An Empirical Research Paper on the Impact of China-Japan Relations on Chinese Export Quality：Based on the Perspective of the Triangle Trade in the East Asian Production Network

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Abstract: Japan's detainment of Chinese fishing boats in 2010 and purchase of China's Diaoyu Islands in 2012 tremendously harmed diplomatic relations between China and Japan, and had a negative impact on bilateral trade. This paper aims to analyze the impact of China-Japan relations and China's participation in the Japan-centered East Asian production network on China's export quality. The empirical research results based on the trade data of the mechanical and electrical industries indicate that China's participation in the Japan-centered triangle trade enhances the quality of Chinese mechanical and electrical exports, and China should continue to strive for its integration into the Japan-centered East Asian production network.

Key words: China-Japan relations; triangle trade; East Asian production network; export sophistication level

Introduction

China and Japan are, respectively, the world's second and third-largest economies, and two of the largest East Asian economies. China is the largest trading partner of Japan, and Japan is the second largest trading partner of China, and they are each other's most important trade partners. Integration into the East Asian production network is the most important way for China to participate in the division of global value chains. The East Asian production network forms a triangular trade model, with Japan as its core and China as the export platform. Leveraging on this, China has become a global manufacturing and export platform for mechanical and electrical products. Relations between the two countries became tense in 2010 due to Japan's detainment of Chinese fishing boats. Bilateral relations worsened in 2012 due to China-Japan territorial conflicts over the purchase of China's Diaoyu Islands. Tension in political conflicts led to a negative influence on China-Japan bilateral trades. By using sampling from mechanical and electrical

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products, this paper aims to investigate Chinese participation in the East Asian production network, with Japan at its core, and its impact on Chinese trades and especially the quality of Chinese exports from the perspective of triangle trade. The thesis hopes to provide theoretical support and policy suggestions for the sound development of China-Japan trade and Chinese foreign trade.

Literature Review

In 2002, most East Asian countries and regions participated in the East Asian production network, giving significantly higher emphasis to the regional trade of components and parts and semi-manufactured goods (Ando & Kimura, 2003); In 2007, the export of intermediate goods among East Asian countries increased when the East Asian production network strengthened (Wang & Wei, 2007); in 2006, mechanical products accounted for 70% of the total volume of the East Asian trade structure, so machinery is a dominant force in East Asian economic development (Athukorala & Yamashita, 2006). In 2010, the export of intermediate components and parts in the mechanical industry played a vital role in East Asia, and China became the most important export platform for mechanical products in East Asia (Kimura & Obashi, 2010).

2010 witnessed the growing tension in China-Japan relations on account of Japan's detaining Chinese fishermen, and 2012 saw their worsening relations due to Japan's purchase of China's Diaoyu Island, greatly harming bilateral trade. Do the worsening bilateral ties of the two countries influence China's export quality? On the one hand, China actively integrates itself into the East Asian Japan-centered production network through the triangle trade; on the other hand, mechanical and electrical products play an essential role in the East Asian production network, and they rank as China's largest export product. Therefore, this paper will take mechanical and electrical products as samples to analyze the influence of the triangle trade of the East Asian production network, with Japan as its core, on China's export quality. This discussion is sure to be of great significance to China's participation in the East Asian production network and the sound development of China's foreign trade.

The structure of the paper goes as follows: the paper first describes and estimates the status quo of China-Japan trade, triangle trade, and China's export quality; then, with mechanical and electrical industry as the sample, triangle trade as the explanatory variable, and export quality as the explained variable, the paper establishes a model to empirically analyze the impact of China's integration into the East Asian production network on China's export quality. The paper then introduces the dummy variables of China-Japan relations to empirically analyze China-Japan relations' influence on China's export quality. From these results, a conclusion is derived.

