RIETI Discussion Paper Series 25-E-123

Empirical Analysis of the Impact of Imports from China on Employment in Japan

HANEDA, Sho
Nihon University

KWON, Ug Hyeog
RIETI

The Research Institute of Economy, Trade and Industry
https://www.rieti.go.jp/en/

RIETI Discussion Paper Series 25-E-123

Empirical Analysis of the Impact of Imports from China on Employment in Japan[1]

Sho Haneda (Nihon University)

Hyeog Ug Kwon (Nihon University and RIETI)

Abstract

Since China's accession to the WTO, the impact of increased competition from Chinese imports (the "China shock") on employment and productivity in many developed countries has become a major concern for policy makers. The share of manufacturing workers in the total number of employees has been declining, and Japan is no exception. The paper empirically examines the impact of the increase in imports from China on employment using questionnaire information of the *Census of Manufactures* and the *Economic Census for Business Activity* as well as the *Trade Statistics of Japan* and the *National Freight Flows Survey (Logistics Census)*. The main results are twofold. First, imports of intermediate products from China have a positive impact on employment at Japanese firms. Second, imports of capital products from China might have a negative effect on employment growth. Thus, reducing trade barriers in intermediate products, participating in global value chains, and supporting inter- and intra-industry labor mobility for specific workers, regions, and industries that are negatively affected by capital goods are key to employment growth in Japan.

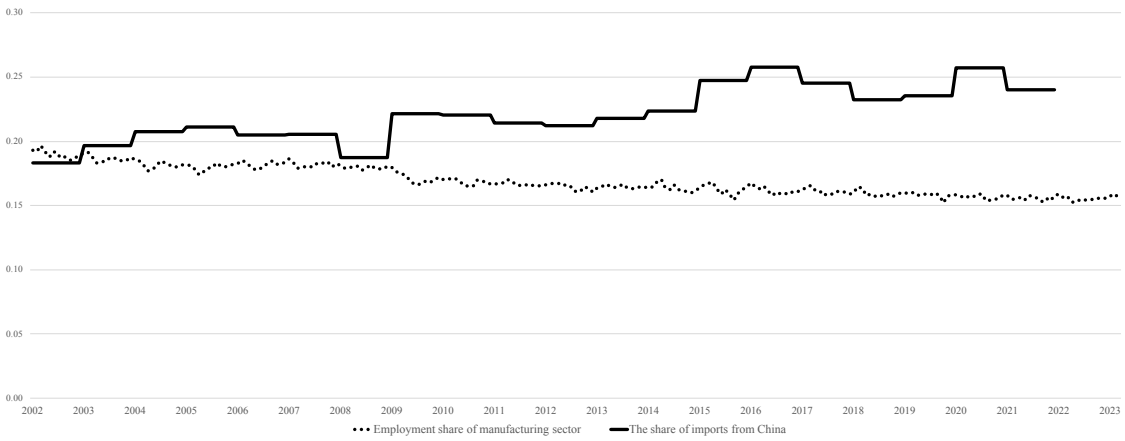
Keywords: China's WTO accession, imports, employment, productivity
JEL classifications: F16, J21

[1] This study is conducted as part of the Project "East Asian Industrial Productivity" conducted at the Research Institute of Economy, Trade and Industry (RIETI). The study utilizes microdata from the Census of Manufactures conducted by the Ministry of Economy, Trade and Industry (METI). We received many useful comments on the draft of this paper from Shujiro Urata, Masayuki Morikawa, Kyoji Fukao, Akira Sasahara, and members of the RIETI Discussion Paper Seminar for the paper. We would like to write here to express our gratitude.

1. Introduction

The share of the manufacturing sector in employment in Japan overall has steadily declined since the turn of the millennium, falling from about 20% in 2002 to about 16% in 2014. At the same time, imports from the Asian region, led by China, and from low-income countries have rapidly increased.

Figure 1 shows developments in the employment share of the manufacturing sector in Japan and China's share in Japan's total imports from 2002 to 2023. Since 2002, the employment share of the manufacturing sector has steadily declined, while the share of imports from China in Japan's total imports has been increasing, suggesting that the two developments may be linked. Similar trends have been observed in other developed economies, giving rise to a substantial literature examining the impact of import competition from China – referred to as the "China shock" hereafter – on domestic employment.[2]



Source: Authors' calculations based on data from the *Labour Force Survey,* Statistics Bureau, Ministry of Internal Affairs and Communications Statistics Bureau, and the *Trade Statistics,* Ministry of Finance.

Figure 1. Employment share of the manufacturing sector and China's share in Japanese imports

One of the studies in this field is that by Autor et al. (2013), whose approach makes it possible to incorporate regional differences in the impact of the China shock, leading to the widespread use of empirical analyses that take regional and industry characteristics into account. This approach is particularly relevant for Japan, where industrial and labor market characteristics vary substantially across prefectures. However, as will be detailed

[2] See, for example, Acemoglu et al. (2016), Balsvik et al. (2015), and Murray (2017) on the negative impact of the China shock on employment and wages in developed countries.

later, the approach may be subject to measurement errors. Essentially, the reason is that national trade and customs statistics typically are aggregated at the national level, making it difficult to measure the impact of the China shock in individual regions within a country. Moreover, data constraints have hampered analyses that, for example, take workers' characteristics such as their skill level and gender into account. Yet, it may be workers in specific occupations or of a specific gender that are more likely to lose their job in the event of a crisis, meaning that in order to examine how policies should respond, it is necessary to understand what types of workers are particularly affected by the China shock.

Against this background, the aim of this paper is to examine regional differences in the impact of the China shock across Japan at the prefecture- and industry-level using data from the *Trade Statistics of Japan* published by the Ministry of Finance and the *National Freight Flows Survey (Logistics Census)* published by the Ministry of Land, Infrastructure, Transport and Tourism. In addition, since these variables are aggregated from HS 9-digit classifications, it is also possible to estimate, at the prefecture level, the impact of the China shock by the production stage of goods (intermediate goods, final consumer goods, capital goods), which many previous studies have not been able to take into account. This is one of the key contributions of this paper. We also empirically examine the relationship between employment trends and the China shock by gender in order to clarify whether the impact of the China shock differs by gender.

We obtain three major results. First, we find that imports of intermediate goods from China in a particular year may have increased both male and female employment at Japanese firms in the same year. Second, however, we find that they had a negative impact on employment growth in Japan in the next year, regardless of gender. Third, our analysis suggests that imports of capital goods from China and the United States may have had a negative impact on employment, especially for female workers. The contribution of this analysis is that the impact of the China shock on employment differs depending on the production stage of the goods imported.

The remainder of this paper is organized as follows. Section 2 provides an overview of the results of previous studies. Section 3 explains our approach for estimating the impact of the China shock and outlines changes in the impact of the China shock in Japan. Section 4 presents econometric analyses on the impact of the China shock on employment in Japan, and Section 5 concludes.

2. Literature review

This section reviews previous research on the impact of the China shock on employment and explains the need for new indicators. We start by introducing previous research on measuring the impact of the China shock, followed by an overview of the results of previous research on the impact of the China shock on economic activities.

2.1 Measuring the impact of the China shock

To measure the impact of the China shock, industry-level variables such as import prices and import penetration tend to be employed.[3] In this study, we particularly focus on Autor et al.'s (2013) approach, which employs local import penetration using trade data as a variable to capture the impact of imports from China. Autor et al. (2013) define the degree of competition with imports from China as follows:

$$IPW_{uit} = \sum_j \frac{L_{ijt}}{L_{ujt}} \frac{\Delta M_{ucjt}}{L_{it}}$$

where *IPW* stands for the degree of import competition, *L* stands for the number of workers, *M* represents imports, subscripts *u* and *c* denote the United States and China, *i* represents the region, *t* the year, and *j* the industry. The first term on the right-hand side is the employment share of region *i* in total US (*u*) employment in industry *j*, and the second term represents the change in US imports from China in industry *j* from the start of the observation period to the present divided by the number of employees in region *i* in the year. Therefore, the first term represents the industry characteristics of a region measured by the share of employees, while the second term is the per capita import value of the region.

While the variable seems quite useful, it may suffer from endogeneity. The causal relationship it aims to examine is the impact of the China shock on regional employment; however, the variable may be subject to reverse causality: for instance, decreases in employment and purchasing power may have led to decreases in imports from China. Autor et al. (2013) addressed this issue by using the following as an instrumental variable:

$$IPW_{oit} = \sum_j \frac{L_{ijt-1}}{L_{ujt-1}} \frac{\Delta M_{ocjt}}{L_{it-1}}$$

[3] A detailed survey of measures for the impact of the China shock is provided by Sasahara (2022).

where *o* represents other high-income countries (Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland). Unlike above, the employment variable in this case is for the period *t*-1, and it is assumed that there was no China shock impact in the previous period. Imports from China are affected by (1) demand in the United States and (2) supply in China. Thus, the value of exports from China to high-income countries other than the United States is employed. This method has been employed in many related studies on the impact of imports from China in a range of countries (Endoh 2018, Choi and Xu 2020, etc.).

Since data on the imports of each region from China are not available, previous studies indirectly estimate regional imports by multiplying a country's imports from China overall by region- and industry-level employment shares. However, it is essentially desirable to directly measure the China shock at the region- and industry-level as well as analyze its impact on the economic activities of firms. Therefore, in order to address this issue, we examine the impact of the China shock in Japan at the prefecture level using aggregated data from the *Trade Statistics* and the *National Freight Flows Survey (Logistics Census).*

2.2 Impact of the China shock on firms' performance

Previous studies examining the impact of the China shock in Japan can be categorized into several strands. The earliest studies empirically investigated the impact of increased imports from Asia and low-income countries on employment and wages at Japanese firms (Ito 2005, Inui et al. 2011, etc.). This section provides an overview of their findings by dividing studies into those at the firm level and those at the regional level, which is what this paper mainly focuses on.

