_A / w_J}{e_{yen/\$B} w_B / w_J})\} \quad (7)$$

Equation (7) shows that relative FDI into country A (in logarithm) is a linear decreasing function of the weighted sum of the two relative real exchange rates (in logarithm), or simply a linear decreasing function of the relative real exchange rates. The real exchange rate in the model is defined according to the standard textbook of international economics and is used widely in empirical literature. With respect to the definition, an increase in $(e_{yen/\$A} r_A / r_J)$ means a real appreciation of \$*A* against the yen. Therefore, the theoretical relation characterized by equation (7) suggests that, as long as the currency of a recipient country appreciates more than the currency of its rival country, its relative FDI will decrease and be diverted to its rival. The result is consistent with economic rationale. The real exchange rate actually measures the relative purchasing power between Japan and the recipient country. A real appreciation in the recipient country's currency will raise the relative costs of both labour and capital in that country for

3 In fact, it is the real exchange rate between \$*A* and \$*B*.

Japanese investors, weakening the recipient's competitiveness. Consequently, FDI will shift to other receipient countries not undergoing similar currency appreciation.

It is important to emphasize that the real exchange rate includes both capital prices and wages. The change of the real exchange rate results from the combination of three variables: nominal exchange rate, capital price and wages. Thus, the impact on FDI due to differentials in capital rents and wages between the two recipient countries is also incorporated in the model. We summarize the theoretical finding in the proposition below.

Proposition 1

When two countries compete for export-oriented FDI from the same source country, a relative real devaluation in one recipient country's currency against that of the source country will enhance its relative FDI inflows while diminishing the relative inflows to its rival.

4 Empirical evidence: the stylized facts of Japan's FDI in Asia

Before conducting econometric tests on the theoretical results in section 5, we review some elements of Japanese FDI in Asian manufacturing from 1981 to 2002 to support our observations and hypothesis.

4.1 The dynamic change of the geographic distribution

The NICs and ASEAN-4 have been the primary destinations for Japanese FDI since the 1960s. In Indonesia, Japan was the largest single source of FDI flows to the non-oil sectors—textiles, nonmetallic minerals and metals (Pangestu 1991). Japan accounted for over one-half of the accumulative FDI in Thailand's textiles, food and chemicals in the 1970s and 63 per cent of its electronic machinery sector in 1989 (Tambunlertchai and Ramstetter 1991). After 1972 Japan replaced the US as the largest investor in Korea, accounting for over one-half of approved total investments (Lee and Ramstetter 1991). Even though China started an aggressive campaign to promote inward FDI as early as 1980, it had failed to gain a substantial share of Japan's FDI compared to other Asian countries. Prior to 1990, the scale of Japanese investments in China was relatively small, targeted mostly to the non-manufacturing sector (Xing 2004). In 1990, Japanese firms invested only 23.7 billion yen in China's manufacturing sector, representing a mere 5.3 per cent of Japanese FDI in Asia, whereas 66.1 of its investments went to ASEAN-4, and 26.2 per cent to the NICs.

A significant change in the geographic distribution of Japanese FDI in Asia occurred in the 1990s. Gradually, China emerged as the largest recipient of Japan's FDI while the NICs and ASEAN-4 experienced a substantial decline. According to Table 1 which summarizes the country distribution of Japanese FDI in Asia from 1990 to 2001, China's share grew drastically from 1990 to 1995, when China became the largest recepient, its share jumping from 5.3 per cent to 43.1 per cent. Conversely, the NICs' share dropped to 14.7 per cent and ASEAN-4 to 38.5 per cent. However, the increase in Japanese FDI to China was not monotonic. After 1995, both the NICs and ASEAN-4

Table 1
Regional distribution of Japanese FDI in Asian manufacturing (%)

Year	NICs	ASEAN-4	China	Others
1990	26.2	66.1	5.3	2.4
1991	21.8	66.5	10.5	1.2
1992	14.2	58.1	21.0	6.7
1993	20.2	39.9	38.0	1.9
1994	16.5	43.0	36.0	4.5
1995	14.7	38.5	43.1	3.7
1996	18.6	47.6	27.2	6.6
1997	25.6	45.0	20.7	8.7
1998	17.1	54.4	21.7	6.8
1999	37.9	43.8	12.3	6.0
2000	32.0	42.7	20.8	4.5
2001	23.6	41.9	30.0	4.5

Source: Authors' calculation based on Monthly Statistics, Ministry of Finance, Japan.

