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China's Reform on Exchange Rate System and International Trade between Japan and China

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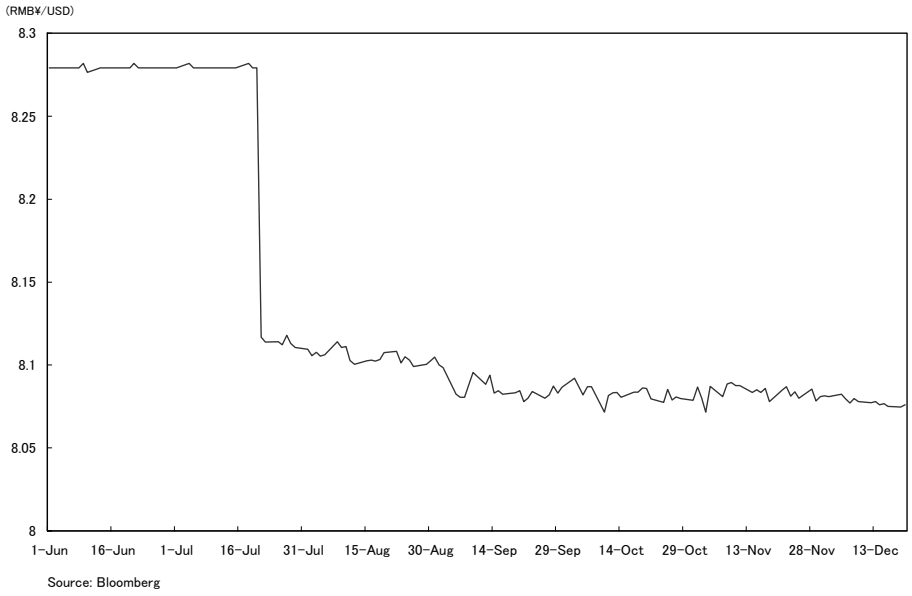
Abstract

This paper explores the impacts of exchange rate on trade between Japan and China, with special attention to differences of pricing structure of international trade across industries. Although the Chinese yuan was fixed against the U.S. dollar for several years, it has been fluctuating against the Japanese yen, which provides us with a natural experiment to test the exchange rate effect. We find that exchange rate changes and volatility have little influence on trade volume in most industries, while Chinese economic growth significantly affects Japan's export to China. For electrical machinery industry, in which Japanese firms' division of production process is prevailing, we find no evidence of exchange rate impact on trade. These results suggest that the recent reform on China's exchange rate system does not seem to have a significant effect on the external sectors of the two countries and the cost of exchange rate fluctuation can be, to some extent, mitigated by Japanese firms' overseas production and pricing structure.

1. Introduction

The Chinese government revalued the yuan by 2.1% against the U.S. dollar on July 21, 2005.At the same time, it also announced that the Chinese currency would be allowed to fluctuate against the basket of currencies. The governor of the People's Bank of China revealed that this currency basket is essentially comprised of the dollar, the euro, the yen and the Korean won, taking into account such factors as trade, capital transactions (external claims and debts) and direct investment. The authority has also adopted a narrow band of 0.3% on either side of the central rate within which the yuan can fluctuate against the dollar.

Figure 1 Daily RMB/USD rate in 2005



Source: Bloomberg

The shift of China's exchange rate system from a traditional dollar peg to a currency basket system drew substantial attention, but press reports and many economists cast doubts on the effectiveness of the revaluation of the RMB because the rate of revaluation was too scant to satisfy their expectations[1]. Figure 1 displays the daily movement of the RMB/USD rate. In addition to the revaluation on July 21 by

[1] Frankel (2005) summarizes several arguments supporting the view that de facto dollar peg may now have outlived its usefulness for China. (1) China's economy is on the overheating side of internal balance, and appreciation would help easy inflationary pressure. (2)It is increasingly difficult to sterilize the inflow over time, exacerbating inflation. (3) Although external balance could be achieved by expenditure reduction, e.g., by raising interest rates, the existence of two policy goals (external and internal balance) in general requires the use of two independent policy instruments (e.g., the real exchange rate and the interest rate). (4) A large economy like China can achieve adjustment in the real exchange rate via flexibility in the nominal exchange rate more easily then via price flexibility.

2.1%, the RMB has been steadily appreciating. Nevertheless, the overall rate of appreciation is about 3% as of March 19, 2006. The Chinese monetary authority did not appreciate their currency markedly although its flexibility was relatively increased.

How does revaluation/devaluation affect current account? This question has been extensively addressed in open macroeconomics. A traditional answer to this question is that it depends on Marshall-Lerner condition. In Mundell-Fleming model, devaluation (revaluation) can improve (deteriorate) the trade balance if the Marshall-Lerner condition is fulfilled. This represents an a-temporal condition that relates to the elasticity of substitution for home and foreign goods.