Starting with regional-level studies, these include analyses at the prefecture and commuting area level. Conducting a prefecture-level analyses, Taniguchi (2019) found that the increase in Japanese imports from China from 1995 to 2007, which included many intermediate goods, led to an increase in employment in Japan. This result differs from that of Autor et al. (2013) and highlights the need to take the characteristics of goods into account. A characteristic of Japan is that people commute between prefectures. For this reason, it has been argued that the appropriate unit for labor market analyses in Japan is the commuting area. Against this background, Saito et al. (2020) have examined the impact of the China shock at the commuting area level, employing the definition of commuting areas proposed by Adachi et al. (2021). Moreover, distinguishing between upstream and downstream industries, they found that imports of intermediate goods from

China had a positive impact on employment in upstream industries, while no significant impact was found for downstream industries.

Next, let us turn to studies examining the impact of the China shock on employment and productivity (innovation) at the firm level. Starting with employment, a number of studies combined data from the *Census of Manufacture*, the *Basic Survey of Japanese Business Structure and Activities*, and the *Economic Census* to find that the China shock caused an increase in non-manufacturing employment at manufacturing firms (Matsuura 2022) and an increase in employment in upstream industries (Hayakawa et al. 2021). Regarding productivity (innovation), the impact of the China shock on innovation as measured by the number of patents and the number of patent citations is examined. The conclusion is that although increased imports from China were associated with an increase in patenting, when measured by the number of patent citations, which is a more appropriate indicator of innovation, the China shock actually adversely affected innovation (Yamashita and Yamauchi 2020). Another way to measure productivity is in terms of the number of goods produced. In this regard, Bellone et al. (2021) have shown that the China shock resulted in a reduction in the number of goods produced.

Finally, it has been pointed out that the impact of the China shock varies depending on worker characteristics. For instance, it has been highlighted that the impact of the China shock differs depending on workers' skill level and type of task. Therefore, it is necessary to take these characteristics into account (Becker et al. 2013, Ebenstein et al. 2014, Hummels et al., 2014, Hakkala and Huttunen 2016, etc.). Furthermore, as pointed out by Kim (2018), the impact of the China shock differs depending on gender as well as skill level, highlighting the need to take these characteristics into account in policy discussions.

While a large number of empirical studies on regional labor markets using Autor et al.'s (2013) indicator have been conducted, one concern, as mentioned, is that this indictor may be subject to measurement error. Furthermore, in order to analyze the impact of the China shock on employment, it may be necessary to consider the characteristics of goods and workers. This study therefore seeks to estimate the China shock at the prefecture level and empirically examine its impact on employment in Japan.

3. The China shock in Japan

This section examines the increase in Chinese imports in Japan at the prefecture level – what we call the "China shock" – using aggregate data from the *Trade Statistics* released by the Ministry of Finance and the *National Freight Flows Survey (Logistics Census)*. We start by explaining our data cleaning method and then provide an overview of the China shock at the prefecture level.

3.1 Data cleaning

3.1.1 Trade statistics

We use the HS 9-digit level import data published by the Ministry of Finance in its *Trade Statistics*. A list of the custom offices whose data we use and the prefectures in which they are located is provided in Appendix Table A. We use these to create our variables for the period from 2002 to 2014. We use the HS02 trade classification for the period 2002 to 2006, HS07 for 2007 to 2011, and HS12 for 2012 to 2014. We converted the HS 9-digit classification to the Input-Output Table industry classification, and from the Input-Output Table classification to the Japan Industrial Productivity (JIP) database classification (JIP2018). Industry-level imports by customs office are denoted as follows:

$$IM_{ijklt} \quad (1)$$

where *IM* stands for the amount of imports in 100,000,000 yen, *i denotes* the prefecture where a customs office is located, *j* denotes the exporting country, *k* denotes the industry (JIP classification), *l* denotes the broad economic categories (BEC) classification, and *t* denotes the year. Since this study focuses on imports from China, *j* = China.

3.1.2 Domestic freight flows statistics

We complement the data from the *Trade Statistics* with data from the *National Freight Flows Statistics* to take into account the flow of goods within Japan. Specifically, we use the tables on the interprefectural flow of goods by type of good in terms of weight and the tables on the interprefectural flow of goods by type of good in terms of the number of items. Depending on the characteristics of the product or industry, there may be large differences between the two – that is, the weight of goods or the number of items – so that we use the average value of the freight shares calculated using both variables. The variables were created for the period from 2002 to 2014. The *National Freight Flows Survey (Logistics Census)* is conducted every five years, so that we use the survey for 2000 for the period 2002 to 2004, the survey for 2005 for the period 2005 to 2009, and

the survey for 2010 for the period 2010 to 2014. The conversion table of the statistical data to the product categories and JIP classifications (JIP2018) is presented in Appendix Table B.

These statistics provide the freight amount of goods produced in each prefecture, which means that it does not completely reflect the freight volume of imported goods. The Ministry of Land, Infrastructure, Transport and Tourism's *National Export/Import Container Cargo Flow Survey* provides statistical data on the domestic freight volume of import containers. The survey contains an index of container and goods transports from producer countries to the prefectures in Japan where the goods are consumed. In other words, using the survey, it is possible to obtain information on the volume of container traffic from China to each prefecture. However, the *National Export/Import Container Cargo Flow Survey* was conducted in 2013 and 2018 only, so that data for other years that this study focuses on are not available. Furthermore, the data does not provide information on the volume of container traffic from China to each prefecture *by industry*. We therefore use the *National Freight Flows Survey (Logistics Census)* instead.

The statistical data consists of a freight matrix by industry across prefectures. Since the freight amount (weight and number of items) from one prefecture to the other prefectures and within the prefecture can be obtained, it is possible to calculate the freight share for each prefecture. For instance, assume that there are only three prefectures in Japan: Kanagawa, Tokyo, and Hokkaido. If the freight shares in terms of weight in an industry from Kanagawa to Hokkaido, Tokyo, and Kanagawa are 0.1, 0.4, 0.5 respectively, the total is 1. Moreover, assume the freight shares in terms of the number of items from Kanagawa to Hokkaido, Tokyo, and Kanagawa are 0.3, 0.6, 0.1 respectively, and the total is 1. Then the freight share from Kanagawa to Hokkaido is (0.1+0.3)/2=0.2, that to Tokyo is (0.4+0.6)/2=0.5, and that within Kanagawa is (0.5+0.1)/2=0.3.

Thus, we calculate these freight shares including the within prefecture freight in terms of both the weight and the number of items, take the average of these two shares, and use this as our *Share* variable:

$$Share_{imkt} \qquad (2)$$

where *i* denotes the prefecture where the freight is shipped from and the customs office is located, *m* denotes the prefecture where the freight is shipped to, *k* denotes the industry (JIP classification), and *t* denotes the year. *Share* also includes the share of freight shipped within the shipping origin prefecture (where the customs office is located), in which case $i = m$.

3.1.3 China shock variable

It is possible that imported goods that pass through a customs office are not consumed or used for production in the prefecture where the customs office is located. Therefore, import data by customs office are insufficient, since they potentially overestimates the import shock. To address this issue, we multiply the trade data (imports by prefecture, industry, and year) with freight data (shipments by prefecture of origin and destination, industry, and year) and sum up the values by prefecture, industry, and year to construct our China shock variable by prefecture, industry, and year. Specifically, we define the import shock of imports from China as follows:

$$ChinaImport_{mklt} = \sum_{i=1}^{40}(IM_{iklt} \cdot Share_{imkt}) \qquad (3)$$

where *m* represents the prefecture, *k* the industry, and *t* the year. That is, the China shock is calculated as the value of imports from China in industry *k* in year *t* that passed customs in one of the 40 prefectures that have customs offices multiplied by the freight share from each prefecture to prefecture *m*. The seven prefectures that do not have customs offices are excluded, resulting in a total of 40 prefectures that import[4].

Table 1 provides descriptive statistics of the share of imports from China based on the *National Export/Import Container Cargo Flow Survey* and our import shock variable, the share of manufacturing imports from China. Specifically, for reference, the table shows the share of container imports from China in each prefecture's total container imports in 2013 calculated from the *National Export/Import Container Cargo Flow Survey*. Moreover, the table shows China's share in prefectures' manufacturing imports from 2012 to 2014. While the number of observations and the means are identical, some differences can be seen in the median, minimum, and maximum values. The standard errors, 0.029 and 0.030, are also very similar.

Finally, the table shows the coefficient of correlation between China's share in prefectures' container imports in 2013 and China's share in prefectures' manufacturing imports – our import shock variable – from 2012 to 2014. The correlation coefficient is at least 0.9 in all cases. Thus, the prefectural patterns regarding our China shock variable incorporating domestic freight data are similar to those suggested by container import data based on the *National Export/Import Container Cargo Flow Survey*. This suggests that our approach to use domestic freight data instead of container import data provides a good approximation.

[4] We develop another type of import shock of imports from China, especially for final products. See appendix C for more details.

