Chukyo University Institute of Economics

Discussion Paper Series

January 2016

No. 1504

Economic interrelationship between Japan and the Chinese coastal area -An empirical analysis using international and regional input-output model-

Mitsuo Yamada

Zaizhe Wang

Kozo Miyagawa

Economic interrelationship between Japan and the Chinese coastal area -An empirical analysis using international and regional input-output model-

Mitsuo Yamada[1], Zaizhe Wang[2], Kozo Miyagawa[3]

Abstract

The aim of this paper is to clarify economic impacts on the Japanese economy from the trade between China and Japan. One is the production expansion and employment creation inside Japan that is caused by export expansion from Japan to China. It can be considered a positive impact on the Japanese economy. On the other hand, it is possible that the production and the employments in Japan are decreased because of the expansion of import from China to Japan. This is considered a negative impact on the Japanese economy. Here, we estimate these economic impacts, the expansion or contraction of production and employment, using the Input-Output model. Considering the regional difference in the magnitude of the impacts in China, we developed the International and Regional Input-Output Model by linking the 2007 Regional Input-Output table for 8 regions with the 2007 Japan-China International Input-Output table. Using this table, we conduct an analysis of the impacts of trade between each region and Japan on the Japanese economy in terms of production and employment.

Keywords:　Input-output; Regional economy; Chinese economy; International trade

JEL classification:　R15, F14

[1] Department of Economics, Chukyo University, Aichi, JAPAN, yamada@mecl.chukyo-u.ac.jp

[2] Department of Economics, Rissho University, Tokyo, JAPAN

[3] Department of Economics, Rissho University, Tokyo, JAPAN

1 Introduction

Since the beginning of the 21st century, Japanese firms operating in China have expanded their production[4] by establishing a specialized, international, intra-industry division of labor system, whereby parts and raw materials are imported from Japan to China, and Chinese manufactured products are exported to Japan and other countries. Accordingly, trade in intermediate goods, as a percentage of total trade between Japan and China, is increasing[5]. As trade in intermediate goods expands, the economic interrelation between Japan and China becomes complex and robust more and more, and the influence of the Chinese economy on the Japanese economy has also increased.

In this paper, we aim to clarify the impact of the trade between Japan and China on the Japanese economy. One of the important effects is that production increase and employment creation are brought to the Japanese economy by expanding exports from Japan to China, which is considered a positive effect for the Japanese economy. On the other hand, the increased imports from China to Japan reduce the domestic production and employment in Japan, which is considered a negative effect for the Japanese economy. Our study employs an international and regional input-output model to measure the influence of trade on the creation and loss of production and employment.

China is a large country with regional disparities such as difference in the industrial structure, the amount of trade, and types of goods traded. The magnitude of the impact on the Japanese economy through Japan-China trade might differ region by region, depending on what region in China is considered. Therefore, in this study, we developed the international and regional input-output model by linking the 2007 regional input-output table for eight regions[6] (hereinafter referred to as a "Regional table"), with the 2007 Japan-China international input-output table (hereinafter referred to as the "Japan-China Table")[7]. The eight regions are Liaoning, Shandong, Jiangsu, Shanghai, Zhejiang, Fujian, and

[4] According to the Ministry of Economy, Trade and Industry's "Basic Survey of Overseas business activities", total sales of Japanese subsidiaries in mainland China (excluding Hong Kong), approximately JPY10.6 trillion in FY2000, expanded to JPY21.8 trillion in FY2007, and to JPY27.7 trillion in FY2012. However, since this amounts were tabulated solely from valid responses, differences in the response rate for each survey should be noted. Despite this caveat, production by Japanese subsidiaries in China obviously has been expanding.

[5] According to Miyagawa (2012), intermediate goods consisted approximately 80% of all exports from Japan to China in 2007.

[6] The economic magnitude of the selected eight regions is large, representing 52% of China's total GDP in 2007. Moreover, approximately 71% of all foreign firms in China operated in these eight regions.

[7] China's regional IOTs represents all competitive import type with 42 sectors. The Japan-China International IOT, compiled by the METI and China's National Bureau of Statistics jointly and published in 2011, represents non-competitive import type with 77 sectors.

Guangdong (in the eastern coastal area) and Sichuan in the western part. Using this linked table, we analyze international and regional interdependence by linking the regional with the global.

We conduct a brief survey of the preceding research on the international and inter-regional input-output analysis of Japan and China in the following section, so to clarify the features of our study. Section 3 describes our analytical framework. Section 4 presents the results of our analysis, and Section 5 summarizes the results of our study.

2 Background of the Research

Our study analyzes the effects of each Region in China on the Japanese economy in terms of induced production and employment by using international and regional IOT, which is recompiled by linking 2007 Japan-China international IOT and each of 2007 regional IOT of eight provinces in China. In this section, we conducted a brief survey of the preceding studies not only on the IO structure between Japan and China but also on the analyses dividing Japan-China further into regions.

After the 2007 Japan-China IOT was published in 2011, there appeared several studies using the Japan-China IOT. Miyagawa (2012) revealed that the ripple effect on the Japanese economy due to China's exports to the ROW is large by using the Japan-China IOT. Wufur (2013) carried out detailed analysis focused on the trade of forest products. He used, in addition to the 2007 Japan-China IOT, 1990 Japan-China IOT compiled by the Institute of Developing Economies, and 1995 and 2000 "Asian International Input-Output Table" at the same time. Kawada (2014) compared the value chain in Japan and China by the ripple effect in both countries.