For the last two decades, most of current account literature have moved towards an inter-temporal choice theoretic approach stressing the importance of consumption smoothing and investment as an explanation of current account dynamics. Devereux (2000) extends a dynamic sticky-price open economy macroeconomics model a la Obstfeld and Rogoff (1995) to allow for the possibility that some firms in one or both countries might set prices in the currency of final sales. This type of pricing structure has been referred to as "pricing-to-market"[2]. He argues that when prices are set in the producers' currency, the effect of the devaluation hinges on the traditional Marshall-Lerner condition. On the other hand, when prices are set in consumers' currency, the response of current account depends on the size of intertemporal elasticity of substitution of consumption across time periods. Pricing structure has a significant bearing on the effect of devaluation on the current account.

This paper explores the impacts of exchange rate changes and volatility on trade between Japan and China, with special attention to differences of pricing structure of international trade across industries. Along with the rapid increase in Japan-China trade in the last decades, Japan and China became large trade partners for both, and their trade pattern transformed from "inter-industry trade" to "intra-industry trade." Formerly, Japan exported manufactured goods while importing food and natural resources. However, China has recently increased to export manufactured goods to Japan to the extent that their imports are greater than their exports to China.

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[2] The justification for this type of pricing structure is that it is consistent with the recent findings of Engel (1993, 1999) and Engel and Rogers (1996), indicating substantial deviation from the law of one price in traded goods across countries, which are almost fully accounted for by movements in nominal exchange rates.

The foreign direct investment of Japanese manufacturing firms in China has played a significant role in changing the trade pattern. They developed the division of production process between Japan and China, which led to increases in trade of differentiated goods within an industry and in trade between intermediate goods and final goods. The more the Japanese firms' production in China is linked to the trade between Japan and China, the more Japanese firms are likely to influence the pricing structure of trade. This mitigates the exchange rate effects on trade volume.

In this paper, we conduct a regression analysis to test this hypothesis. Although the Chinese yuan was fixed against the U.S. dollar from 1997, the JPY/RMB rate has been fluctuating (Figure 2). This provides us with a natural experiment to test for the price impact on trade volume between Japan and China.

Figure 2 Monthly JPY/RMB rate

Source: IMF, "Internaiotnal Financial Statisitcs".

We find evidence from Japan's import and export functions that real exchange rate changes and volatility of the RMB affect the trade volume between China and Japan in few industries, while Chinese income growth has a positive effect on Japan's export to China. For electrical machinery industry, in which the Japanese firms' division of production process is prevailing, we document no significant effects of exchange rate changes on import and export. Moreover, almost no significant effects of foreign demand on trade flows can be detected. These findings are consistent with our hypothesis that, to the extent that Japanese firms are likely to influence the pricing structure of trade, trade cannot be affected by exchange rate fluctuation. The cost of

China's reform on exchange rate system can be, to some extent, mitigated by firms' overseas production and pricing strategy.

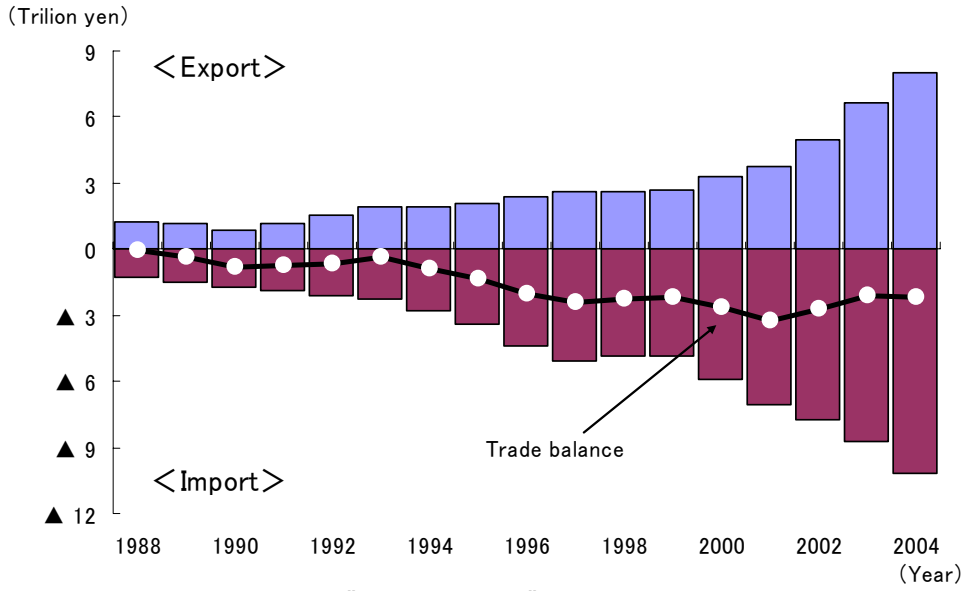
The remainder of the paper is organized as follows. Section 2 discusses the background on the recent change in trade pattern between Japan and China. Section 3 presents the estimation results and Section 4 concludes.