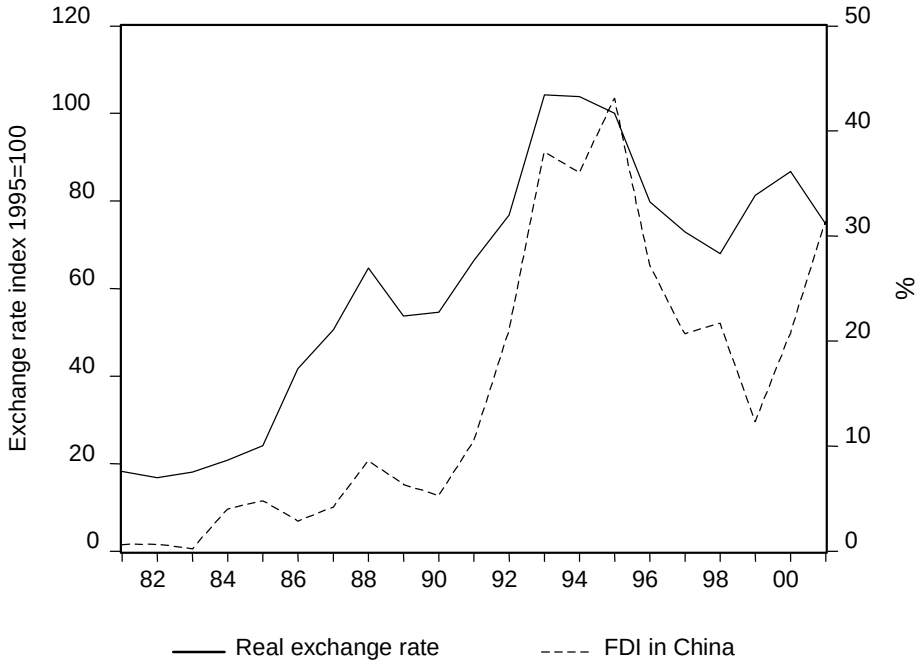
regained their popularity among Japanese MNEs and relatively more FDI, in comparison to the flows to China, was again targeted into these regions. Even during the Asian financial crisis, Japanese investments in the NICs and ASEAN-4 increased rather than decreased; shares to NICs and ASEAN-4 in 2002 increasing to 32.1 per cent and 42.7 per cent, respectively, while China's share decreased to 20.7 per cent.

4.2 Exchange rates and changing regional distribution

The correlation between exchange rates and the dynamic change in the regional composition of Japan's FDI in Asia can be seen in Figure 1 which shows the trend of direct investments in China from 1981 to 2002, and the real exchange rate between the Japanese yen and Chinese yuan. The real exchange rate is the price of the Japanese basket given in terms of the Chinese basket of commodities. The higher value indicates the real appreciation of the yen. Japanese FDI in China is measured as a share of its total investments in the Asian manufacturing sector. According to Figure 1, a highly correlated relationship seems to exist between the two trends; specifically, as the yuan depreciated, more FDI went to China relative to other Asian countries, while an appreciation of the yuan was always associated with a reduction in FDI inflow. Therefore, a systematic relationship seems to exist between the two variables.