Table 1. Correlation coefficient

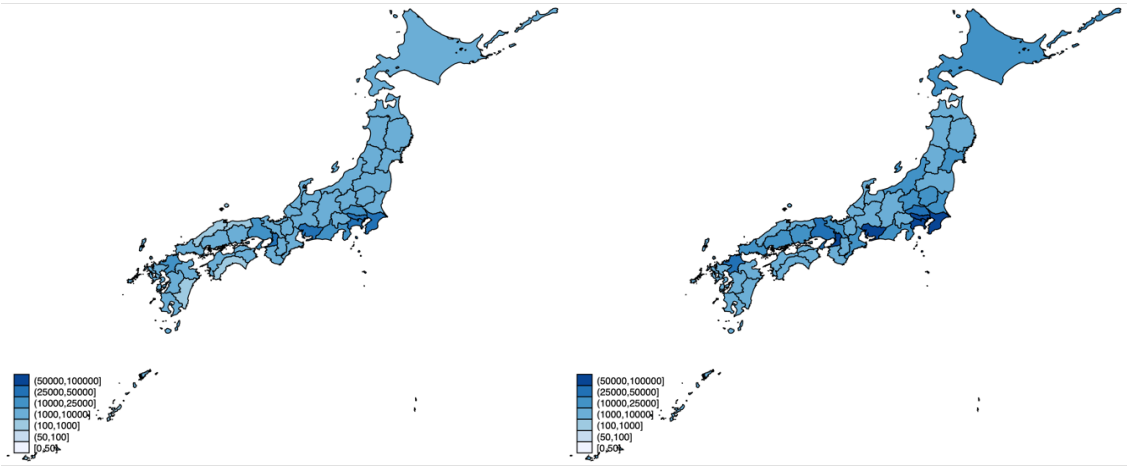
Variable	Observations	Mean	Median	S.D.	Min.	Max.	Correlation coefficient
Share of container imports from China (2013)	47	0.021	0.007	0.029	0.001	0.121	
Share of manufacturing imports from China (2012)	47	0.021	0.009	0.030	0.002	0.128	0.921
Share of manufacturing imports from China (2013)	47	0.021	0.009	0.030	0.002	0.128	0.917
Share of manufacturing imports from China (2014)	47	0.021	0.009	0.030	0.002	0.134	0.906

Source: Authors' calculations.

3.2 Imports by prefecture

Figure 2 shows prefecture-level imports of manufactured goods from the world in 2002 and 2014. In 2002, the prefecture with the largest amount of imports (4,221.1 billion yen) was Tokyo, while the prefecture with the smallest amount of imports (51.3 billion yen) was Kochi. Further, the prefectures with the largest amount of imports, in that order, were Tokyo, Chiba, Kanagawa, Aichi, and Osaka. Turning to the figures for 2014, the prefecture with the largest amount of imports was Tokyo, with 8,539.7 billion yen, while Kochi prefecture had the smallest amount of imports, with 168.1 billion yen. Moreover, the top five prefectures were the same as those in 2002.

2002 2014



Source: Compiled by the authors based on the *Trade Statistics* by the Ministry of Finance and the *National Freight Flow Survey (Logistics Census)* by the Ministry of Land, Infrastructure, Transport and Tourism.

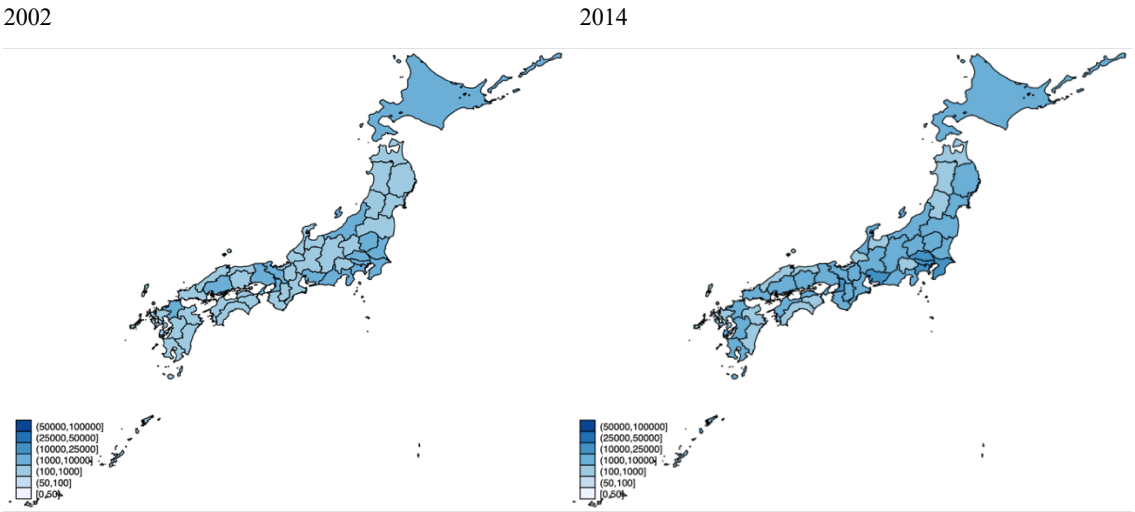
Note: The darker a prefecture, the larger is the amount of imports.

Figure 2. Imports of manufactured goods from the rest of the world (2002 and 2014)

Next, Figure 3 shows prefecture-level imports of manufactured goods from China in 2002 and 2014. In 2002, the prefecture with the largest amount of imports from China (921.4 billion yen) was Tokyo, while the prefecture with the smallest amount (with 17.6

billion yen) was Okinawa. Moreover, the prefectures with the largest amount of imports from China were Tokyo, Osaka, Aichi, Kanagawa, and Chiba, in that order. Turning to 2014, Tokyo accounted for the largest amount of imports, with 2.3 trillion yen, while Kochi had the smallest amount, with 18 billion yen. Finally, the top five prefectures in 2014 were Tokyo, Osaka, Aichi, Kanagawa, and Saitama, in that order.

Further, we divide imports from China into intermediate goods, final consumption goods, and capital goods based on their BEC classification and provide an overview of imports of each type of goods. The results are shown in Figure 4. Starting with intermediate goods, Aichi was the prefecture with the largest amount of intermediate goods imports from China in 2002 with 247.9 billion yen, while Kochi was the prefecture with the smallest amount with 4 billion yen. The prefectures with the largest amount of imports, in that order, were Aichi, Kanagawa, Tokyo, Osaka, and Chiba. In 2014, Tokyo accounted for the largest amount of intermediate goods imports, with 737.4 billion yen, while Kochi, with 16.1 billion yen, accounted for the smallest amount. The top five prefectures were Tokyo, Osaka, Aichi, Kanagawa, and Saitama, and imports were more concentrated among the top three prefectures than in 2002.



Source: Compiled by the authors based on the Trade Statistics by the Ministry of Finance and the National Freight Flow Survey (Logistics Census) by the Ministry of Land, Infrastructure, Transport and Tourism.

Note: The darker a prefecture, the larger is the amount of imports.

Figure 3. Imports of manufactured goods from China (2002 and 2014)

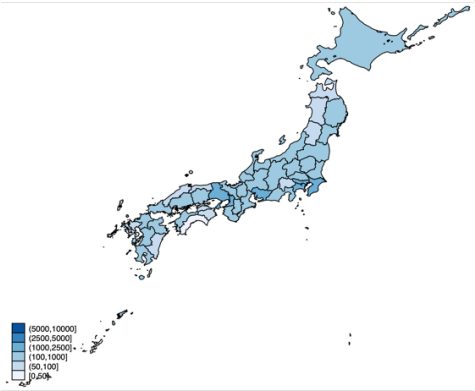
Next, looking at final consumer goods, in 2002, Osaka prefecture accounted for the largest amount of imports, with 5826.7 billion yen, and Miyazaki prefecture for the smallest, with 9.6 billion yen. Further, the prefectures with the largest amount of imports

were Osaka, Tokyo, Aichi, Kanagawa, and Hyogo, in that order. Turning to 2014, Osaka still accounted for the largest amount of imports, with 899.6 billion yen, while Kochi accounted for the smallest amount, with 12.3 billion yen. The top five prefectures, in that order, were Osaka, Tokyo, Aichi, Hyogo, and Kanagawa, and imports were more concentrated among the top two prefectures than in 2002.

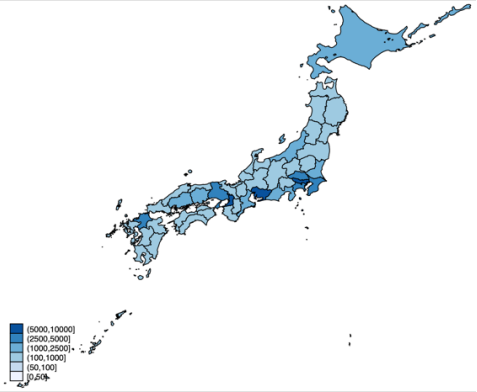
Finally, turning to capital goods, in 2002, Tokyo accounted for the largest amount of imports with 143.7 billion yen, while Kochi accounted for the smallest amount with 1.8 billion yen. The prefectures with the largest amounts of capital goods imports were Tokyo, Kanagawa, Aichi, Osaka, and Chiba, in that order. Tokyo still had the largest amount of capital goods imports in 2014 (764.3 billion yen), while Kochi had the smallest (6.6 billion yen). The top five prefectures were Tokyo, Osaka, Chiba, Saitama, and Kanagawa, with Tokyo's capital goods imports about twice as large as those of Kanagawa.