2. Background

2.1 Changes of Japan-China trade pattern

Japan-China trade has been continuously growing for the recent years. "Trade Statistics" issued by the Ministry of Finance of Japan revealed that total trade value marked a highest record year after year for 6 consecutive years (Figure 3). In 2004, Japan's export to China reached 8.0 trillion yen and its import from China amounted to 10.2 trillion yen. The trade deficit against China increased to 2.2 trillion yen[3].

Figure 3 Japan's trade with China



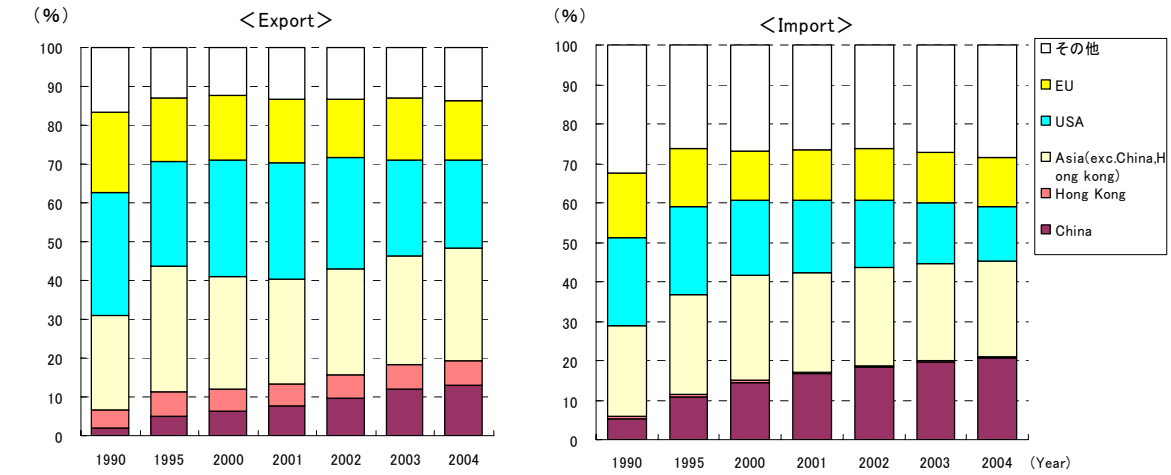
Source: Ministry of Finance,"Trade Statistics"

China is the second largest importing country to Japan, and dependency on China increased from 6.3% of year 2000 to 13.1% in year 2004 (Figure 4). Also, the share of China in Japan's total import increased from 14.5% to 20.7% during the same

[3] According to Japanese statistics, Japan is marking deficit in Japan-China trade, but according to Chinese statistics, it is China who is in deficit. Such difference comes mainly from the different way of recording. In Japan, goods must display the country of origin, and when China exports to Japan via Hong Kong, such trade is recorded as "import from Mainland China". For China, when the final destination is not known at the time of shipping, such deal is recorded as "export to Hong Kong".

period[4]. As a result, the difference between China and USA, who is the largest trading partner to Japan, has become smaller, making the existence of China as a trading partner more significant than ever.

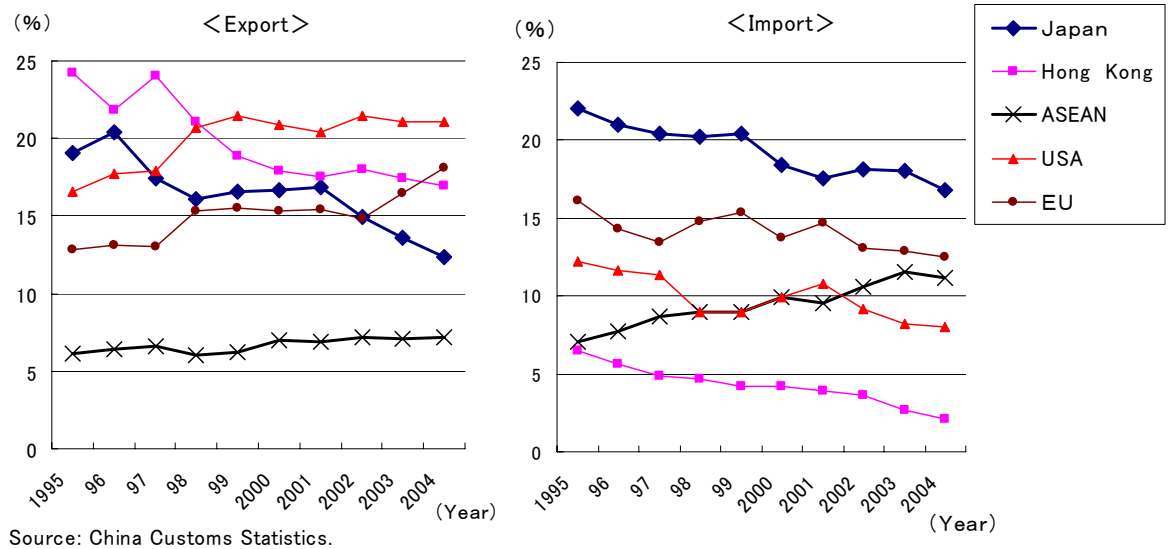
Figure 4 The share of trading partners of Japan