The Status Quo of China-Japan Trade Ties and Relevant Exponent Measurements

China and Japan have close trade ties and they are each other's most important trade partners. According to Table 1, China's import from and export to Japan grew rapidly in 2002 when China entered the World Trade Organization. Between 2002 and 2014, China's export to and import from Japan grew by 9.84% and 9.73% respectively. As far as the total trade value is concerned, China-Japan trade experienced a declining trend after 2011. More specifically, China's export to Japan showed an N-shape increasing trend. Before 2008, China's export to Japan continued to increase. While export declined after 2008, it swiftly recovered and turned into increasing trend in 2009. However, since 2011, the annual volume of China's export to Japan hovered around USD 150 billion, and the export maintained an M-shape rise. Three inflection points appeared in 2008, 2009, and 2011 respectively. After 2011, China's exports to Japan tended to go down. In 2014, the export volume amounted to USD 162.996 billion. Overall changes in total trade value maintained similar levels with import value, i.e., after 2011, the bilateral trade value began to decline and it decreased to USD 312.438 billion in 2014 from USD 342.89 billion in 2011. Japanese statistics showed that a certain difference between Japan-China export value and import statistics from Chinese sources existed, but overall data for total trade value is consistent from two countries, apart from 2014 data.

What happened to Japan's foreign direct investment (FDI) in China when the bilateral trade began to decrease after 2011? Table 1 shows that M-shape changes occurred to Japan's FDI in China: before 2005 the FDI increased; after 2005 it began to decline; in 2007 it reached a record low of USD 3.59 billion; for three years after 2007 it maintained a low level, and began to increase slowly; in 2011 it skyrocketed to USD 6.35 billion, and in 2012 it reached its peak value of USD 7.38 billion, before declining and reaching USD 4.33 billion in 2014. In conclusion, Japan's FDI in China fluctuated remarkably between 2002 and 2014. China-Japan trade value declined after 2011, and Japanese FDI in China began to decline after 2012. The reason lies in Japan's purchase of the Chinese Diaoyu Islands, which worsened the two countries' ties and directly led to the decline of the China-Japan trade value.

	China's Export to and Import	Japan's Export to and	Japan's FDI in

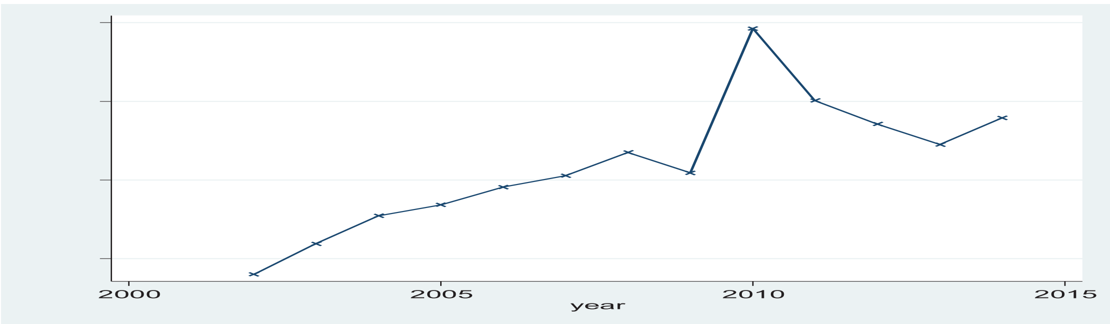
	from Japan (USD 100 Million)			Import from China (USD One Million)			China(USD 100 Million)
Year	Export	Import	Trade Value	Export	Import	Trade Value	Actual Use
2002	484.32	534.57	1018.89	39866	61692	101558	41.9
2003	594.26	741.51	1335.77	57219	75193	132412	50.5
2004	735.14	943.72	1678.86	73818	94227	168045	54.5
2005	839.92	1004.52	1844.44	80340	109105	189445	65.3
2006	916.39	1157.17	2073.56	92852	118516	211368	46.0
2007	1020.71	1339.51	2360.22	109060	127643	236703	35.9
2008	1161.3	1506.5	2667.8	124035	142337	266372	36.5
2009	979.1	1309.4	2288.5	109630	122545	232175	41.1
2010	1210.6	1767.1	2977.7	149086	152801	301887	42.4
2011	1483	1945.9	3428.9	161467	183487	344954	63.5
2012	1516.4	1778.1	3294.5	144686	189019	333705	73.8
2013	1502.8	1622.7	3125.5	129883	182112	311995	70.6
2014	1494.42	1629.96	3124.38	162686	180996	343682	43.3

Table 1 China-Japan Bilateral Trade Ties

Sources: The statistics on China's trade with Japan are from *China Customs Statistical Yearbook* ; those on Japanese trade with China are from Japan's *Trade Statistics* from the Japan External Trade Organization; and those on Japan's FDI in China are from the *China Commerce Yearbook*.