Intermediate goods

2002

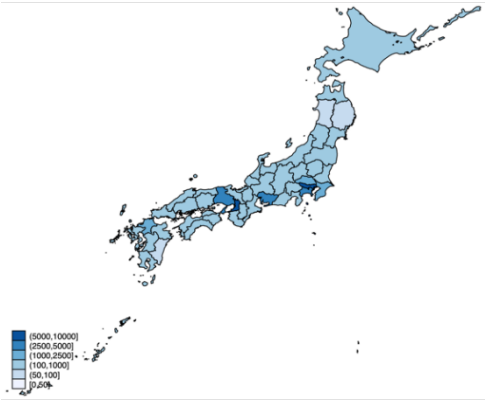


2014

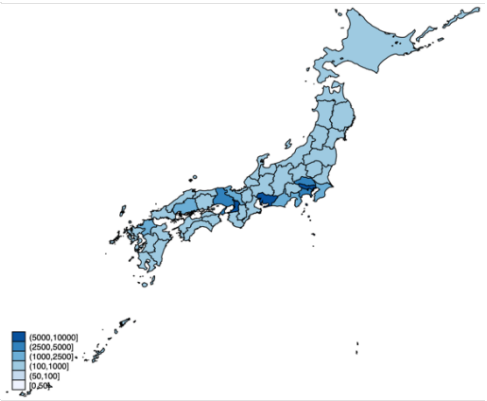


Final consumer goods

2002

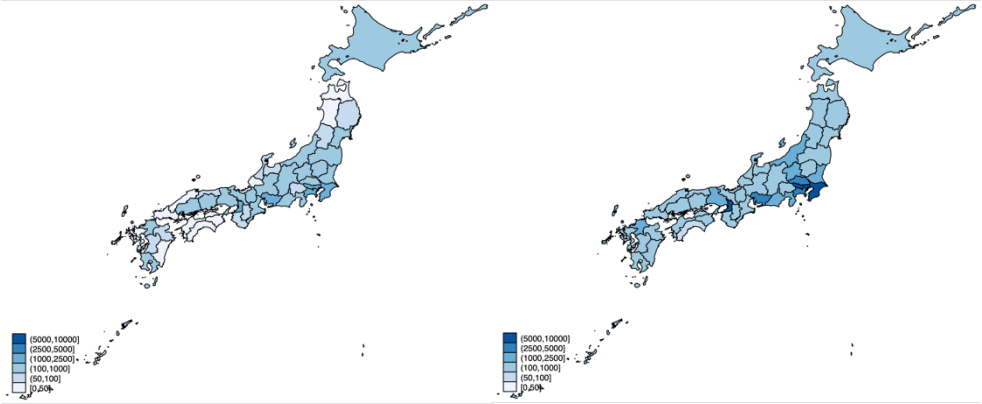


2014



Capital goods

2002 2014



Source: Compiled by the authors based on the Trade Statistics by the Ministry of Finance and the National Freight Flow Survey (Logistics Census) by the Ministry of Land, Infrastructure, Transport and Tourism.

Note: The darker a prefecture, the larger is the amount of imports.

Figure 4. Imports of manufactured goods from China by product type (2002 and 2014)

Table 2. Descriptive statistics of manufacturing sector imports

Variable	Observations	Mean	S.D.	Min.	Max.	Coefficient of variation
Imports from world (2002)	47	6772.77	10007.38	513.75	42211.14	1.48
Imports from world (2014)	47	16186.79	20736.57	1681.77	85039.70	1.28
Imports from China (2002)	47	1547.24	2294.96	176.05	9214.63	1.48
Imports from China (2014)	47	3730.31	5291.25	351.23	23603.77	1.42
Imports from China (intermediate, 2002)	47	446.29	635.74	40.55	2479.15	1.42
Imports from China (intermediate, 2014)	47	1385.70	1825.11	161.12	7374.95	1.32
Imports from China (final, 2002)	47	844.17	1322.73	96.44	5826.79	1.57
Imports from China (final, 2014)	47	1232.04	1969.83	123.53	8996.53	1.60
Imports from China (capital, 2002)	47	252.31	374.56	18.11	1437.70	1.48
Imports from China (capital, 2014)	47	1111.60	1625.25	66.47	7643.47	1.46

Source: Authors' calculations.

Note: The mean, standard deviation, minimum, and maximum are in 100 million yen.

Next, we examine how the degree of dispersion of the *ChinaImport* variable across prefectures has changed using the coefficient of variation. Descriptive statistics for the *ChinaImport* variable and the variable representing imports from the rest of the world, defined in a similar manner as the *ChinaImport* variable, are presented in Table 2. Starting with imports from the rest of the world, the table shows that the coefficient of variation fell from 1.48 in 2002 to 1.28 in 2014, indicating that the degree of dispersion decreased during this period. Next, looking at imports from China, the degree of dispersion also decreased, from 1.48 to 1.42, but the decrease was relatively small. In other words,

compared to imports from the rest of the world, there is greater variation across prefectures in imports from China. Turning to the coefficient of variation for different types of goods, we find that that for intermediate goods fell from 1.42 to 1.32, and that for capital goods declined slightly from 1.48 to 1.46. On the other hand, the coefficient of variation for final consumer goods imports rose from 1.57 to 1.60.

The various results presented here indicate that imports from China varies across regions, and that this variation also changed over time. The next section, using the China shock variable and statistical data on Japanese firms, examines the impact of the China shock on Japanese firms' employment employing regression analysis.

4. Impact of the China shock on the employment in Japan

4.1 Econometric specification

This section presents our empirical analysis examining the impact of the China shock on employment at Japanese firms from 2002 to 2014. We start by explaining the estimation model, then present the results, and finally consider the policy implications of the estimation results.

The following empirical model is estimated using questionnaire data from the Ministry of Economy, Trade and Industry's *Census of Manufacture* and the Ministry of Internal Affairs and Communications/Ministry of Economy, Trade and Industry's *Economic Census for Business Activity*:

$$\Delta L_{prst} = \beta_0 + \beta_1 \Delta IM^c_{rst} + \beta_2 \Delta IM^u_{rst} + \gamma X_{pt} + \tau_t + \alpha_s + \delta_r + \varepsilon_{ft} \qquad (4)$$

where p represents individual business establishments, r stands for the prefecture, s represents the industry (using the industry classification of the JIP2018 Database), and t is the year. The dependent variable ΔL_{prst} is the change in employment at establishment p. In order to examine whether the impact of the China shock differs depending on employees' gender, we also use the rates of change in the number of male employees and female employees as dependent variables. The explanatory variable ΔIM^c_{rst} represents the import shock from China. In addition to overall imports from China, we also run estimations in which this variable represents imports from China of intermediate, final consumer, and capital goods. Another variable we use is the share of imports from China in Japan's total imports in order to examine the impact of the relative increase or decrease in imports from China. Moreover, we include the one-period lag of the import shock

variable in order to take into account that employment adjustments may take time and appear with a lag.

Further, we include the following control variables in our estimation. First, we constructed a variable for imports from the United States similar to the import shock variable for China. Further, we include a vector of establishment characteristics, X_{pt}, containing the logarithm of the number of employees, value-added labor productivity, and an export dummy. Finally, we control for year, industry, and prefecture fixed effects by including year, industry, and prefecture dummies. Most previous studies do not take the movement of labor across regions into account. We follow this example and assumes that production activities, consumption activities, and the movement of labor all take place within a prefecture.

Since firms tend to mitigate economic shocks by reassigning workers across establishments, the impact of imports from China may differ between independent establishments and establishments belong to multi-establishment firms. We therefore estimate the regression for all establishments as well as for independent establishments.

4.2 Estimation results

Tables 3 to 5 present the estimation results for overall imports from China, not taking the type of goods into account. Starting with Table 3 for total employment, the results show that, regarding imports from China, only the lagged variable is statistically significant and has a negative coefficient, suggesting that imports from China may have had a negative impact on employment at Japanese firms. On the other hand, regarding imports from the United States, only the lagged variable is statistically significant and has a positive coefficient, suggesting that imports from the United States had a positive impact on employment. Further, Tables 4 and 5 show that in the estimation for male workers, this variable is insignificant, while in the estimation for women it is significant, indicating that imports from the United States had a particularly positive impact on female employment.

Looking at changes in the import share, the results indicate that an increase in the share of imports from China in total imports has a positive contemporaneous effect on employment, but the impact after one period is negative. Moreover, this pattern holds for both male and female workers. On the other hand, an increase in the import share of the United States has a negative impact on employment overall. Looking at the control variables, we find that the results for firm size – as measured by the number of employees – are positive and significant in all cases. Moreover, the coefficients for both value-added

labor productivity and the export dummy are negative and significant. Next, we repeat these estimations for the different types of imported goods.

Table 3 Estimation results (total employment)

	All establishments								Independent establishments							
	Change in total employment															
Change in *ChinaImport*	0.0000005								0.000001							
	[0.0000]								[0.0000]							
Change in import shock variable of US	0.000001								0.000003							
	[0.0000]								[0.0000]							
Change in *ChinaImport,* lag			-0.000002	***							-0.000003	***				
			[0.0000]								[0.0000]					
Change in import shock variable of US, lag			0.00001	***							0.00001	***				
			[0.0000]								[0.0000]					
Change in the share of imports from China					0.0069	***							0.0065	***		
					[0.0011]								[0.0013]			
Change in the share of imports from US					-0.0028	***							-0.0010			
					[0.0018]								[0.0021]			
Change in the share of imports from China, lag							-0.0093	***							-0.0090	***
							[0.0011]								[0.0013]	
Change in the share of imports from US, lag							-0.0120	***							-0.0079	***
							[0.0019]								[0.0022]	
Log of the number of employees	0.0221	***	0.0222	***	0.0221	***	0.0222	***	0.0263	***	0.0262	***	0.0263	***	0.0262	***
	[0.0001]		[0.0001]		[0.0001]		[0.0001]		[0.0001]		[0.0002]		[0.0001]		[0.0002]	
Log of value-added productivity	-0.0205	***	-0.0204	***	-0.0205	***	-0.0204	***	-0.0222	***	-0.0221	***	-0.0222	***	-0.0221	***
	[0.0001]		[0.0002]		[0.0001]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]	
Export dummy	-0.0141	***	-0.0136	***	-0.0141	***	-0.0136	***	-0.0113	***	-0.0105	***	-0.0113	***	-0.0105	***
	[0.0005]		[0.0006]		[0.0005]		[0.0006]		[0.0008]		[0.0008]		[0.0008]		[0.0008]	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Observations	2,584,862		2,330,268		2,584,862		2,330,268		1,685,323		1,503,322		1,685,323		1,503,322	
R-squared	0.030		0.030		0.030		0.030		0.033		0.034		0.033		0.034	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. *** denotes statistical significance at the 1% level.