Source: Ministry of Finance,"Trade Statistics"

For China, Japan is the largest exporting country (Fourth importing country). However, China, who is achieving high economic growth of annual 9%, is an extremely promising market to all other countries. So, even though Japan's total export value with China has increased, the share of Japan in China's total import has shrunk, since other countries like Korea and ASEAN countries are increasing their export to China（Figure 5）.

Figure 5 Share by countries trading with China



Source: China Customs Statistics.

[4] If we include Hong Kong, export dependency on China as of 2004 jumped to 19.3% from 12.0% of 2000, and import dependency on China during the same period also rose from 15.0% to 21.1%.

What are the items Japan is exporting to China, and what are the items it is importing from China? In the past, a major trade pattern between Japan and China was "inter-industry trade", in which Japan exported manufactured products while importing food, fuel, and raw materials. However, export of manufactured products from China to Japan increased and, as a result, the pattern has now shifted to "intra-industry trade", in which both countries export their industrial products to each other (Table 1).

Table 1 Japan's trade with China (by types of goods)

<Export> (%)

Year	1980	1990	1995	2000	2004
Food	0.0	0.4	0.4	0.5	0.4
Fuels & raw materials	0.5	1.8	2.4	3.2	3.1
Manufactured products	99.5	97.8	97.2	96.3	96.5
Textiles	8.0	9.9	10.8	9.8	4.8
Chemicals	10.7	12.3	9.3	13.2	12.4
Metals	33.2	19.5	14.2	10.7	9.7
Machineries	42.3	46.2	55.8	54.9	60.4

<Import>

Year	1980	1990	1995	2000	2004
Food	10.9	16.1	13.1	10.7	7.9
Fuels & raw materials	66.6	33.2	9.6	6.6	5.1
Manufactured products	22.5	50.7	77.3	82.7	87.0
Textiles	n.a.	26.5	34.4	29.6	21.4
Chemicals	n.a.	5.4	3.7	3.0	3.2
Metals	n.a.	4.6	6.1	4.1	5.3
Machineries	n.a.	4.3	14.4	26.1	39.4

Source: Ministry of Finance, "Trade Statistics"

When we look at imported goods from China, we find that goods manufactured in labor-intensive industry, such as food, textiles, and footgear still take up large share. As for textiles, the share of Chinese textiles among Japan's imported textiles is as high as 74.6%, due to wide distribution of low price commodities through mass sales store such as UNIQLO. The reasons behind this are; a) Quality of Chinese goods have improved very much from the days when Chinese goods were thought to be "cheap and nasty". b) Japanese consumers' inclination to buy low price goods.

Along with above tendency, the share of capital-intensive goods such as machineries and electrical instruments is increasing. When we look at export of 2004, while textiles increased 13.1% from the previous year, machineries and equipment

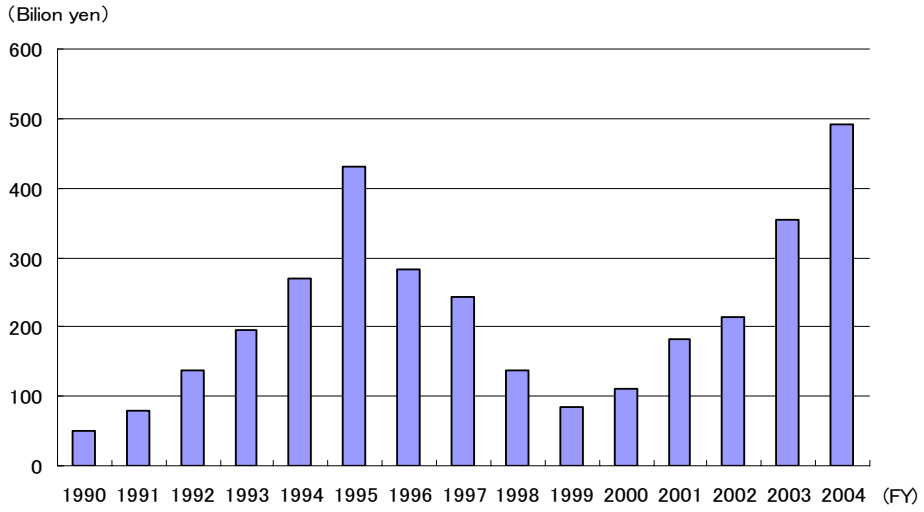
showed great increase of 32.6%, due to increase in office appliances, computer applications, and mobile phones.