Miyagawa and Wang (2013), on the other hand, arranged the Japan-China IOT to capture the difference in firm's scales, and analyzed the effects of Japan-China trade on both large-scale and small-scale firms in Japan. In addition, Yamada (2014) analyzed the impact of Japanese subsidiaries in China on the Japanese economy by recompiling the IOT, in which the production activities of Japanese subsidiaries were separated. These two papers commonly recompiled the IOT while incorporating another element. Our study also recompiles the Japan-China IOT, taking region as a new factor.

Among the studies of regional IOT, there are many IO researches dividing China into multi-regions. Ichimura and Wang (2004) made a contribution in compiling the 1987 China interregional IOT. Miyagawa et al. (2008) made a skyline analysis using the 1997 region IOTs of China provinces, and carried out the analysis of inter-regional structure with inter-regional

IOT that was compiled by connecting those regional IOTs. There were a number of studies that mentioned how to compile the IOT and analyzed using the IOT (IDE-JETRO (2003), China State Information Center (2004), Han and Li (2007), Meng and Qu (2007), Zhang and Zhao (2008), etc.).

Furthermore, Okamoto (2012) analyzed the global relation of regional economies between Japan and China by dividing the two countries into several regions in their Asian International IOT, in addition to the analysis of changing regional economic structure in China, using between China inter-regional IOT in 1987, 1997, and 2007. The transnational interregional IOT between Japan and China has been published in the IDE-JETRO (2007). Ye and Fujikawa (2008), Yonemoto et al. (2008), etc. are using this IOT. This IOT has 17 regions; 7 regions in China, 8 regions in Japan, and East Asia and the United States, and has an advantage in the analysis of interregional issues for the areas. On the other hand, there are only ten sectors, which are relatively few for the detailed industrial analysis. Since the IOT adopted relatively wider 7 regions in China, it is not suitable for a detailed analysis of the ripple effect due to each province in the eastern coastal region in China as in our study.

Yamada, Wang, and Miyagawa (2015), targeting the year 2007 when China IOT, national and regional are benchmark tables, analyzed the interdependence between Japan and China by linking regional IOTs to Japan-China IOT directly. However, there remains some room for improvement in the linking method of IOTs, because a simplified approach was adopted using various assumptions. Nevertheless, there is an advantage to carry out a relatively detailed analysis of the provinces with 41 sectors. So, in our study, we will apply the same method adopted in Yamada, Wang and Miyagawa (2015), and will investigate each Chinese region's effect on Japan.

3 Analytical Framework

3.1 International-regional Input Output Table

Figure 1 shows a form of international and regional IOT used in our study. Although the table is depicted on the Shanghai case, we have constructed eight separate international and regional IOTs mentioned in section 1, and have compared the regional effects on Japan.

These international and regional IOTs are estimated using the statistical information of 2007 Regional IOTs in China for eight regions and 2007 Japan-China IOT[8]. Using these tables, we measure the ripple effect of the expansion of the import of each Region in China

[8] For more information about the estimation technique, there is a detailed description in Wang and Yamada (2014), Yamada, Wang and Miyagawa (2015).

from Japan, on Japanese economy (positive effect for Japan) in terms of production, value added, and employment. Also the effect of exports expansion of each region in China to Japan is calculated as negative ripple effect.

Fig. 1 Conceptual diagram of Japan-China, Others-Shanghai international input-output tables

		Intermediate Demand			Final Demand				Import	Total Output
		Japan	China, the Rest	China. S-Region	Japan	China, the Rest	China. S-Region	Export		
Interme-diate Input	Japan	X_{JJ}	X_{JO}	X_{JS}	F_{JJ}	F_{JO}	F_{JS}	E_{JR}	0	X_J
	China, the Rest	X_{OJ}	X_{OO}	X_{OS}	F_{OJ}	F_{OO}	F_{OS}	E_{OR}	0	X_O
	China, S-Region	X_{SJ}	X_{SO}	X_{SS}	F_{SJ}	F_{SO}	F_{SS}	E_{SR}	0	X_S
	ROW	X_{RJ}	X_{RO}	X_{RS}	F_{RJ}	F_{RO}	F_{RS}	0	$-M_J-M_O-M_S$	0
Value Added		V_J	V_O	V_S						
Total Input		X_J	X_O	X_S						

3.2 Model

Based on the international and regional IOT of Figure 1, the equations of production, imports, and value-added are shown as follows:

$$\begin{bmatrix} \mathbf{X}_J \\ \mathbf{X}_O \\ \mathbf{X}_S \end{bmatrix} = \begin{bmatrix} \mathbf{A}_{JJ} & \mathbf{A}_{JO} & \mathbf{A}_{JS} \\ \mathbf{A}_{OJ} & \mathbf{A}_{OO} & \mathbf{A}_{OS} \\ \mathbf{A}_{SJ} & \mathbf{A}_{SO} & \mathbf{A}_{SS} \end{bmatrix} \begin{bmatrix} \mathbf{X}_J \\ \mathbf{X}_O \\ \mathbf{X}_S \end{bmatrix} + \begin{bmatrix} \mathbf{F}_{JJ} + \mathbf{F}_{JO} + \mathbf{F}_{JS} \\ \mathbf{F}_{OJ} + \mathbf{F}_{OO} + \mathbf{F}_{OS} \\ \mathbf{F}_{SJ} + \mathbf{F}_{SO} + \mathbf{F}_{SS} \end{bmatrix} + \begin{bmatrix} \mathbf{E}_{JR} \\ \mathbf{E}_{OR} \\ \mathbf{E}_{SR} \end{bmatrix}$$

$$\begin{bmatrix} \mathbf{V}_J \\ \mathbf{V}_O \\ \mathbf{V}_S \end{bmatrix} = \begin{bmatrix} \hat{\mathbf{V}}_J & \mathbf{O} & \mathbf{O} \\ \mathbf{O} & \hat{\mathbf{V}}_O & \mathbf{O} \\ \mathbf{O} & \mathbf{O} & \hat{\mathbf{V}}_S \end{bmatrix} \begin{bmatrix} \mathbf{X}_J \\ \mathbf{X}_O \\ \mathbf{X}_S \end{bmatrix}$$