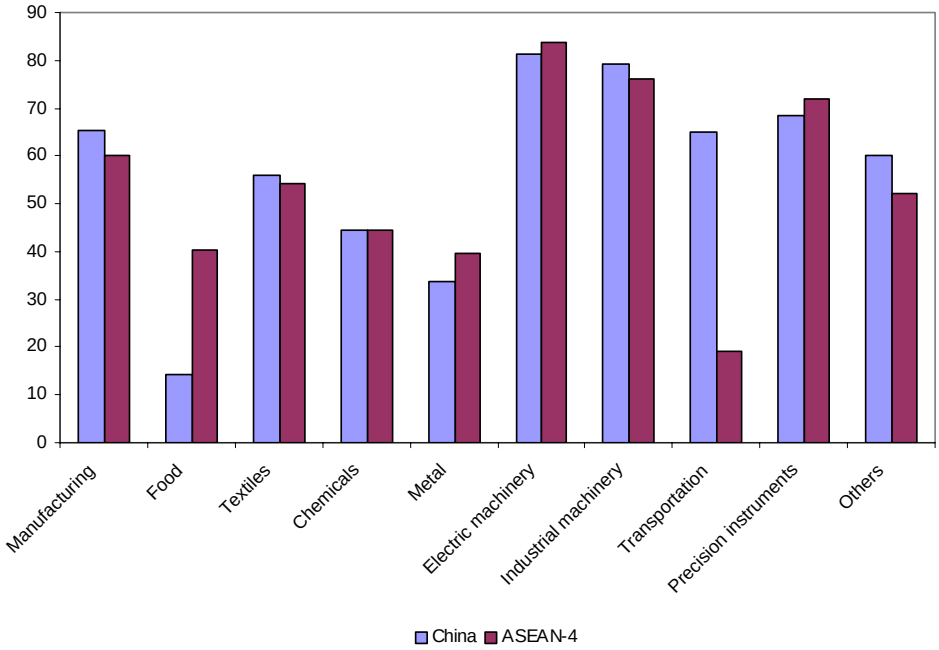
Japanese FDI in China and ASEAN-4 was mainly export oriented, followed the so-called 'Japanese model' (Kojima 1978). A survey conducted by JETRO in 2002, covering 1,362 Japanese affiliated manufacturers in 11 Asian countries and regions, reveals that on average 56 per cent of the companies surveyed export at least 70 per cent of their production. The percentages of the manufacturers in ASEAN-4 and China that were mainly engaged in exports were even higher; 62 per cent of the surveyed companies in China reported exporting at least 70 per cent of their production, while the figure in ASEAN-4 was 59 per cent (JETRO 2003).

Figure 1
Japanese FDI in China as the percentage of its total FDI in Asia and the exchange rate



Source: Authors' calculation based on IMF and monthly statistics from METI (2003).

Figure 2
Export intensity of Japanese affiliated manufacturers in China and ASEAN-4



Source: Authors' calculations based on METI (2003).

By examining the annual destinations of the sales of Japanese affiliated firms across the major manufacturing sectors, we obtained additional information on the export-oriented nature of Japan's FDI. Figure 2 illustrates the export intensities of Japanese affiliated manufacturers in ASEAN-4 and China in 2002. Export intensity is defined as the ratio of exports to total sales revenues, which in China was 65 per cent for the manufacturing sector as a whole. In other words, Japanese affiliated manufacturers sold only 35 per cent of their products in the local market and made most of their sales to the overseas market. In ASEAN-4, the export intensity for the whole manufacturing sector was more than 60 per cent; specifically, intensity exceeded 50 per cent in textiles, electronic machinery, industrial machinery, precision instruments, and others. The export intensity of Japanese affiliated manufacturers with regard to electronic machinery and industrial machinery in China was 71 per cent and 79 per cent, respectively, while in ASEAN-4 the corresponding figures were 83 per cent and 76 per cent. It is worth noting that in the transportation equipment sector, export intensity in China was 65 per cent, even though in ASEAN-4 it was less than 20 per cent. As these facts suggest, Japanese direct investment in these countries' manufacturing sectors was mainly export-oriented.

5 Empirical evidence: econometric analysis

We now turn, in the context of Japanese FDI in the Asian manufacturing industry, to the econometric analysis on how exchange rate affects the competition for FDI. We specify a scenario in which ASEAN-4 compete with China for Japanese FDI. There are three reasons for undertaking this scenario. First of all, as indicted in the previous section, significant changes exist in the geographic distribution of Japan's FDI to the two regional destinations. Thus, it is likely that there exists a systematic relationship between exchange rate fluctuations and the dynamics of the location of distribution. Second, since the 1980s China has devalued the yuan against the dollar, thus inducing a sharp devaluation of the yuan against the yen as well, while ASEAN-4 pegged their currencies to the dollar before the Asian financial crisis. The devaluation of the yuan obviously led to the appreciation of the ASEAN-4's currencies versus the yuan, thereby improving China's competitiveness for FDI. Finally, as suggested by the stylized facts, Japanese FDI in these countries has mainly been export-oriented, thus making it sensitive to exchange rate fluctuations.