2.2 Japanese firms' division of production process in China

The expansion of Japan-China product trade is largely promoted by foreign direct investment of Japanese firms in China.

Japan's FDI in China after the Chinese government took the "reform and opening-up policy" in the 80s, and the yen appreciation in mid 90s further urged Japanese firms to shift their production location（Figure 6）. During this period, the number and total amount of contract increased dramatically and marked the peak in 1995. When prospect of China joining WTO became clearer, contract amount started to rise once again and real spending for 2001 exceeded that of 1998 and marked the highest in history. It should also be noted that, after 2001, global trend of foreign direct investment turned toward decrease, but FDI to China kept increasing. The current situation may be called as the "Third China Investment Boom".

Figure 6 Japan's FDI to China



Note: On prior notice basis. The fiscal year begins in April, and ends in March of the following year.
Source: Ministry of Finance,"Outward and Inward Foreign Direct Investment"

Japanese firms operating in China established systems to carry out final assemblies in China, but procure parts necessary for the assembly do not always come from domestic market but from other countries such as East Asian countries. Especially, highly sophisticated parts and materials are mostly imported from Japan. According to the regular survey conducted by Ministry of Economy, Trade and Industry, "Overseas

Business Activities of Japanese Companies", Japanese firms engaging in production activities in China procured only one third （37.7%）of necessary materials from domestic market, and imported 33.7% from Japan.

Figure 7 shows production process of digital camera A, from one of the leading precision equipment manufacturer[5].

Figure 7 Production process and division of function for digital camera A

		Marketing/product plannig	Product development	Component production	Product assemnbly	Sales
In-house division of labor	Japan	Head quarters (Planning/development)	Headquarters (Product development/design)	Affiliated companies in Japan		Sales headquarters (Reimport)
	Overseas market (China)			Affiliated companies in China	**Affiliated companies in China**	Affiliated companies in China distributuion in China
	Third country	Affiliated companies in Europe and US				Worldwide (Europe and US, etc.)
Other companies				Japanese,Taiwanese components manufacturers in Chinese local companies Original design manufacturing companies of Asian regions other than China		

Source: METI,"White Paper on International Economy and Trade 2004"

Product planning and development of the digital camera are basically implemented in Japan (Headquarter). Parts are procured from various countries, and the parts production is undertaken by many different countries according to the function of each part. For example, in the manufacturing of CCD (charge-coupled device for picking up images), the initial stage of manufacturing is undertaken in East Asian countries, and the final stage in Japan. As for lenses, 5 to 7 lenses are mounted in one camera, and each lens is manufactured in different countries according to its function. Furthermore, the metal cladding, which is part of the image operation function, is also procured from various manufacturers in Japan and other countries. They are procured according to the production skills of the manufacturer. Some manufacturers are good at producing tiny parts, some are good at processing delicately designed products, and some are good at processing flat parts. However, as mentioned later, high added value

[5] The firm's operation in China started in early 90's when it built factories in Guangdong. At the initial stage of its operation in China, only assembly of final products was undertaken. However, the scope and scale of the works gradually expanded to lens parts, plastic molding, painting, and mounting. By late 1990's, fully independent silver salt camera production line had been established. The firm started manufacturing digital cameras in early 2000. The following explanation is based on "White Paper on International Economy and Trade 2004" p164～p166.

products are manufactured by Japanese firms. As for assembly, China is the sole location for assembly, and assembled final products are shipped to all sales points in the world.

Table 2 shows parts of a digital camera, the country they come from, the cost share, and share by countries. From this figure, we see that most of the important parts come from Japanese firms. The main reason could be that since a digital camera is a high-added value product, it needs high quality parts, and at present, there are no other firms but Japanese ones who can constantly provide high-quality precise parts.

Table 2 Production cost structure of digital camera A

Component group		Location of supplier	Share of production costs(%)
Component costs	Imaging operation function/exterior	Japan	13
Total：63	eg. TFT, Metal cladding, etc.	China	1
Japan：49	Optical system unit	Japan	13
China： 8	eg. Filters, Image pickup devices, Lenses, etc.	China	6
Switzerland：4		Thailand	2
Thailamd：2	Circuit board	Japan	17
	eg. Custom IC, Electrical components, etc.	Switzerland	4
	Other components	Japan	6
		China	1
Labor costs・Others			37
Total			100

Note: Japan in ″Location of supplier″ means that a component is supplied by Japanese company (excluding Japanese companies in China). It does not always mean that its production processes were all oprated in Japan.