Since we describe the Shanghai case as an example, the subscripts J, O, S, and R denote

Japan, the rest of China (except Shanghai), Shanghai, and the rest of the world (ROW), respectively. In our actual analysis, as mentioned in the beginning, we repeat the same analysis for all eight regions, not only Shanghai. In this model, $\mathbf{X_i}$ represents the production vector for country or region i, $\mathbf{A_{ij}}$ denotes the input coefficient matrix of country or region j from the country or region i, $\mathbf{F_{ij}}$ denotes the final demand vector of country or region j from country or region i, and $\mathbf{E_{iR}}$ denotes the export vector of country or region i. In addition, $\mathbf{V_i}$ represents the value-added vector of country or region i, and $\hat{\mathbf{V}}_\mathbf{i}$ represents the value-added ratio matrix, the diagonal elements of which are the value-added ratio of country or region i. Solving the equation for production, the following equation is obtained.

$$\begin{bmatrix} \mathbf{X_J} \\ \mathbf{X_O} \\ \mathbf{X_S} \end{bmatrix} = \begin{bmatrix} \mathbf{I - A_{JJ}} & \mathbf{-A_{JO}} & \mathbf{-A_{JS}} \\ \mathbf{-A_{OJ}} & \mathbf{I - A_{OO}} & \mathbf{-A_{OS}} \\ \mathbf{-A_{SJ}} & \mathbf{-A_{SO}} & \mathbf{I - A_{SS}} \end{bmatrix}^{-1} \left[\begin{bmatrix} \mathbf{F_{JJ}} + \mathbf{F_{JO}} + \mathbf{F_{JS}} \\ \mathbf{F_{OJ}} + \mathbf{F_{OO}} + \mathbf{F_{OS}} \\ \mathbf{F_{SJ}} + \mathbf{F_{SO}} + \mathbf{F_{SS}} \end{bmatrix} + \begin{bmatrix} \mathbf{E_{JR}} \\ \mathbf{E_{OR}} \\ \mathbf{E_{SR}} \end{bmatrix} \right]$$
$$= \begin{bmatrix} \mathbf{B_{JJ}} & \mathbf{B_{JO}} & \mathbf{B_{JS}} \\ \mathbf{B_{OJ}} & \mathbf{B_{OO}} & \mathbf{B_{OS}} \\ \mathbf{B_{SJ}} & \mathbf{B_{SO}} & \mathbf{B_{SS}} \end{bmatrix} \left[\begin{bmatrix} \mathbf{F_{JJ}} + \mathbf{F_{JO}} + \mathbf{F_{JS}} \\ \mathbf{F_{OJ}} + \mathbf{F_{OO}} + \mathbf{F_{OS}} \\ \mathbf{F_{SJ}} + \mathbf{F_{SO}} + \mathbf{F_{SS}} \end{bmatrix} + \begin{bmatrix} \mathbf{E_{JR}} \\ \mathbf{E_{OR}} \\ \mathbf{E_{SR}} \end{bmatrix} \right]$$

The induced effect on Japan caused by the final demand of the Shanghai region is expressed as follows:

$$\begin{bmatrix} \mathbf{\Delta X_{J+}} \\ \mathbf{\Delta X_{O+}} \\ \mathbf{\Delta X_{S+}} \end{bmatrix} = \begin{bmatrix} \mathbf{B_{JJ}} & \mathbf{B_{JO}} & \mathbf{B_{JS}} \\ \mathbf{B_{OJ}} & \mathbf{B_{OO}} & \mathbf{B_{OS}} \\ \mathbf{B_{SJ}} & \mathbf{B_{SO}} & \mathbf{B_{SS}} \end{bmatrix} \begin{bmatrix} \mathbf{F_{JS}} \\ \mathbf{F_{OS}} \\ \mathbf{F_{SS}} \end{bmatrix}.$$

Then, we are able to show as follows:

(1) $\mathbf{\Delta X_{J+}} = \mathbf{B_{JJ}F_{JS}} + \mathbf{B_{JO}F_{OS}} + \mathbf{B_{JS}F_{SS}}$

(2) $\mathbf{\Delta V_{J+}} = \hat{\mathbf{V}}_\mathbf{J}\, \mathbf{\Delta X_{J+}}$

(3) $\mathbf{\Delta L_{J+}} = \hat{\mathbf{l}}_\mathbf{J}\, \mathbf{\Delta X_{J+}}$

Here, $\hat{\mathbf{l}}_i$ represents the employment coefficient matrix, the diagonal elements of which are the employment coefficients of country or region i. In addition, $\mathbf{F_{JS}}$, $\mathbf{F_{OS}}$, and $\mathbf{F_{SS}}$ represent the final demand vector in Shanghai Regional for each made-in-Japan product, made-in-the-rest-of-China products, and made-in-Shanghai products, respectively.