With regards to the theoretical result of equation (7), we specify the following econometric model:

$$\log\left(\frac{FDI_{iJ}}{FDI_{CJ}}\right)_t = \alpha + \beta_1 \log\left(\frac{e_{yen/\$i}\, p_i / p_J}{e_{yen/yuan}\, p_C / P_J}\right)_t + \beta_2 \log\left(\frac{GDP_i}{GDP_C}\right)_t + \beta_3 (g_i - g_C)_t + \beta_4 \log\left(\frac{open_i}{open_C}\right)_t + \varepsilon_{it} \quad (8)$$

where FDI_{iJ} denotes Japanese direct investment in country i, GDP is the gross domestic product, g is the GDP growth rate, and $open$ measures the level of openness in the recipient country. Subscript C stands for China and i Indonesia, Malaysia, Thailand, or the Philippines. In the model, we define the dependent variable as the ratio of the FDI flow into an ASEAN-4 country versus the flow into China. An increase in the variable implies an increase in the relative FDI received by the ASEAN country, and vice versa. If both China and ASEAN-4 countries experience the same growth in FDI, the dependent variable will be constant. Therefore, the dynamic changes of the dependent

variable over the time horizon reflect variations in the relative competitiveness between China and ASEAN-4.

Among the four independent variables, the focus of our interest is $\frac{(e_{yen/yuan} p_i / p_J)}{(e_{yen/yuan} p_C / p_J)}$, in which the denominator is the real exchange rate between the yen and yuan, and the numerator the real exchange rate between the yen and the currency of country *i*. An increase in the dependent variable means that the currency of country *i* appreciates against the yen in real terms more than the Chinese yuan. According to the theoretical result expressed in equation (7), the coefficient of the relative real exchange rate is expected to be negative.

The remaining three independent variables primarily serve as control variables mirroring other major factors determining FDI. $(\frac{GDP_i}{GDP_C})$ captures the relative market size effect of a recipient country on FDI. Both theoretical and empirical literature (e.g., Agarwal 1980; Moosa 2002) underlines the importance of market size. While capital inflows are always attracted to areas where a high return is to be expected, a country with a relative higher growth rate generally receives more FDI if other conditions are held constant. We include $(g_i - g_C)$ as an additional determinant to embody the pulling effect of the growth rate. The fourth independent variable $\left(\frac{open_i}{open_C}\right)$, calculated as the ratio of trade volume to GDP, indicates to what extent the recipient country has integrated with the global economy. Generally, high openness would smooth the inflow of FDI. Further, export-oriented FDI tends to flow into a country that promotes exports. $\left(\frac{open_i}{open_C}\right)$ could also proxy the policy preference.

We estimate equation (8) for the manufacturing sector as a whole and for the nine sub-sectors (food, textiles, pulp and paper, metal, chemicals, electronics, machinery, transport equipment, and others) for the period 1981-2002. All FDI data are from monthly statistics, courtesy of the Japanese Ministry of Finance. Growth rate, GDP, and openness are from the World Bank's *World Development Indicators*. Real exchange rates are from IMF's *International Financial Statistics*, or in some cases, calculated by the authors using normal exchange rates and GDP deflators. Panel data is used for all estimations, both pooled regressions and fixed effect models are estimated for each sector. Table 2 gives the estimates of the pooled regressions while Table 3 summarizes the estimates of the fixed effect models. In terms of adjusted R-squared, the fixed effect models generally perform better than the corresponding pooled regressions, except for the food sector.

According to the fixed effect model estimation, the coefficient of the real exchange rate for manufacturing as a whole is -1.14 and is statistically significant at 1 per cent. This suggests that if an ASEAN-4 country's currency appreciates more against the yen than yuan, the country in question will receive relatively less FDI. Alternatively, if the yuan depreciates against the yen more than the currencies of ASEAN-4, China will benefit with an inflow of relatively more FDI. As all variables are in logarithm, the estimated coefficient demonstrates the elasticity of the FDI inflows to the exchange rate. Specifically, a relative 1 per cent appreciation would induce the inflow to decline by

1.14 per cent. The adjusted R-squared is 0.76, suggesting a strong explanatory power of the model. The estimated coefficients of GDP and openness are 2.92 and 2.64, respectively. Both are statistically significant at 1 per cent, indicating that country size and openness are among the factors that matter for FDI.