Table 4 Estimation results (male workers)

	All establishments								Independent establishments							
	Change in employment of male workers															
Change in *ChinaImport*	-0.0000001								-0.0000003							
	[0.0000]								[0.0000]							
Change in import shock variable of US	0.000002								0.000003							
	[0.0000]								[0.0000]							
Change in *ChinaImport,* lag			-0.000002	**							-0.000003	**				
			[0.0000]								[0.0000]					
Change in import shock variable of US, lag			0.000001								0.000002					
			[0.0000]								[0.0000]					
Change in the share of imports from China					0.0053	***							0.0061	***		
					[0.0019]								[0.0022]			
Change in the share of imports from US					0.0012								0.0038			
					[0.0030]								[0.0037]			
Change in the share of imports from China, lag							-0.0112	***							-0.0094	***
							[0.0019]								[0.0023]	
Change in the share of imports from US, lag							-0.0257	***							-0.0061	
							[0.0031]								[0.0037]	
Log of the number of employees	0.0297	***	0.0297	***	0.0297	***	0.0297	***	0.0340	***	0.0339	***	0.0340	***	0.0339	***
	[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]	
Log of value-added productivity	-0.0285	***	-0.0281	***	-0.0285	***	-0.0281	***	-0.0287	***	-0.0281	***	-0.0287	***	-0.0281	***
	[0.0002]		[0.0003]		[0.0002]		[0.0003]		[0.0003]		[0.0003]		[0.0003]		[0.0003]	
Export dummy	-0.0186	***	-0.018	***	-0.0186	***	-0.0180	***	-0.0151	***	-0.0143	***	-0.0151	***	-0.0143	***
	[0.0008]		[0.0008]		[0.0008]		[0.0008]		[0.0012]		[0.0012]		[0.0012]		[0.0012]	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Observations	2,603,065		2,346,952		2,603,065		2,346,952		1,689,022		1,506,506		1,689,022		1,506,506	
R-squared	0.018		0.018		0.018		0.018		0.020		0.021		0.020		0.021	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. *** and ** denote statistical significance at the 1% and 5% level, respectively.

Table 5 Estimation results (female workers)

	All establishments								Independent establishments							
	Change in employment of female workers															
Change in *ChinaImport*	0.0000002								-0.000001							
	[0.0000]								[0.0000]							
Change in import shock variable of US	-0.0000003								0.000001							
	[0.0000]								[0.0000]							
Change in *ChinaImport*, lag			-0.000003	**							-0.000003	***				
			[0.0000]								[0.0000]					
Change in import shock variable of US, lag			0.00001	***							0.00002	***				
			[0.0000]								[0.0000]					
Change in the share of imports from China					0.0094	***							0.0057	**		
					[0.0022]								[0.0025]			
Change in the share of imports from US					0.0029								0.0049			
					[0.0037]								[0.0043]			
Change in the share of imports from China, lag							-0.0142	***							-0.0104	***
							[0.0023]								[0.0026]	
Change in the share of imports from US, lag							-0.0131	***							-0.0033	
							[0.0039]								[0.0045]	
Log of the number of employees	0.0292	***	0.0292	***	0.0292	***	0.0292	***	0.0345	***	0.0344	***	0.0345	***	0.0344	***
	[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0003]		[0.0003]		[0.0003]		[0.0003]	
Log of value-added productivity	-0.0313	***	-0.0307	***	-0.0313	***	-0.0307	***	-0.0313	***	-0.0307	***	-0.0313	***	-0.0307	***
	[0.0003]		[0.0003]		[0.0003]		[0.0003]		[0.0003]		[0.0004]		[0.0003]		[0.0004]	
Export dummy	-0.0148	***	-0.0139	***	-0.0148	***	-0.0139	***	-0.0116	***	-0.0103	***	-0.0116	***	-0.0103	***
	[0.0010]		[0.0010]		[0.0010]		[0.0010]		[0.0015]		[0.0016]		[0.0015]		[0.0016]	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Observations	2,512,852		2,264,724		2,512,852		2,264,724		1,640,353		1,463,008		1,640,353		1,463,008	
R-squared	0.013		0.013		0.013		0.013		0.015		0.015		0.015		0.015	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. *** and ** denote statistical significance at the 1% and 5% level, respectively.

Tables 6 to 8 present the results when we distinguish between intermediate, final consumption, and capital goods. Starting with intermediate goods, we find that the coefficient for all the variables for such imports are positive and significant, except for the lagged values of China's import share. Since the lagged values of the import share are insignificant for independent establishments for both male and female workers, we assume that this result reflects the results for establishments belonging to multi-establishment firms. For final consumption goods, the coefficient estimates are essentially all negative and significant except for the lagged values of the import share. Meanwhile, for capital goods, the coefficient estimates are generally significant and have a negative sign, and only the lagged import share variable has a positive sign. Moreover, the results suggest that capital goods imports from China may have had a negative contemporaneous impact on female employment only, while China's share in capital goods imports may have had a *positive* impact on female employment with a lag.

Next, looking at imports from the United States, the results indicate that intermediate and final consumer goods imports had a negative impact on employment, while capital goods imports had a positive impact. However, looking at the lagged variables, these suggest that intermediate goods imports from the United States had a negative impact on employment for men, while they had a positive impact on for women. Furthermore, turning to the share variables, we find that capital goods imports had a negative impact on employment in all cases.

Table 6 Estimation results (total employment, by product type)

	All establishments								Independent establishments							
	Change in employment								Change in employment							
Change in *ChinaImport* (intermediate)	0.00005	***							0.00005	***						
	[0.0000]								[0.0000]							
Change in *ChinaImport* (final)	-0.000004	***							-0.000003	***						
	[0.0000]								[0.0000]							
Change in *ChinaImport* (capital)	-0.00001	**							-0.00002	**						
	[0.0000]								[0.0000]							
Change in import shock variable of US (intermediate)	-0.00004	***							-0.00004	***						
	[0.0000]								[0.0000]							
Change in import shock variable of US (final)	-0.00004	***							-0.00002							
	[0.0000]								[0.0000]							
Change in import shock variable of US (capital)	0.00004	***							0.00003	***						
	[0.0000]								[0.0000]							
Change in *ChinaImport* (intermediate), lag			0.00004	***							0.0000003	***				
			[0.0000]								[0.0000]					
Change in *ChinaImport* (final), lag			-0.00001	***							-0.00001	***				
			[0.0000]								[0.0000]					
Change in *ChinaImport* (capital), lag			-0.00001	*							-0.000004					
			[0.0000]								[0.0000]					
Change in import shock variable of US (intermediate), lag			-0.000005								0.0000003					
			[0.0000]								[0.0000]					
Change in import shock variable of US (final), lag			0.00001								0.00001					
			[0.0000]								[0.0000]					
Change in import shock variable of US (capital), lag			-0.000003								-0.000008					
			[0.0000]								[0.0000]					
Change in the share of imports from China (intermediate)					0.0107	***							0.0112	***		
					[0.0013]								[0.0015]			
Change in the share of imports from China (final)					-0.0047	***							-0.0064	***		
					[0.0008]								[0.0010]			
Change in the share of imports from China (capital)					-0.0037	***							-0.0028	**		
					[0.0011]								[0.0013]			
Change in the share of imports from US (intermediate)					-0.0011								0.0016			
					[0.0016]								[0.0019]			
Change in the share of imports from US (final)					0.0021								0.0019			
					[0.0016]								[0.0019]			
Change in the share of imports from US (capital)					-0.0042	***							-0.0063	***		
					[0.0011]								[0.0014]			
Change in the share of imports from China, lag (intermediate)							-0.0061	***							-0.0029	*
							[0.0013]								[0.0016]	
Change in the share of imports from China, lag (final)							-0.0013								-0.0023	**
							[0.0008]								[0.0010]	
Change in the share of imports from China, lag (capital)							0.0034	***							0.0042	***
							[0.0011]								[0.0013]	
Change in the share of imports from US, lag (intermediate)							0.0009								0.0066	***
							[0.0017]								[0.0020]	
Change in the share of imports from US, lag (final)							-0.0044	**							-0.0038	*
							[0.0018]								[0.0020]	
Change in the share of imports from US, lag (capital)							-0.0101	***							-0.0107	***
							[0.0012]								[0.0015]	
Log of the number of employees	0.0221	***	0.0222	***	0.0221	***	0.0222	***	0.0263	***	0.0262	***	0.0263	***	0.0262	***
	[0.0001]		[0.0001]		[0.0001]		[0.0001]		[0.0001]		[0.0002]		[0.0001]		[0.0002]	
Log of value-added productivity	-0.0205	***	-0.0204	***	-0.0206	***	-0.0204	***	-0.0223	***	-0.0221	***	-0.0223	***	-0.0221	***
	[0.0001]		[0.0002]		[0.0001]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]	
Export dummy	-0.0141	***	-0.0136	***	-0.0141	***	-0.0136	***	-0.0113	***	-0.0105	***	-0.0113	***	-0.0105	***
	[0.0005]		[0.0006]		[0.0005]		[0.0006]		[0.0008]		[0.0008]		[0.0008]		[0.0008]	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Observations	2,584,862		2,330,268		2,584,862		2,330,268		1,685,323		1,503,322		1,685,323		1,503,322	
R-squared	0.030		0.030		0.030		0.030		0.034		0.034		0.034		0.034	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 7 Estimation results (male workers, by product type)