$\mathbf{\Delta X_{J+}}$, $\mathbf{\Delta V_{J+}}$, and $\mathbf{\Delta L_{J+}}$, calculated from equations (1) to (3), represent the induced product, the induced value added, and the induced employment, which are brought to Japan from Shanghai region, respectively. Those are positive effects on the Japanese economy, which the trade between Japan and Shanghai Regional influences. In this paper, we refer to this effect as the "**import from Japan effect**" of the Shanghai Region. It measures how much effect on production and employment is brought to Japan through the export from Japan to Shanghai.

On the other hand, if exports from Shanghai to Japan had been produced in Japan, it is possible to assess Shanghai region's "**exports to Japan effect**" by measuring the repercussion in Japan.

Export vector from the Shanghai region to Japan $\mathbf{T_{SJ}}$ comprises the following:

$$\mathbf{T_{SJ} = A_{SJ}X_J + F_{SJ}}$$

Thus, if not only final demand but also the derived intermediate goods are supplied from Japan rather than the Shanghai Region, we can deduce the following:

$$\begin{bmatrix} \Delta\mathbf{X_{J-}} \\ \Delta\mathbf{X_{O-}} \\ \Delta\mathbf{X_{S-}} \end{bmatrix} = \begin{bmatrix} \mathbf{I - A_{JJ} - A_{SJ}} & \mathbf{-A_{JO}} & \mathbf{-A_{JS}} \\ \mathbf{-A_{OJ}} & \mathbf{I - A_{OO}} & \mathbf{-A_{OS}} \\ \mathbf{0} & \mathbf{-A_{SO}} & \mathbf{I - A_{SS}} \end{bmatrix}^{-1} \begin{bmatrix} \mathbf{F_{SJ}} \\ \mathbf{0} \\ \mathbf{0} \end{bmatrix}$$

$$= \begin{bmatrix} \mathbf{B^*_{JJ}} & \mathbf{B^*_{JO}} & \mathbf{B^*_{JS}} \\ \mathbf{B^*_{OJ}} & \mathbf{B^*_{OO}} & \mathbf{B^*_{OS}} \\ \mathbf{B^*_{SJ}} & \mathbf{B^*_{SO}} & \mathbf{B^*_{SS}} \end{bmatrix} \begin{bmatrix} \mathbf{F_{SJ}} \\ \mathbf{0} \\ \mathbf{0} \end{bmatrix}$$

Then,

(4) $$\mathbf{\Delta X^*_{J-} = B^*_{JJ}F_{SJ}}$$

(5) $$\mathbf{\Delta V^*_{J-}} = \hat{\mathbf{v}}_\mathbf{J}\, \mathbf{\Delta X^*_{J-}}$$

(6) $\Delta \mathbf{L}^{*}_{J-} = \hat{\mathbf{l}}_{J}\, \Delta \mathbf{X}^{*}_{J-}$

$\Delta \mathbf{X}^{*}_{J-}$, $\Delta \mathbf{V}^{*}_{J-}$, and $\Delta \mathbf{L}^{*}_{J-}$ calculated from the equations (4) to (6), represent the induced production, the induced value added, and the induced employment that is brought to Japan if the imports of the final goods from Shanghai are replaced by Japan's production. As this can be interpreted as production, value added, and employment lost in Japan due to imports from Shanghai, we can consider this as a negative effect on the Japanese economy. As we assume that the intermediate goods produced in Shanghai, used in domestic production, also are being produced in Japan, we add to $\mathbf{A}_{JJ}$ the input portion of the imported intermediate goods $\mathbf{A}_{SJ}$ for our input coefficient matrix.[9]

However, imports from the Shanghai region not only decrease production and employment in Japan, but also, conversely, increase them. For instance, goods and services, produced in Shanghai for export to Japan, partly require intermediate goods produced in Japan, the magnitude of which are calculated as $\Delta \mathbf{X}^{SJ}_{J}$, $\Delta \mathbf{V}^{SJ}_{J}$, and $\Delta \mathbf{L}^{SJ}_{J}$ by the following equations (7) to (9):

(7) $\Delta \mathbf{X}^{SJ}_{J} = \mathbf{B}_{JS} \mathbf{F}_{SJ}$

(8) $\Delta \mathbf{V}^{SJ}_{J} = \hat{\mathbf{V}}_{J}\, \Delta \mathbf{X}^{SJ}_{J}$

(9) $\Delta \mathbf{L}^{SJ}_{J} = \hat{\mathbf{l}}_{J}\, \Delta \mathbf{X}^{SJ}_{J}$

The objective here is to estimate the potential loss of production and employment in Japan caused by importing final goods to Japan from Shanghai. Thus, we need to deduct the import repercussion components, $\Delta \mathbf{X}^{SJ}_{J}$, $\Delta \mathbf{V}^{SJ}_{J}$, and $\Delta \mathbf{L}^{SJ}_{J}$ from $\Delta \mathbf{X}^{*}_{J-}$, $\Delta \mathbf{V}^{*}_{J-}$, and $\Delta \mathbf{L}^{*}_{J-}$. That is,

(10) $\Delta \mathbf{X}_{J-} = \Delta \mathbf{X}^{*}_{J-} - \Delta \mathbf{X}^{SJ}_{J}$