The result is generally robust across the sub-sectors. The estimated coefficients of the real exchange rate in the fixed effect models are -2.03, -2.34, -2.68, and -1.61 for food, textiles, transportation equipment and other sectors, all significant at 1 per cent. The estimated coefficient for the electronic sector is -1.23 and significant at 5 per cent. The empirical results based on the sub-sectors demonstrate that the relative real exchange rate is a significant factor determining the relative FDI inflow in these sectors. This provides further evidence to support the argument that a relative real appreciation in the currency of a FDI recipient country against that of the source country will undermine inflows and divert FDI to its rival countries. The estimated coefficients of the relative real exchange rate are not statistically significant in four sectors only (metal, lumber and pulp, chemicals, and machinery). The insignificance can be explained by the fact that FDI in natural resource intensive sectors, such as lumber and chemicals, largely depends on the availability and relative price of the resources. Thus, compared with the comparative advantage of the recipient country' resource endowment of, say, oil in Indonesia or timber in Malaysia, the currency devaluation/appreciation is less important for FDI in these sectors. The low export intensity of the metal sector could account for the fact that FDI in that particular sector was not significantly affected by currency devaluation. We were unable to determine why FDI in machinery was not affected by real exchange rate, and this will be the subject of future research.

As far as control variables are concerned, the estimated coefficient of the relative GDP is positive and statistically significant at 1 per cent for all sectors, except for lumber and pulp, and food, implying that the relative size of an economy also has an impact on FDI. The result is consistent with existing literature. Openness is positive and significant at least at 10 per cent for textiles, metal, machinery, electronics, transportation equipment, and total manufacturing. The difference in GDP growth rate is generally not significant, except for the food and transportation sectors.

These empirical results basically prove the theoretical inference derived in section 4, implying that in addition to structural variables such as market size, GDP growth rate, openness, etc., real exchange rate is one of the factors determining relative FDI. In particular, a relative devaluation against the currency of an FDI source country could strengthen competitiveness and boost inflows. Given both the theoretical and empirical results, we conclude that the dynamic change in the geographic distribution of Japan's FDI in the Asian manufacturing sectors was partially attributed to relative changes in exchange rate policies among the recipient countries. The Chinese yuan underwent devaluations while the ASEAN-4 countries primarily pegged their currencies on the dollar before 1995. This cumulative currency adjustment substantially improved the country's competitiveness for FDI, causing Japan to divert its FDI from ASEAN-4 to China. Compared with ASEAN-4, the cumulative devaluation undoubtedly enhanced China's comparative advantage with regard to labour costs and other intermediate inputs such as land. The relocation from ASEAN-4 to China, or simply reducing FDI in the former and raising the scale of investment in the latter, is a rational decision of the Japanese MNEs when investment is primarily export-oriented. Therefore, it can be stated that diverging exchange policies between China and ASEAN-4 attributed partially to the shift of focus in Japan's FDI in Asia.

Table 2
Exchange rates and competition for FDI in Asia
Pooled regression model

Sectors	Const.	$\log(\frac{e_{yen/\$i}\, p_i / p_J}{e_{yen/yun}\, p_C / p_J})$	$\log(\frac{GDP_i}{GDP_c})$	$(g_i - g_c)$	$\log(\frac{open_i}{open_c})$	# of obs.	Adj. R^2	F-value
Food	8.13	-1.92***	0.65	0.10**	-0.43	60	0.20	3.4
	(3.14)	(0.72)	(0.78)	(0.04)	(0.53)			
Textiles	16.18	-3.48***	3.14***	0.03	-0.98***	61	0.59	20.1
	(2.23)	(0.51)	(0.68)	(0.03)	(0.38)			
Lumber and pulp	5.24	-0.88	1.25*	0.07*	-0.32	64	0.18	3.2
	(2.60)	(0.61)	(0.71)	(0.04)	(0.43)			
Chemicals	0.54	0.33	2.67***	0.01	-0.58*	82	0.31	8.7
	(2.09)	(0.49)	(0.48)	(0.03)	(0.36)			
Metal	5.80	-1.12**	2.26***	0.02	0.45	73	0.38	10.35
	(2.19)	(0.50)	(0.44)	(0.03)	(0.34)			
Machinery	4.53	-1.30**	1.47***	0.03	0.88**	68	0.25	5.23
	(2.71)	(0.62)	(0.53)	(0.03)	(0.42)			
Electronics	4.66	-1.25***	0.87**	0.04	0.96***	72	0.27	6.22
	(2.10)	(0.48)	(0.42)	(0.03)	(0.33)			
Transportation	15.28	-3.05	1.44**	0.11***	-1.05**	61	0.38	8.71
	(3.15)	(0.71)	(0.63)	(0.04)	(0.48)			
Others	6.97	-1.53***	2.44***	0.02	0.45*	81	0.58	26.48
	(1.63)	(0.38)	(0.37)	(0.02)	(0.28)			
Total	9.39	-1.99***	2.04***	0.03	0.34	82	0.60	29.47
	(1.51)	(0.35)	(0.35)	(0.02)	(0.26)			