Source: METI,″White Paper on International Economy and Trade 2004″

The division of functions for China and Japan for this firm is apparent. In other words, the firm's headquarter in Japan concentrates to "developing added values", and "innovating technologies", and China is regarded as "production sites of added value"[6]. As for the future division of functions between Japan and China, the firm is trying to

[6] If Japan tries to keep only R&D section in Japan, manufacturing capability and knowledge may disappear. For this reason, domestic site recently engages not only in R&D but also test production, production of key components, and production of high technology few production products such as single-lens reflex cameras. Also, up until recently, the firms were concentrate assembly works to China only to establish robust production systems. However, the firms expressed their plan to seek production sites other than China, in the future, in order to reduce the risk of production site other than China.

strengthen and expand the capacity of Chinese mass production plants and transfer some parts of unit design technology to local plants which do not include state of the art technology. By doing so, it is seeking ways to expand local procurement in China by improving the technological capabilities in China.

2.3 Two types of trade patterns

We next provide a trade specialization coefficient as a measure of competitiveness or the division structure between Japan and China. The “trade specialization coefficient” referred here shows figures expressing difference in export and import of a certain industry, divided by their sum. The value of the coefficient varies from +1 to -1, and the closer the value to zero, the more balanced the trade between two countries in that industry is, in other words, horizontal division of work is going on between the two. In terms of Japan-China trade, the closer the coefficient is to +1, the more one-way export is going out from Japan, and closer to -1, the more one-way import from China to Japan.

Table 3 shows Japan’s trade specialization coefficients with China by items. For primary products such as food and beverages (vegetables and fruits) and mineral fuels, there are far more import from China to Japan than export vice versa, showing

Table 3 Japan's trade specialization coefficient with China by items

Year	1988	1990	1995	2000	2005
Food and beverages	-0.97	-0.97	-0.96	-0.95	-0.92
Mineral and fuels	-0.99	-0.95	-0.75	-0.82	-0.50
Manufactured products	0.33	-0.10	-0.20	-0.30	-0.22
Iron and steels	0.93	0.51	0.34	0.55	0.51
Clothing and accessories	-0.98	-0.99	-0.99	-0.99	-0.99
General machinery	0.97	0.87	0.73	0.22	-0.07
Electorical machinery	0.91	0.57	0.19	-0.01	-0.01
Transport equipment	0.99	0.93	0.60	0.34	0.43

Note: The trade specialization coefficient(TSC) is caluculated as follows: TSC=(value of exports−Value of imports)/(Value of exports + Value of imports). Figures are always within the range between −1 and 1. −1 indicates a specialization in imports and 1 in exports.

Source: Ministry of Finance,"Trade statistics"

great competitiveness of China in this field. On the other hand, the coefficient of industrial products as a whole was 0.33 in 1988, but in 2005, the value has became -0.22, which implies the relationship between Japan and China may be described as horizontal division of work.

Nevertheless, when we look closer to each item, the situation differs very much by item. In some items, conventional situation has not changed. For example, in clothing, China has continuously been strong, and in transport machines, Japan has been strong.

On the contrary, coefficients for general machinery and electrical machinery used to be close to +1, but have drastically reduced. This may be described as a development that along with expansion of business activities of Japanese firms in China, household electrical appliances and precision machines which used to be exported to China one-sidedly have gradually come to be manufactured in China, and then exported back to Japan. The movement we observe recently is Japan's machine parts import from Japanese firms in China. These are machine parts using medium degree technology and not manufactured in Japan any more. These machine parts are assembled in Japan with capital intensive high quality production management process, to become high added value products, and exported to Europe and USA. As a result of these corporate activities, even though the items fall in the same category, thanks to the difference of added value, the volume of traded goods increases and horizontal division of works also increases. When we compare the price per unit of the items exported from Japan and

Figure 8 Comparison of an export unit price and an import unit price of the same item in trade with China

Articles	Unit	Export unit price (A)	Import unit price (B)	(A) ／ (B)
Iron and steel products	Thousand yen/1000kg	104.19	72.34	1.44
Non-metaric mineral ware	Thousand yen/1000kg	617.9	346.4	1.78
Medical products	Thousand yen/kg	10.3	1.0	9.92
Leather	Thousand yen	6952.4	919.4	7.56
Computer and parts	Thousand yen	23.4	14.39	1.63
Facimile	Thousand yen	67.8	13.9	4.88
Audio disk players	Thousand yen	6.9	5.2	1.35
Passenger automobiles	Thousand yen	2524.2	350.2	7.21

Note： It was calculated based on the data of 2005(the amount from January to October).
Source：Ministry of Finance,"Trade stistics"

imported to Japan, both in raw material and final products, export item unit price far exceed that of import items（Figure 8）.

Based on those examinations, Japan-China trade pattern can be categorized into following patterns.

(1) Inter-industry trade

Japan exports capital-intensive goods (e.g., durables) to China, and imports labor-intensive products (e.g., textile) and primary products.