9 Here, it has been taken into account that the intermediate goods of Japan are to be used in producing the imported intermediate goods from the rest of China. If we ignore such the ripple effect and set the rest of China as exogenous, the equation (4) becomes simply:

$$\Delta \mathbf{X}^{*}_{J-} = \left[\mathbf{I} - (\mathbf{A}_{JJ} + \mathbf{A}_{SJ})\right]^{-1} \mathbf{F}_{SJ}.$$

(11) $\mathbf{\Delta V_{J-} = \Delta V^*{}_{J-} - \Delta V_J^{SJ}}$

(12) $\mathbf{\Delta L_{J-} = \Delta L^*{}_{J-} - \Delta L_J^{SJ}}$

$\mathbf{\Delta X_{J-}}$, $\mathbf{\Delta V_{J-}}$, and $\mathbf{\Delta L_{J-}}$ of the equations (10) to (12) ultimately represent the potential loss of production, value added, and employment in Japan due to imports to Japan from Shanghai. Here, we regard this as a negative impacts on the Japanese economy due to trade between Shanghai and Japan, and refer to this as the "**exports to Japan effect**."

In this section, we used Shanghai to illustrate our point, but the same analysis can be conducted for each of the other seven regions as well, to discuss the regional difference in the effects on Japanese economy from the aspects of both production and employment.

4 Comparison of the Results

Table 1 shows the total sum, of all sectors, for each region's "imports from Japan effect" and "exports to Japan effect" in the case of each region in China. We refer to the difference between the "imports effect from Japan" and the "export effect to Japan" as the "net effect."

Table 1 Import from Japan effect, Export to Japan effect, and Net effect, by region

Region	Induced Production (100 Million US Dollars)			Induced Value Added (100 Million US Dollars)			Induced Employment (Thousand Persons)		
	Import from Japan effect	Export to Japan effect	Net effect	Import from Japan effect	Export to Japan effect	Net effect	Import from Japan effect	Export to Japan effect	Net effect
Shanghai	191	142	49	79	56	23	113	88	26
Guangdong	243	420	-178	93	168	-75	125	275	-150
Liaoning	50	28	22	19	12	8	26	21	5
Fujian	71	65	5	28	27	1	39	51	-11
Shandong	119	123	-4	46	53	-7	61	119	-58
Jiangsu	137	248	-111	53	101	-48	72	196	-124
Zhejiang	108	208	-100	42	85	-42	57	172	-115
Sichuan	36	8	28	14	3	10	18	6	12
All Regions	955	1,243	-288	374	504	-131	512	928	-415

According to Table 1, the City of Shanghai positively impacted Japan as a "net effect," whether in terms of the induced production amount, the value-added amount, or the induced employment on Japanese economy. The large trade with Shanghai brought a larger "Import from Japan effect" than an "Export to Japan effect." Liaoning and Sichuan were other regions where all factors had a positive “net effect.” It is interesting that the positive "imports from Japan effect" surpassed the negative "exports to Japan effect" in an inland province such as Sichuan, but reflecting the small magnitude of trade with Japan, the size of the net effect was smaller than in Shanghai and Guangdong.

In Fujian, the net effect was positive for induced production and amount and the induced value-added amount but negative for the induced number of employment. This is due to the fact that the "exports to Japan effect" was significantly large in the "7 textile industry" sector, which has the lowest labor productivity of all manufacturing sectors in Japan. All four remaining regions other than Shanghai, Liaoning, Sichuan, and Guangdong, had a negative “net effect.” From the above, we can conclude that even among the regions situated on the eastern coast of China, a significant difference exists in the magnitude and direction of the impact on the Japanese economy.

Overall, the eight regions have a negative net effect in terms of production, value added, and employment inducement. The expansion of trade between Japan and China had the effect of suppressing production and employment in Japan, at least with respect to the eight regions examined in this study.

Table 2 The per capita value added, induced in Japan

(Unit: 100 Million US Dollars／thousand persons)