The relevant literature shows that the East Asian production network establishes its triangle trade with China as the export platform, through which China develops into the most globally important export country for mechanical and electrical products. Using the UN's COMTRADE database (2002-2014), this paper selects six mechanical and electrical industries as subjects of study. The six industries are: general equipment manufacturing; special equipment manufacturing; transport equipment manufacturing; electrical power and equipment; machinery and apparatus manufacturing; communication equipment; computers and other electronic equipment manufacturing; and instruments, apparatuses, culture equipment and stationery. Based on the preliminary industrial classification, the paper borrows classification methods and procedures from Kimura & Obashi (2010) to categorize mechanical and electrical components and parts, in order to differentiate between intermediate products and end products.

The most evident characteristic of the triangle trade is the processing of imported components and parts into end products, which are then exported back. China's mechanical and electrical industry is relatively reliant on Japanese components and parts. The Chinese imports of Japanese mechanical and electrical components and parts climbed to USD 5.58 billion in 2014 from USD 1.6 billion in 2002 (refer to Graph 1). The first inflection point appeared in 2008, before which the import volume was only rising incrementally. The second inflection point happened in 2009, and the third one appeared in 2010 when the import volume reached its peak value of USD 7.85 billion, before going back down for a number of years until 2014, when it recovered again. On the whole, China's import of Japanese mechanical and electrical components and parts tremendously fluctuated owing to the financial crisis, the China-Japan territorial dispute, and earthquake in Japan. China's import of Japan's mechanical and electrical components and parts reflects the trends in the two countries' trade.



Graph 1. The import volume of China's import of Japan's mechanical and electrical components and parts and intermediate goods between 2002 and 2014
Sources: Author's calculation based on UN COMTRADE Database.

In accordance with Hadder (2007), the triangle trade index is constructed as follows:

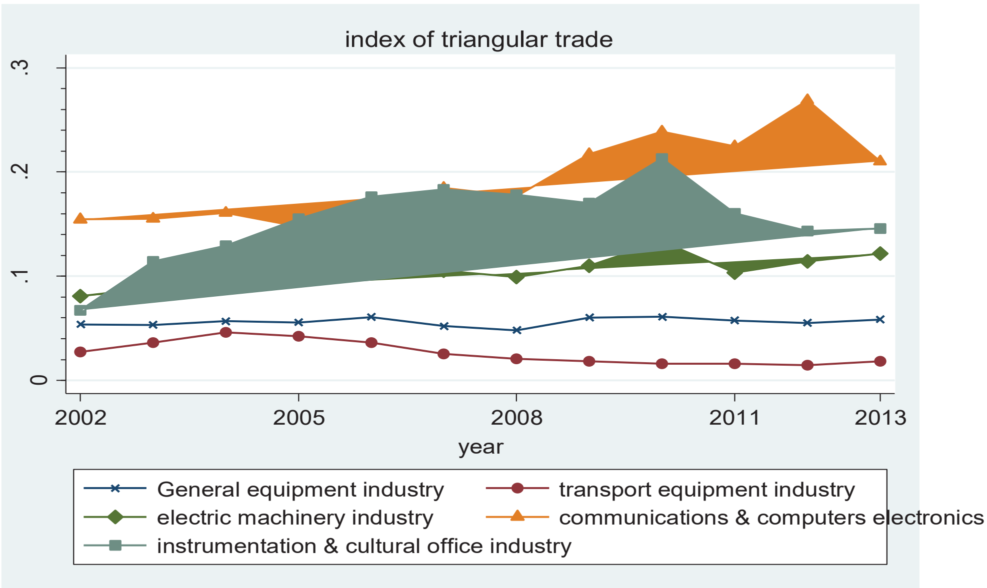
Model 1

$$TRI = A * B$$

$$\text{Where } A = \frac{Volume\ of\ Japan's\ Export\ of\ Intermediate\ Products_i\ to\ China}{Total\ Volume\ of\ Japan's\ Export\ of\ Intermediate\ Products_i}$$

$$B = \frac{Volume\ of\ China's\ Export\ of\ End\ Products_j\ to\ US\ and\ EU}{Total\ Volume\ of\ China's\ Export\ of\ End\ Products_j}$$