(2) Vertical intra-industry trade

a) The trade between intermediate and final goods (division of production process between China and Japan). Japan exports parts/intermediate goods and China assembles and exports final products.

b) The trade between low and high value-added goods of the same item.

3. Regression analysis

In this section, we undertake regression analysis on Japan's import and export functions to test for the impacts of exchange rate changes and volatility on trade volume. We examine in what industries the changes and volatility of the JPY/RMB rate affect trade volume. Also, we investigate whether the exchange rate effect on trade volume is weaker for the industries in which the division of production process is prevailing.

We estimate a regression of the following form:

$$\Delta TR_t = \alpha + \beta \Delta TR_{t-1} + \gamma \Delta e_t + \lambda \Delta FD_t + \mu \ln(\sigma_t^2) + \varepsilon_t$$

where ΔTR is the quarterly rate of change in trade volume by industry, Δe is the real effective exchange rate change, and ΔFD is the rate of change in foreign demand (e.g., Japanese real GDP growth rate and Chinese real GDP growth rate). Lastly, $\ln(\sigma_t^2)$ is the exchange rate volatility, which is estimated by assuming that real effective exchange rate follows an EGARCH model[7].

$$\Delta e_t = c + \varepsilon_t$$
$$\varepsilon_t \sim N(0, \sigma_t^2),$$
$$\ln(\sigma_t^2) = a + b\frac{\varepsilon_{t-1}}{\sigma_{t-1}} + d\ln(\sigma_{t-1}^2)$$

[7] EGARCH model assumes the non-negativity of conditional volatility.

We use quarterly trade volume by industry as a dependent variable. The Japan's import function covers 31 industries (3 digit HS codes) and 11 sectors (7-digit PC codes) in electrical machinery industry. The export function covers 19 industries (3 digit HS codes) and 25 sectors (7-digit PC codes) in electrical machinery industry[8]. The sample period is from the first quarter of 1988 to the third quarter of 2005.

The key parameters we focus are γ and μ. Since an increase in e implies real appreciation of the RMB against the Japanese yen, γ is expected negative for Japan's import functions while positive for the export functions. An increase in exchange rate volatility will reduce trade if hedging is not possible or is expensive. Therefore, μ is expected negative for the export and import functions. λ is expected positive since income growth increases import from abroad.

Both Table 4 and 5 displays only regression results with significant coefficients because most regression coefficients are not significant. The former is the outcome of Japan's import function and the latter is about the export function. Table 4 shows that the changes and volatility of the RMB rate have negative effects on China's export to Japan in few industries (five out of 31 industries (3-digit codes) for exchange rate changes and three out of 31 for exchange rate volatility). Japanese income growth has a positive effect on import in four industries (3-digit codes) out of 31.

Table 5 presents the regression results from the export function. We find no significant effects of exchange rate changes on trade volume. In only two out of 19 industries, exchange rate volatility affects negatively the trade volume. On the other hand, Chinese income growth has a significantly positive effect on Japan's export to China. This relationship can be detected in 9 out of 19 industries.

For electrical machinery industry (7-digit codes), in which Japanese firms actively engage in division of production process, we find no evidence of exchange rate effects on import or export (Table 4 and 5). Moreover, there are almost no significant effects of foreign demand on trade flows (one out of 11 sectors for import and 4 out of 25 sectors for export).

[8] HS code refers to the Harmonized Commodity code subject to the international convention on the Harmonized Commodity Description and Coding System. PC code refers to principal commodity code that the Japanese customs create for 7 to 9-digit statistic codes. They are used in publication of the Trade Statistics.

Table 4 Japan's import functions by industry (Trade from China to Japan)

Commodity	Diary products and eggs	Coal, coke, and briquettes	Mineral tar and crude chemical	Dyeing tanning and coloring	Fertilizers	Leather and dressed fur skins	Iron and steel products	Nonferrous metals	Audio disk players
PC-code	005	301	503	505	511	601	613	615	7030513
Lagged export growth rate	−0.429 ***	−0.171	−0.194	−0.438 ***	−0.436 ***	−0.153	0.079	−0.366 ***	0.418 ***
	(0.112)	(0.123)	(0.122)	(0.105)	(0.104)	(0.115)	(0.120)	(0.113)	(0.082)
Change in yen/yuan rate	−0.185	−0.727 **	0.272	−0.600 **	−0.096	−1.619 ***	−1.258 **	−1.758 **	−0.076
	(0.552)	(0.318)	(0.548)	(0.274)	(1.007)	(0.583)	(0.630)	(0.779)	(0.926)
Japan's growth rate	8.353 **	4.338 *	7.803 *	−2.312	21.447 ***	−3.280	5.429	0.261	14.159 **
	(3.983)	(2.321)	(4.055)	(2.001)	(7.358)	(4.277)	(4.613)	(5.739)	(6.457)
Exchange rate volatility	0.007	−0.030	−0.018	−0.029	−0.007	−0.091 **	−0.098 **	−0.090 *	−0.041
	(0.036)	(0.021)	(0.036)	(0.018)	(0.066)	(0.038)	(0.041)	(0.051)	(0.058)
Constant	−0.026	0.063	0.002	0.132 ***	−0.055	0.199 **	0.158 ***	0.189 *	0.023
	(0.076)	(0.044)	(0.076)	(0.038)	(0.140)	(0.081)	(0.088)	(0.108)	(0.121)
Adj. R2	0.217	0.098	0.032	0.269	0.248	0.106	0.060	0.169	0.315
Obs.	68	68	68	68	68	68	68	68	66