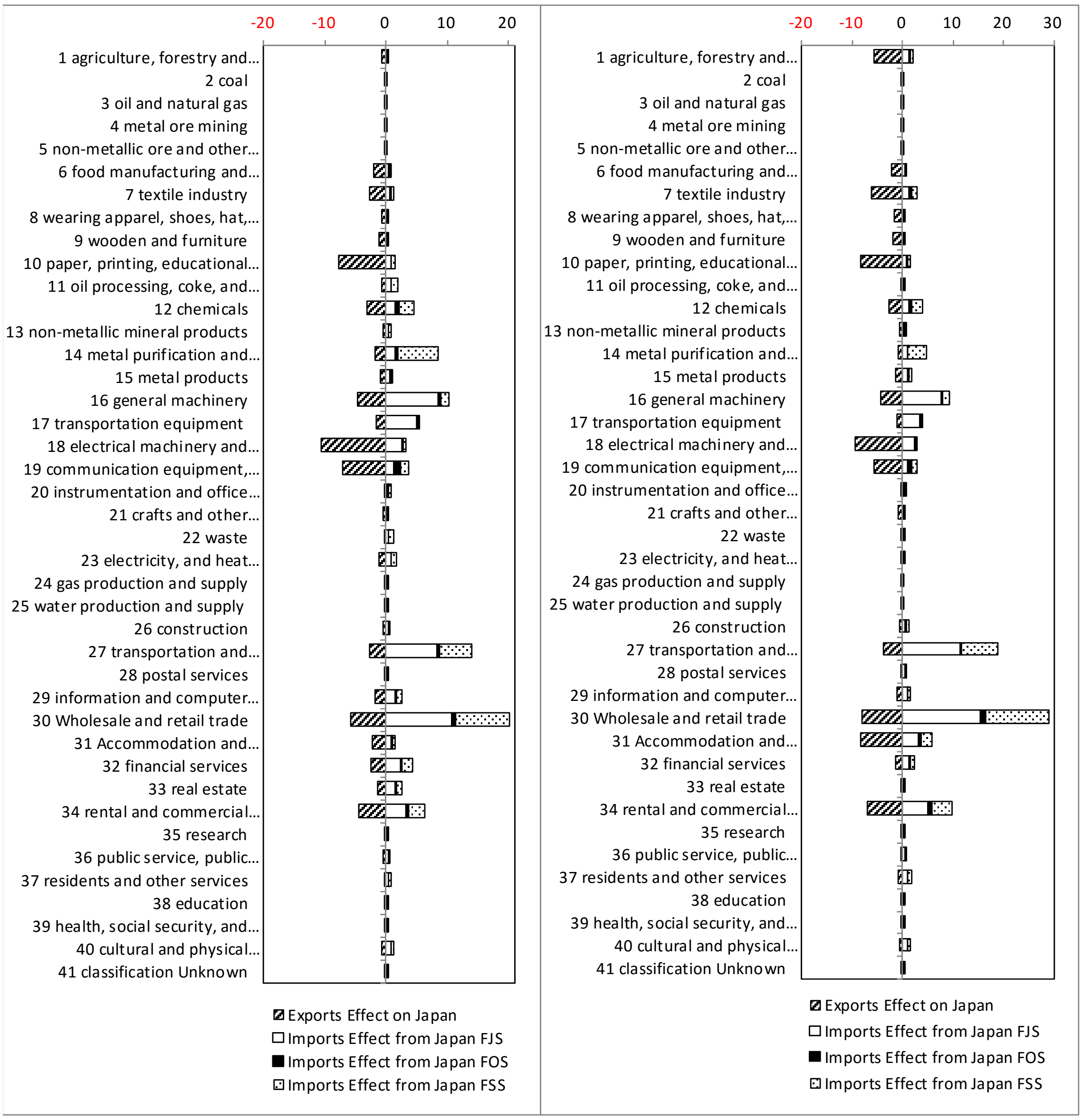
Region	Import from Japan effect	Export to Japan effect
Shanghai	0.694	0.634
Guangdong	0.742	0.610
Liaoning	0.738	0.555
Fujian	0.714	0.535
Shandong	0.755	0.445
Jiangsu	0.735	0.517
Zhejiang	0.739	0.493
Sichuan	0.761	0.533
All Regions	0.730	0.544

Table 2 shows the per capita value added, obtained from dividing the induced value added by the corresponding induced employment for the “imports from Japan effect” and the “exports to Japan effect” in Table 1. The results can be interpreted as the labor productivity of the “imports from Japan effect” and the “export to Japan effect,” respectively. We find that, for all regions, the “imports from Japan effect” surpass the “export to Japan effect.” We can infer that the industrial sectors’ labor productivity, which increased production and employment in

Japan, was caused by higher gains in the "imports from Japan effect," compared with the "exports to Japan effect." If the expansion of trade between Japan and China increased production in Japan, in sectors with relatively high labor productivity, and conversely, decreased production in sectors with low labor productivity, we can argue that the Japan-China trade factored into the structural change of the Japanese economy, in the form of improved labor productivity.

Fig. 2 The induced value added and employment by sector in Japan: Case of Shanghai

(Unit: 100 Million US Dollars) (Unit: Thousand Persons)



Figures 2 and 3 represent the induced value added and the induced employment in Shanghai and the sum of the eight regions, including Shanghai, to determine the magnitude of the “import from Japan effect” and “export to Japan effect” by sector. Those figures show the "exports to Japan effect" as negative values, and the "imports from Japan effect" as positive values. With regard to the "imports from Japan effect," we have distinguished the induced factors $\mathbf{F_{JS}}$, $\mathbf{F_{OS}}$, and $\mathbf{F_{SS}}$ by color. This decomposition is obtained from the induced effect for each term of the equation (1).

Figure 2 shows the induced value added and the induced employment for the case of Shanghai. The left side shows the induced value added in the "export to Japan effect" as negative values. We see that large production-reduction in Japanese economy is observed in the sectors as "electrical machinery and equipment," "paper, printing, educational and physical education supplies," and "communication equipment, computer and other electronic equipment." Another characteristic of the Shanghai region is the low value for the "textile industry."

On the other hand, the "imports from Japan effect" for non-manufacturing sectors such as "wholesale and retail" and "transportation and warehousing" are increasing, because of commercial margins and transportation fares generated in Japan-Shanghai trade. In spite of the repercussion of trade, the results indicate a significant impact on the non-manufacturing sectors in Japan. Furthermore, it is important to consider the trade repercussion effect as our analysis, when discussing the trade deficit or surplus based on the trade statistics. The decomposition of the "import from Japan effect" shows that the effects due to $\mathbf{F_{JS}}$ and $\mathbf{F_{SS}}$ are significant, whereas the effect from $\mathbf{F_{OS}}$ is insignificant.