	All establishments								Independent establishment							
	Change in employment of male workers															
Change in *ChinaShock* (intermediate)	0.00004	***							0.00005	***						
	[0.0000]								[0.0000]							
Change in *ChinaShock* (final)	-0.000004	***							-0.000005	***						
	[0.0000]								[0.0000]							
Change in *ChinaShock* (capital)	-0.00001								-0.00002							
	[0.0000]								[0.0000]							
Change in import shock variable of US (intermediate)	-0.00003	***							-0.00004	***						
	[0.0000]								[0.0000]							
Change in import shock variable of US (final)	-0.00005	***							-0.00004	*						
	[0.0000]								[0.0000]							
Change in import shock variable of US (capital)	0.00004	***							0.00004	***						
	[0.0000]								[0.0000]							
Change in *ChinaShock* (intermediate), lag			0.00004	***							0.00004	***				
			[0.0000]								[0.0000]					
Change in *ChinaShock* (final), lag			-0.00001	***							-0.00001	***				
			[0.0000]								[0.0000]					
Change in *ChinaShock* (capital), lag			-0.00001								0.000009					
			[0.0000]								[0.0000]					
Change in import shock variable of US (intermediate), lag			-0.00002	**							-0.00002	**				
			[0.0000]								[0.0000]					
Change in import shock variable of US (final), lag			-0.00001								0.00001					
			[0.0000]								[0.0000]					
Change in import shock variable of US (capital), lag			0.000001								0.000002					
			[0.0000]								[0.0000]					
Change in the share of imports from China (intermediate)					0.0072	***							0.0096	***		
					[0.0022]								[0.0026]			
Change in the share of imports from China (final)					-0.0052	***							-0.0054	***		
					[0.0014]								[0.0017]			
Change in the share of imports from China (capital)					-0.0012								0.0006			
					[0.0017]								[0.0019]			
Change in the share of imports from US (intermediate)					-0.0058	**							-0.0023			
					[0.0029]								[0.0034]			
Change in the share of imports from US (final)					0.0080	***							0.0089	***		
					[0.0027]								[0.0032]			
Change in the share of imports from US (capital)					-0.0057	***							-0.0057	**		
					[0.0019]								[0.0024]			
Change in the share of imports from China, lag (intermediate)							-0.0054	**							-0.0004	
							[0.0022]								[0.0027]	
Change in the share of imports from China, lag (final)							-0.0010								-0.0010	
							[0.0014]								[0.0017]	
Change in the share of imports from China, lag (capital)							0.0028								0.0053	***
							[0.0018]								[0.0020]	
Change in the share of imports from US, lag (intermediate)							-0.0013								0.0111	***
							[0.0030]								[0.0035]	
Change in the share of imports from US, lag (final)							-0.0088	***							-0.0005	
							[0.0029]								[0.0034]	
Change in the share of imports from US, lag (capital)							-0.0084	***							-0.0111	***
							[0.0019]								[0.0025]	
Log of the number of employees	0.0297	***	0.0297	***	0.0297	***	0.0297	***	0.0340	***	0.0339	***	0.0340	***	0.0339	***
	[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]		[0.0002]	
Log of value-added productivity	-0.0285	***	-0.0281	***	-0.0285	***	-0.0281	***	-0.0287	***	-0.0281	***	-0.0287	***	-0.0281	***
	[0.0002]		[0.0003]		[0.0002]		[0.0003]		[0.0003]		[0.0003]		[0.0003]		[0.0003]	
Export dummy	-0.0186	***	-0.0180	***	-0.0186	***	-0.0180	***	-0.0150	***	-0.0143	***	-0.0151	***	-0.0143	***
	[0.0008]		[0.0008]		[0.0008]		[0.0008]		[0.0012]		[0.0012]		[0.0012]		[0.0012]	
Year dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes		Yes		Yes		Yes		Yes	
Observations	2,603,065		2,346,952		2,603,065		2,346,952		1,689,022		1,506,506		1,689,022		1,506,506	
R-squared	0.018		0.018		0.018		0.018		0.020		0.021		0.020		0.021	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table 8 Estimation results (female workers, by product type)

	All establishments				Independent establishment	
	Change in employment of female workers					
Change in *ChinaShock* (intermediate)	0.00006 ***				0.00005 ***	
	[0.0000]				[0.0000]	
Change in *ChinaShock* (final)	-0.00001 ***				-0.000005 ***	
	[0.0000]				[0.0000]	
Change in *ChinaShock* (capital)	-0.00001				-0.00003 *	
	[0.0000]				[0.0000]	
Change in import shock variable of US (intermediate)	-0.00004 ***				-0.00003 ***	
	[0.0000]				[0.0000]	
Change in import shock variable of US (final)	-0.00006 ***				-0.00003	
	[0.0000]				[0.0000]	
Change in import shock variable of US (capital)	0.00004 ***				0.00003 ***	
	[0.0000]				[0.0000]	
Change in *ChinaShock* (intermediate), lag		0.00005 ***				0.00004 ***
		[0.0000]				[0.0000]
Change in *ChinaShock* (final), lag		-0.00001 ***				-0.00001 ***
		[0.0000]				[0.0000]
Change in *ChinaShock* (capital), lag		-0.00002				-0.00002
		[0.0000]				[0.0000]
Change in import shock variable of US (intermediate), lag		0.00001				0.00003 ***
		[0.0000]				[0.0000]
Change in import shock variable of US (final), lag		-0.00002				-0.000003
		[0.0000]				[0.0000]
Change in import shock variable of US (capital), lag		-0.00001				-0.000005
		[0.0000]				[0.0000]
Change in the share of imports from China (intermediate)			0.0109 ***			0.0077 **
			[0.0027]			[0.0031]
Change in the share of imports from China (final)			-0.0045 ***			-0.0056 ***
			[0.0017]			[0.0019]
Change in the share of imports from China (capital)			-0.0048 **			-0.0042
			[0.0023]			[0.0026]
Change in the share of imports from US (intermediate)			-0.0002			0.0035
			[0.0033]			[0.0037]
Change in the share of imports from US (final)			0.0012			0.0037
			[0.0034]			[0.0039]
Change in the share of imports from US (capital)			-0.0050 ***			-0.0083 ***
			[0.0024]			[0.0029]
Change in the share of imports from China, lag (intermediate)				-0.0112 ***		
				[0.0027]		
Change in the share of imports from China, lag (final)				-0.0018		
				[0.0017]		
Change in the share of imports from China, lag (capital)				0.0037		
				[0.0024]		
Change in the share of imports from US, lag (intermediate)				0.0073 **		
				[0.0034]		
Change in the share of imports from US, lag (final)				-0.0108 ***		
				[0.0037]		
Change in the share of imports from US, lag (capital)				-0.0088 ***		
				[0.0025]		
Log of the number of employees	0.0292 ***	0.0292 ***	0.0292 ***	0.0292 ***	0.0345 ***	0.0344 ***
	[0.0002]	[0.0002]	[0.0002]	[0.0002]	[0.0003]	[0.0003]
Log of value-added productivity	-0.0313 ***	-0.0307 ***	-0.0313 ***	-0.0307 ***	-0.0313 ***	-0.0307 ***
	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0003]	[0.0004]
Export dummy	-0.0148 ***	-0.0139 ***	-0.0148 ***	-0.0139 ***	-0.0116 ***	-0.0103 ***
	[0.0010]	[0.0010]	[0.0010]	[0.0010]	[0.0015]	[0.0016]
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,512,852	2,264,724	2,512,852	2,264,724	1,640,353	1,463,008
R-squared	0.013	0.013	0.013	0.013	0.015	0.015

	Independent establishment			
	Change in employment of female workers			
Change in *ChinaShock* (intermediate)				
Change in *ChinaShock* (final)				
Change in *ChinaShock* (capital)				
Change in import shock variable of US (intermediate)				
Change in import shock variable of US (final)				
Change in import shock variable of US (capital)				
Change in *ChinaShock* (intermediate), lag				
Change in *ChinaShock* (final), lag				
Change in *ChinaShock* (capital), lag				
Change in import shock variable of US (intermediate), lag				
Change in import shock variable of US (final), lag				
Change in import shock variable of US (capital), lag				
Change in the share of imports from China (intermediate)				
Change in the share of imports from China (final)				
Change in the share of imports from China (capital)				
Change in the share of imports from US (intermediate)				
Change in the share of imports from US (final)				
Change in the share of imports from US (capital)				
Change in the share of imports from China, lag (intermediate)				-0.0045
				[0.0032]
Change in the share of imports from China, lag (final)				-0.0032
				[0.0020]
Change in the share of imports from China, lag (capital)				0.0053 **
				[0.0026]
Change in the share of imports from US, lag (intermediate)				0.0137 ***
				[0.0039]
Change in the share of imports from US, lag (final)				-0.0067
				[0.0042]
Change in the share of imports from US, lag (capital)				-0.0100 ***
				[0.0030]
Log of the number of employees	0.0345 ***	0.0344 ***	0.0345 ***	0.0344 ***
	[0.0003]	[0.0003]	[0.0003]	[0.0003]
Log of value-added productivity	-0.0313 ***	-0.0307 ***	-0.0313 ***	-0.0307 ***
	[0.0003]	[0.0004]	[0.0003]	[0.0004]
Export dummy	-0.0116 ***	-0.0103 ***	-0.0116 ***	-0.0103 ***
	[0.0015]	[0.0016]	[0.0015]	[0.0016]
Year dummies	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes
Prefecture dummies	Yes	Yes	Yes	Yes
Observations	1,640,353	1,463,008	1,640,353	1,463,008
R-squared	0.015	0.015	0.015	0.015

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

4.3 Discussion

This section considers how the impact of imports from China and the United States on employment in Japan differs depending on the type of imported goods. Starting with imports from China, we found that imports of intermediate goods generally had a positive impact on employment. A possible interpretation is that using intermediate goods inputs from China allows Japanese firms to participate in global value chains (GVCs), which may have increased employment at business establishments in Japan. However, the lagged share variable had a negative sign. This result implies that if intermediate inputs originally imported from other countries were replaced by intermediate goods from China,

this may have had a negative impact on employment, albeit with a lag. That said, since the negative sign on the lagged import share variable does not apply to independent establishments and reflects the results for establishments belonging to multi-establishment firms, another interpretation is that it reflects employment adjustments between establishments, between establishments and headquarters, and between Japan and overseas branches. However, to examine whether intermediate goods imports from China boosted employment on a firm-level rather than an establishment-level basis, we would need to examine factors such as employment adjustments between establishments and the number of non-regular employees, which can be adjusted in a relatively short period of time. Turning to final goods imports from China, these were found to have a negative impact on employment in Japan. Finally, for capital goods imports, we found that the contemporaneous variables, i.e., those without a lag, had a negative coefficient. In other words, the use of capital goods inputs from China had a negative impact on employment at Japanese firms, and the effect was particularly pronounced for female workers. That said, using the lagged import share variable yielded a positive coefficient for independent establishments, suggesting that such imports may have had a positive impact on employment over the longer term. On the other hand, the results for capital goods imports from the United States are the exact opposite of those for imports from China, suggesting that how firms participate in GVCs plays an important role in the impact on employment.