Note: ***, **, and * indicate significance level at 1%, 5%, and 10%, respectively; numbers in parentheses are standard errors which are estimated with the White consistent estimator.

Table 3
Exchange rate and competition for FDI in Asia
Fixed effect model

Sectors	$\log(\frac{e_{yen/\$i}\, p_i / p_J}{e_{yen/yuan}\, p_C / p_J})$	$\log(\frac{GDP_i}{GDP_c})$	$(g_i - g_c)$	$\log(\frac{open_i}{open_c})$	# of obs.	Adj. R^2	F-value
Food	-2.03*** (0.74)	0.65 (1.85)	0.09*** (0.03)	-1.51 (1.25)	60	0.25	2.50
Textiles	-2.34*** (0.71)	2.54*** (0.79)	0.03 (0.03)	2.63*** (1.23)	61	0.69	16.84
Lumber and pulp	-0.13 (1.03)	0.56 (1.02)	0.08 (0.05)	1.40 (1.00)	64	0.39	5.23
Chemicals	1.14 (0.97)	2.56*** (0.75)	0.01 (0.03)	1.64 (1.14)	82	0.42	7.79
Metal	-0.38 (0.72)	3.17*** (0.73)	0.02 (0.02)	3.56*** (0.89)	73	0.50	9.17
Machinery	-0.74 (0.88)	2.27*** (0.89)	0.03 (0.03)	2.13** (1.02)	68	0.41	6.03
Electronics	-1.23** (0.54)	2.24*** (0.90)	0.04 (0.03)	1.75* (0.93)	72	0.39	5.93
Transportation	-2.68*** (0.84)	4.60*** (0.86)	0.11** (0.05)	2.86*** (85.00)	61	0.68	16.04
Others	-1.61*** (0.51)	3.52*** (0.52)	0.02 (0.02)	0.52 (0.56)	81	0.63	17.42
Total	-1.14*** (0.44)	2.92*** (0.39)	0.03 (0.02)	2.64*** (0.46)	82	0.76	33.26

Note: ***, **, and * indicate significance level at 1%, 5%, and 10%, respectively; numbers in parentheses are standard errors which are estimated with the White consistent estimator.

6 Concluding remarks

The importance of exchange rate policy is usually emphasized in trade-balance, or balance-of-payment debates, but its role in determining a country's competitiveness for FDI is largely ignored in the process of policy formation. This paper argues that exchange rates play a significant role in shaping competition among FDI recipient countries. It advances the existing literature by showing explicitly that relative FDI is determined by the relative real exchange rate between the currency of the recipient country and that of the source country. A relative real appreciation in the currency of a recipient country will reduce its FDI inflows and divert investment to its rival country.

Using data on Japan's FDI to China and ASEAN-4 in nine manufacturing sectors from 1981 to 2002, the paper empirically analyses the impact of real exchange rate on relative FDI inflows. It shows that the competition between China and ASEAN-4 for Japanese FDI in Asian manufacturing was significantly affected by the relative real appreciation of these countries' currencies to the yen. The redirection of Japan's FDI from its traditional destinations ASEAN-4 countries to China was largely attributed to the cumulative effect of the yuan's devaluations over the last two decades. The empirical results demonstrate that, besides the differences in structure variables, ASEAN-4 lost their competition to China largely due to differences in exchange policy.

Both theoretical and empirical results of the paper provide a new interpretation of the dynamic change in Japan's geographic distribution of FDI in Asia. The results are robust not only when we aggregate all manufacturing sectors together, but also in the major sub-sectors concerned (food, textile, electronics, transportation equipment, and others). However, we are unable to provide a reasonable answer to the question as to why FDI in the machinery sector was not affected by real exchange rates. This question leaves room for future investigation.

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