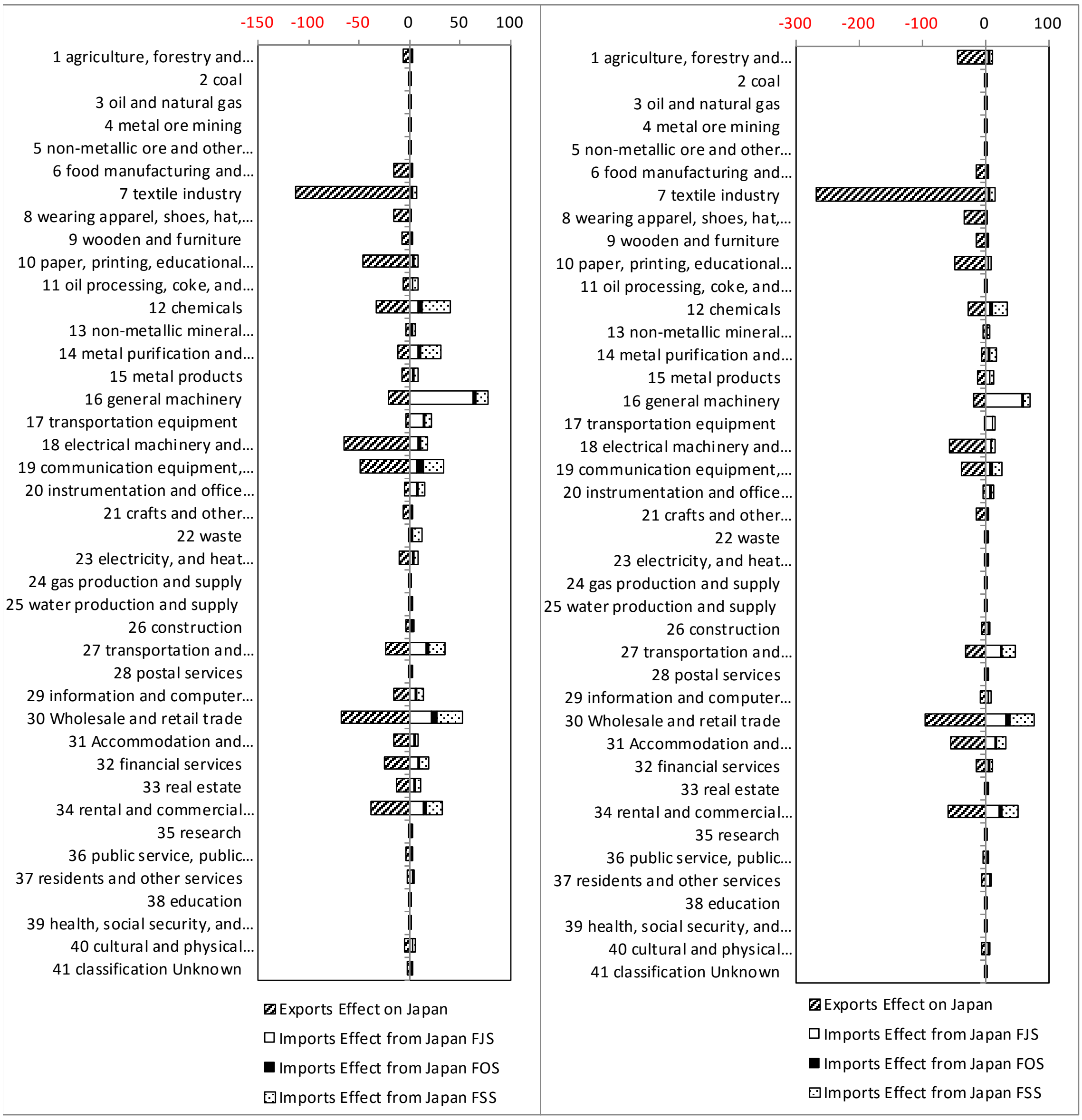
The right side of the figure shows the induced employment in the Shanghai case. Regarding the "export to Japan effect" on employment, in addition to the sectors cited in Figure 2, we see a high value in "agriculture, forestry and fisheries" and "textile industry." These results are accounted for by their relatively low labor productivity. As with the induced value-added amount, regarding the "imports from Japan effect," non-manufacturing sectors, such as "wholesale and retail" and "transportation and warehousing," have exhibited a high value.

Figure 3 shows the induced value-added amount and the induced number of employment for the eight regions as a whole. The "exports to Japan effect" of the induced value-added figure indicates the significant difference from the Shanghai case (Fig. 2 same part) in high for the "textile industry." On the other hand, regarding the "imports from Japan effect," values are lower in almost all sectors compared to "export to Japan effect." This also significantly differs from the Shanghai case. From the above considerations, we can surmise that the trade structure of the Shanghai region significantly differs from that of other regions.

Fig. 3 The induced value added and employment by sector in Japan:

Case of Eight Regions Total

(Unit: 100 Million US Dollars) (Unit: Thousand Persons)



The right side of Figure 3 shows the induced employment for eight regions total. Note that the "exported to Japan effect" for the sector "textile industry" is strikingly high, even more than the induced value-added amount case on the left. This is because "textile industry" represents a high percentage of total exports to Japan in regions other than Shanghai, and moreover, it has a low labor productivity compared to other industry sectors. Thus, we can conclude that trade between Japan and China has been a large factor causing the decline of the "textile industry" in Japan.

5 Concluding Remarks

In the analysis of the previous section, we have shown that the region's impact on the Japanese economy differs from region to region. Even among the relatively advanced coastal regions of China, the results from Shanghai significantly differed from those of the other regions. Considering that differences exist between stages of economic development, industrial structure, and trade structure, it is important to perform a detailed, region-by-region analysis when considering Japan-China relationship.