Based on the above-mentioned criteria, industrial classifications and research targets, this paper calculates the triangle trade indexes of mechanical and electrical sectors (see Graph 2). The indexes of China's mechanical and electrical industrial integration into the Japan-centered triangle trade differs among various industries. The highest-ranked triangle trade indexes include such industries as communications equipment, computers, and other electronic equipment manufacturing, as well as the manufacturing of instruments, apparatuses, culture equipment, and stationery. Their indexes reached 0.125 and 0.086 respectively in 2014. The lowest ranked industries include transport equipment manufacturing and general equipment manufacturing, respectively reaching 0.0259 and 0.006 in 2014. From this can be drawn that the Chinese mechanical and electrical industry is deeply integrated in the Japan-centered production network. As far as the changing trend is concerned, communications equipment, computers, and other electronic equipment manufacturing industries achieved their greatest percentage in growth at 186.2% between 2002 and 2014. This demonstrates the rapid pace at which China integrated itself into the triangle trade of the East Asian production network with Japan at its core.



Graph 2. The indexes of China's integration into Japan-centered triangle trade
Sources: Author's calculation based on UN COMTRADE Database.

This paper employs the level of an export's technological sophistication to gauge export quality. The PRODY index was constructed to measure the level of technological sophistication of export products (Hausmann et al, 2007).

Model 2

$$PRODY_i = \sum_j \frac{(x_{ji}/X_j)}{\sum_j (x_{ji}/X_j)} Y_j = \sum_j \frac{RCA_{ji}}{\sum_j RCA_{ji}} Y_j$$

$PRODY_i$ stands for the technological sophistication of the product i; i stand for a certain product i and j an exporting country j; x_{ji} stands for the export volume of the product i of the country j; X_j stands for the total export volume of the country j; Y_j stands for the per capita income of the country j. The technological sophistication of the exports of a country's industry can be calculated as follows:

Model 3

$$EXPY_j = \sum_i \frac{x_{ij}}{\sum x_{ij}} PRODY_i$$

$EXPY_j$ means the technological sophistication of the exports of the country j. The HS 6-digit (2002) classification scheme trade data of 142 countries between 2002 and 2014 is used. Raw data for per capita income are drawn from the World Development Indicators database.

Model Construction and Data Processing

A large amount of existing research shows that the export quality of China's manufacturing industry has improved through its participation in the labor division of global value chains, while China's integration into the East Asian production network is an important vehicle for its participation in the labor division of the global value chains. Additionally, through international trade, technological progress in new materials, intermediate products, capital equipment, etc. are acquired by other importing countries, paving a crucial path for technology spillover. How does China's participation in the East Asian production network impact the export quality of China's mechanical and electrical products? Based on existing literature and the above-mentioned statistical results, the following hypotheses are proposed.

Hypothesis 1: China's participation in the East Asian production network with Japan at the center has a positive influence on the export quality of China's mechanical and electrical products.

Hypothesis 2: If Hypothesis 1 holds, China-Japan ties will impact China's participation in the East Asian production network and consequently its export quality. Therefore, China-Japan ties will have a negative influence on its export quality.

Using the panel data of the mechanical and electrical industries between 2001 and 2014, this paper takes export quality as the explained variable and the degree of China's participation in the triangle trade of the Japan-centered global production network as the explanatory variable to construct an econometric model and empirically analyze the influence of China's participation in the triangle trade of the East Asian production network on China's export quality. Based on relevant theories and existing research conclusions, domestic endowment and the research and development (R&D) level are chosen as the control variables, and the empirical model is constructed as follows:

Model 4

$$\exp y_{it} = \alpha_0 + \alpha_1 tri_{it} + \alpha_2 kp_{it} + \alpha_3 lab_{it} + \alpha_4 \quad +$$

$\exp y$ the explained variable, is the logarithm of the technological sophistication level of mechanical and electrical sectors' exports of final products. tri, the explanatory variable, is the triangle trade exponent of the degree of China's participation in the Japan-centered global production network. As control variables, kp stands for material capital endowment, lab for labor force endowment, and rd for the R&D level. The raw data come from sources including the *China Industry Economy Statistical Yearbook*, the *Chinese Labour Statistical Yearbook*, and the *China Statistical Yearbook on Science and Technology*.