Table 5 Japan's export functions by industry (Trade from Japan to China)

Commodity	Crude rubber	Textile fibers	Crude minerals	Plastic materials	Rubber manufactured	Paper and paper manufactured	Iron and steel products	Furniture	Bags	Comuputers and units	Machine tools	Audio tape recorders	Optical microscopes
PC-code	205	211	213	515	603	606	611	803	805	7010505	7010701	7031103	8110111
Lagged export growth rate	0.041	0.058	−0.150	0.019	−0.190	−0.200	−0.027	−0.251 *	−0.266	−0.171	−0.102	−0.170	−0.204 *
	(0.099)	(0.118)	(0.133)	(0.135)	(0.124)	(0.127)	(0.131)	(0.127)	(0.118)	(0.127)	(0.120)	(0.135)	(0.111)
Change in yen/yuan rate	0.400	−0.003	1.551	0.176	−0.913	−0.091	−0.047	−0.253	0.300	−0.697	0.040	−1.449	0.663
	(0.413)	(0.345)	(1.479)	(0.313)	(0.698)	(0.562)	(0.474)	(0.596)	(1.030)	(0.840)	(1.177)	(2.610)	(0.847)
China's growth rate	0.676 ***	0.407 ***	0.741 *	0.206 **	0.869 ***	0.465 ***	0.373 ***	0.420 ***	0.557 *	0.601 ***	1.496 ***	1.301 *	0.891 ***
	(0.125)	(0.099)	(0.425)	(0.093)	(0.217)	(0.164)	(0.139)	(0.171)	(0.301)	(0.246)	(0.352)	(0.753)	(0.249)
Exchange rate volatility	−0.053 *	−0.047 *	−0.072	−0.011	0.008	0.043	−0.032	0.005	−0.013	0.075	0.069	−0.183	0.002
	(0.031)	(0.026)	(0.110)	(0.023)	(0.051)	(0.041)	(0.036)	(0.045)	(0.076)	(0.064)	(0.088)	(0.198)	(0.063)
Constant	0.113	0.101 *	0.247	0.052	−0.017	−0.067	0.063	0.018	0.072	−0.064	−0.157	0.298	0.014
	(0.067)	(0.056)	(0.241)	(0.052)	(0.111)	(0.091)	(0.079)	(0.098)	(0.169)	(0.143)	(0.194)	(0.434)	(0.139)
Adj. R2	0.460	0.323	0.108	0.067	0.383	0.154	0.136	0.135	0.125	0.136	0.272	0.099	0.266
Obs.	57	57	57	57	57	57	57	57	57	57	57	57	57

Note: ***, **, * indicate the significance of coefficients at 1%, 5% and 10% levels.

The findings are summarized as follows: first, we find little evidence that China's exchange rate fluctuations affect the international trade between Japan and China. For the trade from Japan to China, China's income growth is more influential for trade than exchange rate changes and volatility. This finding is consistent with that of previous studies such as Fernald et al. (1999).

Our new finding is that trade volume is not affected by exchange rate fluctuation for the industry in which firms' division of production process is prevailing. This suggests that the cost of exchange rate fluctuation can be, to some extent, mitigated by firms' overseas production and pricing strategy.

4. Conclusion

Following the revaluation of Chinese yuan and its shift from a dollar peg to basket peg, their effects have attracted tremendous attentions. This paper explores the impacts of real exchange rate on trade between Japan and China. We find evidence from Japan's import and export functions that real exchange rate changes and volatility of the RMB affect the trade volume between China and Japan in few industries, while Chinese income growth has a positive effect on Japan's export to China.

For electrical machinery industry, in which the Japanese firms' division of production process is prevailing, we document no significant effects of exchange rate changes on import and export. Moreover, we find almost no significant effects of foreign demand on trade. These findings are consistent with our hypothesis that, to the extent that Japanese firms are likely to influence the pricing structure of trade, trade cannot be affected by exchange rate fluctuation. The cost of China's reform on exchange rate system can be, to some extent, mitigated by firms' overseas production and pricing strategy.

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