In addition, we demonstrated that trade between Japan and China likely increased Japanese domestic production for sectors with relatively high labor productivity and decreased production for sectors with low labor productivity. It is possible that because of a changing industrial structure, trade expansion between Japan and China caused higher labor productivity in the Japanese economy as a whole. From this perspective, the "export to Japan effect," which was implied as a negative effect in our study, can be perceived as a necessary contraction in the scale of production, which is necessary for structural changes in the Japanese economy.

As for our sectoral analysis, we have shown that trade between Shanghai and Japan largely influenced the expansion of value added and employment in Japan in the commercial and transportation sectors, rather than in traded goods themselves. This resulted from transactions, commercial margins and freight, occurring in Japan, or exports from Japan. These costs are induced not only by domestic transactions and exports but also imported goods. On the other hand, we have demonstrated that reductions in production and employment are concentrated in the "textile industry," and that trade between Japan and China was a significant factor in the decline of the domestic "textile industry." Nevertheless, if we import "textile" products, it is certain that commercial margins and freight costs will be generated as well. In our analysis, we were unable to investigate the production and job creation effect of commerce and transport sectors, in relation to the increase in imported goods. However, in conjunction with findings relating to Shanghai, as mentioned above, we should consider how the increase in imports impacts the domestic economy for future studies.

Looking ahead, as the Chinese economy continues to develop, and as the industrial structure of the eastern regions other than Shanghai as well as that of the inland regions transforms itself, the magnitude of the effect of trade between Japan and China on the Japanese economy could possibly significantly change. Using the most up-to-date IO database available, we plan to extend our analysis to include the impacts of regions not covered in this study.

Acknowledgement

This paper was presented at the 2015 Conference of Chinese Input-Output Association held in Tianjin, China, August 15-16, 2015. The authors thank Dr. Yaxiong ZHANG of the State Information Center, China, for his suggestive comments. This work was supported by JSPS KAKENHI Grant Number 25380335.

References

China State Information Center (2004) Multiregional input-output table of China (in Chinese).

Han Wenqing, and Zinai Li (2007) "Feedback and spillover effects between coastal and inland economies in China," Economic Studies No.5 pp.68-77 (in Chinese).

Ichimura Shin-ichi, and Huijiong Wang (2004) Interregional input-output analysis of the Chinese economy, ICSEAD Research Monograph Series No.2, Sobunsha (in Japanese).

IDE-JETRO (2003), Multi-regional input-output model for China 2000, Statistical Data Series No.86, Institute of Developing Economies-Japan External Trade Organization.

IDE-JETRO (2007), Transnational interregional I-O table between China and Japan, AIO Series No.68, Institute of Developing Economies-Japan External Trade Organization.

Kawada Yuya (2014) "Value chain analysis based on value added induced by final demands: Using 2007 Japan-China input-output tables," Distribution Studies, the Journal of Japan Society for Distributive Sciences, No.35, pp.1-14 (in Japanese).

Meng Bo and Chao Qu (2007) "Application of the input-output decomposition technique to China's regional economies," IDE Discussion Paper No.102.

Miyagawa Kozo (2012), "An empirical study on the influence of the intermediate goods trade between Japan and China on the Japanese economy," Journal of Economic Statistics Studies, Economy, Trade and Industry Statistics Association 40(1), pp.49-72 (in Japanese).

Miyagawa Kozo, and Zaizhe Wang (2013) "The economic impacts of the expansion of trade between Japan and China on Japanese production, employment and labor productivity," The Quarterly Report of Economics, Rissho University 63(3), pp.69-120 (in Japanese).

Miyagawa Kozo, ZaiZhe Wang, Zuyao Hu, Masahiko Shimizu, Masuyou Arai, Kozo Ishida (2008) Study on the Regional Industrial Structure of China, Keio University Press.

Okamoto Nobuhiro (2012) Regional Economy of China – Spatial Structure and Interdependence, Nihon-Hyoronsha, Tokyo (in Japanese).

Wang Zaizhe, and Mitsuo Yamada (2014) "Multiregional input-output analysis of the interdependence between Japan-China-Shanghai," The Quarterly Report of Economics, Rissho University 63(4), pp.73-118 (in Japanese).

Wufur Roxangul (2013) "China-Japan forest products trade and its influencing factors: A structural analysis based on the intra-industry trade index," Journal of Rural Problems, 49(2), pp.241-252 (in Japanese).

Yamada Mitsuo (2014) "Input-output analysis of the interdependence between Japan and China through Japanese overseas production," Journal of Economic Structures, 3(3) 1-28.

Yamada Mitsuo, ZaiZhe Wang, and Kozo Miyagawa (2015) "Economic interdependence between the eastern coastal regions in China and Japan: an empirical analysis using 2007 China regional input output tables and Japan-China international input output table," Chukyo Economic Review, Chukyo University (26), pp.13-57 (in Japanese).

Ye Zuoyi, and Kiyoshi Fujikawa (2008) "An analysis of structural changes of interregional division of labor in China," Input-Output Analysis, Papaios, 16(2), pp.63-76 (in Japanese).

Yonemoto Kiyoshi, Shibasaki Ryuichi, and Watanabe Tomihiro (2008), "Regional impact analysis of the trade and development policy using Japan-China multi-regional Asia input-output table," Research Paper of the National Institute for Land and Infrastructure Management, No.451 (in Japanese).

Zhang Yaxiong, and Kun Zhao (2008) "Impacts of Beijing Olympics investment on Chinese economy –based on regional input-output model analysis," Economic Studies, No.3 pp.4-15 (in Chinese).