According to measurement results on components and parts trades in the mechanical and electrical industries, Chinese import of components, parts, and semi-finished products with Japanese origins decreased markedly after 2010. The decline can be attributed to the worsening of China-Japan relations. Do China-Japan relations impact China's export quality? Considering China-Japan relations suffered significantly due to the territorial dispute, this thesis introduces a dummy variable in Model 4 to represent China-Japan relations. For the years before 2010, the dummy variable *dum* equals 0. For the years after 2010, *dum* equals 1. The empirical model is constructed as follows:

$$\exp y_{it} = \beta_0 + \beta_1 dum_{it} + \beta_3 kp_{it} + \beta_4 lab_{it} + \beta_5 rd_{it} \qquad (5)$$

The Analysis of the Empirical Results

Through a stationary test and co-integration test, Hausman chose the fixed effect (FE) model. This is followed by collinearity tests, tests for heteroscedasticity, and tests for serial correlations and cross-sectional correlation. More attention should be given to relevant serial correlation and cross-sectional dependence issues when the panel data are smaller than N but bigger than T. Therefore, the xtscc command is chosen for the regression. The results are shown in the first column FE of Table 2. The second column of Table 2 shows the regression results of Model 5.

	（1）FE	(2) contain dum
dum		-1.481 （.9723）
tri	2.694*** （.5074）	1.647* （.6832）
kp	.11576 (.0995)	.1871* （.0827）
lab	.79457*** （.2136)	.4227* （2041）
rd	.1247*** (.03483)	.2339 （.1538）
year	Y	-
Con	7.0005*** (.7849)	6.529*** （.7984）
R^2	0.34	0.363
F	43.54	40.22

Table 2. The regression results of the impact of Japan-centered triangle trade on export quality
Note: ***, ** and * mean 1%, 5%, and10% respectively.

The regression results of FE indicate that a significant positive correlation between the triangle trade and the technological sophistication of Chinese mechanical and electrical exports exists. In other words, the deepening of China's integration and participation in the Japan-centered

East Asian production network is conducive for enhancing the quality of China's mechanical and electrical exports. China's integration in the Japan-centered East Asian production network plays a positive role in improving China's export quality. It would bear great significance for China to strengthen its integration into the Japan-centered triangle trade, so that Chinese mechanical and electrical export quality is improved and Chinese trade improved. The controlled-variable regression results under two regression methods show that capital intensity, labor force endowment, and the R&D level all have a positive correlation for export technological sophistication. Under two regression models, labor force endowment and the R&D level all showed positive coefficient and impact for export sophistication with significance. The significance of the controlled variable is consistent with theoretical expectations.

As far as the regression results of Model 5 is concerned, if the coefficient β_1 of the dummy variable is significant, it suggests that China-Japan relations do have an effect on China's export quality. The regression coefficient is negative, but insignificant. Negativity suggests that worsening China-Japan relations are not conducive to improving China's export quality. The insignificance may be attributed to the sampling timespan of 2002 to 2014, which differs from the worsening of China-Japan relations which started from 2010. The sample T is too short, rendering regression results insignificant. Moreover, just as the regression results of Models 4 and 5 show, the triangle trade exponent has a positive and significant impact on the technological sophistication of Chinese mechanical and electrical exports, which indicates that the conclusion is stable. The control variable and signs are consistent with the regression results from Model 4.

Currently, the territorial dispute has a negative impact on the trade relations between China and Japan. In accordance with the empirical results from this paper, China should continue to strengthen its integration into the Japan-centered triangle trade, and actively participate in the East Asian production network to improve China's export quality. In addition, although China-Japan ties have a negative impact on China's export quality, the influence is not significant.

Main Conclusions

Tension in China-Japan relations erupted in 2010 due to Japan's detainment of Chinese fishing boats and worsened in 2012 due to Japan's purchase of China's Diaoyu Islands, harming bilateral trade relations. This paper empirically demonstrated a positive improvement to the quality of

China's mechanical and electrical exports because of Chinese participation in the East Asian production network with Japan at its core. This means that the triangle trade model enhances the export quality of Chinese mechanical and electrical products. Sino-Japan relations have a bearing on Chinese export quality, and thus China should continue to strengthen its integration into the Japan-centered triangle trade. Infusion into the East Asian production network is the most crucial way for China to participation in the division of the global value chain. Through triangular trade in the network, both China and Japan would reap their own profits. Both China and Japan should pay attention to the mutual economic gains and enhance their cooperation, allowing mutually beneficial and advantageous relations.

This thesis is limited to a certain degree. Since Sino-Japan relations worsened in 2010, the timespan T of the empirical model is so short that it renders insignificant the index for China-Japan relations and Chinese export quality. Hence, this thesis may be further improved upon in future by increasing timespan T for further analysis of the impact between the variables.

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