Let us consider the differences between Chinese and U.S. capital goods . First, it has been pointed out that there are large unit price differences – by up to a factor of five – between Japanese and Chinese capital goods exported to the United States, indicating that capital goods from China are relatively cheap (Ministry of Economy, Trade and Industry 2012). Furthermore, many capital goods imports from China consist of general-purpose capital goods and are used for relatively simple tasks, which differs from the capital goods exported from the United States (Nagata 2005). This means that capital goods imports from China are likely to affect the employment of non-regular workers, who tend to be responsible for simple task. In terms of our econometric analysis, this means that they would mainly have a negative impact on the employment of women, assuming that women account for a large proportion of non-regular workers.

Turning to policy implication, it is important to have policy discussions regarding the participation in production networks and GVCs in which firms procure intermediate goods from developing countries such as China. For example, if trade in intermediate goods with China faced additional barriers, this could have a negative impact on employment in Japan. Moreover, for multi-establishment firms, the analysis suggested

that imports of intermediate goods from China could have a negative effect on employment in the long run. More detailed analyses are required to precisely quantify the effects. The results also indicated that imports of capital goods may negatively impact employment, especially for women. This suggests that policies that take the characteristics of workers and industries into account and that promote labor mobility not only within the same industry but also between different industries are necessary.

4.4 Limitations

Finally, some limitations of this study need to be mentioned. First, the indicator for the China shock used in this study does not measure spillover effects outside a prefecture. It is necessary to consider the spatial spillover effects of the China shock. It should also be noted that final goods in particular are not necessarily consumed within the prefecture where they are produced, which may distort the results. Therefore, measuring the China shock at the product level rather than at the industry level could produce important insights in this field. In addition, it is necessary to link establishment and firm-level statistics as well as product statistics for future research. Further, it would be helpful to include workers' skill level and type of employment as worker characteristics in future econometric analyses. Finally, export opportunities at the regional and firm level should also be included in the analysis.

5. Conclusion

The share of manufacturing workers in Japan's total employment has been on a declining trend since 2002. At the same time, imports from Asia, led by China, and low-income countries outside Asia have been increasing. Furthermore, the impact of imports from China – the so-called China shock – has differed by industry and region and has changed substantially over time. Even within Japan, there are industries and regions that were affected considerably by the China shock, while other industries and regions remained relatively unaffected.

Against this background, the present study empirically examined the impact of imports from China on employment focusing on business establishments in Japan from 2002 to 2014. We found that while the increase in imports of intermediate goods from China may have boosted employment in Japan in the short term, it likely had a negative effect on employment in the longer term. Additional analysis is required to interpret this long-term effect. Finally, the results show that capital goods from China have a negative impact on employment in Japan. This negative impact appears to be particularly pronounced for female workers.

These results indicate that in order for Japanese firms to achieve employment growth, it is important for them to participate in GVCs and use intermediate goods inputs mainly from Asia and low-income countries outside Asia. To do so, more open trade policies, including the reduction of unnecessary trade barriers, are required. Moreover, to boost employment, support for specific worker groups that have been negatively affected by capital goods imports, as well as measures to promote inter- and intra-industry labor mobility within regions and industries are essential.

Issues for future research include analyses that take spillover effects of the China shock across prefectures into account, that conduct product level analyses, and that take more detailed worker characteristics into account.

References

Acemoglu, D., Autor, D. H., Dorn, D., Hanson, G. H., and Price, B. (2016). Import Competition and the Great US Employment Sag of the 2000s. *Journal of Labor Economics*, 34 (S1), pp.141– 198.

Adachi, D., Fukai, T., Kawaguchi, D., and Saito, Y. U. (2021). Commuting Zones in Japan. *RIETI Discussion Paper*, 20-E-021.

Autor, D., Dorn, D., and Hanson, G. (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. *American Economic Review*, 103 (6), pp.2121–2168.

Balsvik, R. S. J., and Salvanes, K. G. (2015). Made in China, Sold in Norway: Local Labour Market Effects of an Import Shock. *Journal of Public Economics*, 127, pp.137–144.

Becker, S. O., Ekholm, K., and Muendler, M.-A. (2013). Offshoring and the Onshore Composition of Tasks and Skills. *Journal of International Economics*, 90 (1), pp. 91–106.

Bellone, F., and Matsuura, T. (2021). Import Competition and Product Churning: Evidence from Japanese Plant-Product-Level Data. *KEO Discussion Paper*, No.158.

Choi, J., and Xu, X. (2020). The Labor Market Effects of the China Syndrome: Evidence from South Korean Manufacturing. *The World Economy*, 43 (11), pp.3039–3087.

Ebenstein, A., Harrison, A., McMillan, M., and Phillips, S. (2014). Estimating the Impact of Trade and Offshoring on American Workers Using the Current Population Surveys. *The Review of Economics and Statistics*, 96 (4), pp.581–595.

Endoh, M. (2018). The Effect of Import Competition on Wages in the Japanese Manufacturing Sector. *Asian Economic Papers*, 17 (1), pp.46–67.

Hakkala, K. N., and Huttunen, K. (2016). Worker-Level Consequences of Import Shocks. IZA Institute of Labor Economics, *IZA Discussion Paper*, No.10033, July.

Hayakawa, K., Ito, T., and Urata, S. (2021). Impacts of Increased Chinese Imports on Japan's Labor Market. *Japan and the World Economy*, 59 (September), 101087.

Hummels, D., Jørgensen, R. Munch, J., and Xiang, C. (2014). The Wage Effects of Offshoring: Evidence from Danish Matched Worker-Firm Data. *American Economic Review*, 104 (6), pp. 1597–1629.

Inui, T., Edamura, K., and Matsuura, T. (2011). The Impact of Imports from Low-Wage Countries: The Role of Regional Characteristics on Plant Employment Growth and the Survival of Plants. *Economic Analysis*, 185, pp.1–21 (in Japanese).

Ito, K. (2005). Competition with Imports from Low- and Lower-Middle-Income Countries and its Impact on the Growth of Japanese Companies: Empirical Analysis Based on Micro-Data of the "Basic Survey of Japanese Business Structure and Activities." *RIETI Discussion Papers*, 05-J-028, pp.1–31 (in Japanese).

Kikuchi, M., Tamura, M., and Suzuki, G. (2022). Reasons for the Increase in Capital Goods Imports. Cabinet Office. *Monthly Topics*, No.68, pp.1–23 (in Japanese).

Kim, M. (2018). Rising Import Competition in Canada and its Employment Effect by Gender: Evidence from the 'China Shock.' *CSLS Research Report,* 2018-03.

Matsuura, T. (2022). Heterogeneous Impact of Import Competition on Firm Organization: Evidence from Japanese Firm-Level Data, *The World Economy*, 45 (7), pp.2251–2269.

Ministry of Economy, Trade and Industry (2012). *Trade White Paper, 2012*.

Murray, A. (2017). The Effect of Import Competition on Employment in Canada: Evidence from the 'China Shock.' *CSLS Research Report,* 2017-03.

Nagata, M. (2005). China's Rise as a Capital Goods Exporter (Part 2). *International Trade and Investment*, No. 61, pp.119–138 (in Japanese).

Saito, Y. U., Kainuma, S., and Fabinger, M. (2020). China's Impact on Regional Employment: Propagation through Supply Chains and Co-Agglomeration Pattern. *RIETI Discussion Paper*, 20-E-054.

Sasahara, A. (2022). The Empirics of the China Trade Shock: A Summary of Estimation Methods and a Literature Review. *Keio-IES Discussion Paper Series*, DP2022-008.

Taniguchi, M. (2019). The Effect of an Increase in Imports from China on Local Labor Markets in Japan. *Journal of the Japanese and International Economies*, 51 (March), pp.1–18.

Yamashita, N., and Yamauchi, I. (2020). Innovation Responses of Japanese Firms to Chinese Import Competition. *The World Economy*, 43 (1), pp.60–80.

Appendices

A. List of customs offices in Japan

Custom	Prefecture	Custom	Prefecture	Custom	Prefecture
Tokyo Customs (Headquarters)	Tokyo	Niihama Customs Branch	Ehime	Imari Customs Branch Karatsu Branch	Saga
Tokyo Customs Tokyo Foreign Mail Branch	Tokyo	Niihama Customs Branch Mishima Branch	Ehime	Imari Customs Branch	Saga
Tokyo Customs Tachikawa Branch	Tokyo	Matsuyama Customs Branch Uwajima Branch	Ehime	Izuhara Customs Branch	Nagasaki
Tokyo Customs Maebashi Branch	Tokyo	Kochi Customs Branch	Kochi	Izuhara Customs Branch Hitakatsu Branch	Nagasaki
Tokyo Customs Oi Branch	Tokyo	Kochi Customs Branch Susaki Branch	Kochi	Oita Customs Branch	Oita
Tokyo Customs Yamanashi Cabinet Office	Tokyo	Komatsushima Customs Branch	Tokushima	Oita Customs Branch Oita Airport Branch	Oita
Tokyo Customs Maebashi Branch Office Ota Cabinet Office	Tokyo	Osaka Customs (Honseki)	Osaka	Oita Customs Branch Tsukumi Branch	Oita
Tokyo Customs Tokyo Air Cargo Branch	Tokyo	Osaka Customs Osaka Foreign Mail Branch	Osaka	Oita Customs Branch Saiki Branch	Oita
Tokyo Customs Haneda Customs Branch	Tokyo	Osaka Customs Nanko Branch	Osaka	Hososhima Customs Branch	Miyazaki
Tokyo Customs Narita Air Cargo Branch	Chiba	Sakai Customs Branch	Osaka	Hososhima Customs Branch Miyazaki Airport Branch	Miyazaki
Narita Customs Branch	Chiba	Sakai Customs Branch Kishiwada Branch	Osaka	Hososhima Customs Branch Aburatsu Branch	Miyazaki
Niigata Customs Branch	Niigata	Kansai Airport Customs Branch	Osaka	Nagasaki Customs (Headquarters)	Nagasaki
Niigata Customs Branch Higashiko Branch Office	Niigata	Maizuru Customs Branch Miyazu Branch	Kyoto	Sasebo Customs Branch	Nagasaki
Niigata Customs Branch Sanjo/Tsubame Cabinet Office	Niigata	Kyoto Customs Branch	Kyoto	Nagasaki Customs Nagasaki Airport Branch	Nagasaki
Niigata Customs Branch Naoetsu Branch	Niigata	Kyoto Customs Branch Shiga Branch	Kyoto	Miike Customs Branch	Fukuoka
Niigata Customs Branch Kashiwazaki Branch	Niigata	Maizuru Customs Branch	Kyoto	Miike Customs Branch Kurume Branch	Fukuoka
Niigata Customs Branch Niigata Airport Branch	Niigata	Fushiki Customs Branch	Toyama	Yatsushiro Customs Branch Misumi Branch	Kumamoto
Sakata Customs Branch	Yamagata	Fushiki Customs Branch Toyama Branch	Toyama	Yatsushiro Customs Branch Minamata Branch	Kumamoto
Sakata Customs Branch Yamagata Branch	Yamagata	Fushiki Customs Branch Toyama Airport Branch	Toyama	Yatsushiro Customs Branch	Kumamoto
Yokohama Customs (Headquarters)	Kanagawa	Kanazawa Customs Branch Nanao Branch	Ishikawa	Yatsushiro Customs Branch Kumamoto Airport Branch	Kumamoto
Yokohama Customs Kawasaki Overseas Mail Branch	Kanagawa	Kanazawa Customs Branch	Ishikawa	Yatsushiro Customs Branch Kumamoto Branch	Kumamoto
Yokohama Customs Honmoku Pier Branch	Kanagawa	Kanazawa Customs Branch Komatsu Airport Branch	Ishikawa	Kagoshima Customs Branch	Kagoshima
Yokohama Customs Daikoku Wharf Branch	Kanagawa	Tsuruga Customs Branch	Fukui	Kagoshima Customs Branch Inase Surveillance Office	Kagoshima
Kawasaki Customs Branch	Kanagawa	Tsuruga Customs Branch Fukui Branch	Fukui	Kagoshima Customs Branch Kagoshima Airport Branch	Kagoshima
Yokosuka Customs Branch	Kanagawa	Wakayama Customs Branch Shimotsu Branch	Wakayama	Kagoshima Customs Branch Shibushi Branch	Kagoshima
Yokosuka Customs Branch Misaki Surveillance Station	Kanagawa	Wakayama Customs Branch	Wakayama	Kagoshima Customs Branch Kawauchi Branch	Kagoshima
Chiba Customs Branch	Chiba	Wakayama Customs Branch Shingu Branch	Wakayama	Kagoshima Customs Branch Makurazaki Branch	Kagoshima
Chiba Customs Branch Anesaki Branch	Chiba	Nagoya Customs (Honseki)	Aichi	Hakodate Customs (Honseki)	Hokkaido
Chiba Customs Branch Choshi Surveillance Station	Chiba	Nagoya Customs Chubu Foreign Mail Branch	Aichi	Muroran Customs Branch	Hokkaido
Chiba Customs Branch Funabashi Ichikawa Branch	Chiba	Nagoya Customs Southern Branch	Aichi	Tomakomai Customs Branch	Hokkaido
Chiba Customs Branch Kisarazu Branch	Chiba	Nagoya Customs Suwa Branch	Aichi	Otaru Customs Branch	Hokkaido
Kashima Customs Branch	Ibaraki	Nagoya Customs Suwa Branch Office Nagano Ordinance Branch	Aichi	Sapporo Customs Branch Rumoi Branch	Hokkaido
Kashima Customs Branch Hitachi Branch	Ibaraki	Nagoya Customs Western Branch	Aichi	Sapporo Customs Branch	Hokkaido
Kashima Customs Branch Tsukuba Branch	Ibaraki	Nagoya Customs Gifu Ordinance Branch	Aichi	Kushiro Customs Branch	Hokkaido
Kashima Customs Branch Ibaraki Airport Branch	Ibaraki	Chubu Airport Customs Branch	Aichi	Nemuro Customs Branch	Hokkaido
Onahama Customs Branch	Fukushima	Toyohashi Customs Branch	Aichi	Wakkanai Customs Branch	Hokkaido
Onahama Customs Branch Soma Branch	Fukushima	Community Verified icon	Aichi	Kushiro Customs Branch Abashiri Branch	Hokkaido
Onahama Customs Branch Fukushima Airport Branch	Fukushima	Toyohashi Customs Branch Kinuura Branch	Aichi	Kushiro Customs Branch Monbetsu Branch	Hokkaido
Sendai Shiogama Customs Branch	Miyagi	Shimizu Customs Branch	Shizuoka	Chitose Customs Branch	Hokkaido
Sendai Shiogama Branch Customs Ishinomaki Branch	Miyagi	Shimizu Customs Branch Yaizu Branch	Shizuoka	Otaru Customs Branch Ishikari Branch	Hokkaido
Sendai Shiogama Customs Branch Kesennuma Branch	Miyagi	Shimizu Customs Branch Numazu Branch	Shizuoka	Kushiro Customs Branch Tokachi Branch	Hokkaido
Sendai Airport Customs Branch	Miyagi	Shimizu Customs Branch Shimoda Surveillance Station	Shizuoka	Sapporo Customs Branch Asahikawa Airport Branch	Hokkaido
Yokohama Customs Utsunomiya Branch	Tochigi	Shimizu Customs Branch Hamamatsu Branch	Shizuoka	Aomori Customs Branch	Aomori
Kobe Customs (Headquarters)	Hyogo	Shimizu Customs Branch Okitsu Branch	Shizuoka	Hachinohe Customs Branch	Aomori
Kobe Customs Port Island Branch	Hyogo	Shimizu Customs Branch Tagonoura Branch	Shizuoka	Aomori Customs Branch Aomori Airport Branch	Aomori
Kobe Customs Rokko Island Branch	Hyogo	Shimizu Customs Branch Omaezaki Branch	Shizuoka	Kamaishi Customs Branch Miyako Branch	Iwate
Amagasaki Customs Branch	Hyogo	Shimizu Customs Branch Shizuoka Airport Branch	Shizuoka	Kamaishi Customs Branch	Iwate
Himeji Customs Branch	Hyogo	Yokkaichi Customs Branch	Mie	Ofunato Customs Branch	Iwate
Himeji Customs Branch Higashiharima Branch	Hyogo	Yokkaichi Customs Branch Owase Branch	Mie	Akita Funagawa Customs Branch	Akita
Mizushima Customs Branch Uno Branch	Okayama	Yokkaichi Customs Branch Tsu Branch	Mie	Akita Funagawa Customs Branch Akita Airport Branch	Akita
Okayama Airport Customs Branch	Okayama	Moji Customs (Honseki)	Fukuoka	Okinawa District Customs (Honoseki)	Okinawa
Mizushima Customs Branch	Okayama	Moji Customs Fukuoka Foreign Mail Branch	Fukuoka	Okinawa District Customs Naha Foreign Mail Branch	Okinawa
Mizushima Customs Branch Katakami Branch	Okayama	Moji Customs Tanoura Branch	Fukuoka	Okinawa District Customs Kagamizu Branch Office	Okinawa
Fukuyama Customs Branch Onomichi Itozaki Branch	Hiroshima	Moji Customs Kanda Branch	Fukuoka	Okinawa Customs Branch	Okinawa
Fukuyama Customs Branch	Hiroshima	Tobata Customs Branch	Fukuoka	Okinawa Customs Branch Henza Branch Office	Okinawa
Hiroshima Customs Branch Kure Branch	Hiroshima	Tobata Customs Branch Wakamatsu Branch	Fukuoka	Ishigaki Customs Branch Hirara Branch	Okinawa
Hiroshima Customs Branch	Hiroshima	Hakata Customs Branch	Fukuoka	Ishigaki Customs Branch	Okinawa
Hiroshima Airport Customs Branch	Hiroshima	Fukuoka Airport Customs Branch	Fukuoka	Ishigaki Customs Branch Yonaguni Surveillance Station	Okinawa
Border customs branch	Chiba	Moji Customs Kitakyushu Airport Branch	Fukuoka	Naha Airport Customs Branch	Okinawa
Hamada Customs Branch	Shimane	Lower Customs Branch	Yamaguchi	Ishigaki Customs Branch Ishigaki Airport Branch	Okinawa
Sakaide Customs Branch	Kagawa	Shimo Customs Branch Hagi Branch	Yamaguchi		
Sakaide Customs Branch Takamatsu Branch	Kagawa	Shimo Customs Branch Ube Branch	Yamaguchi		
Sakaide Customs Branch Takuma Branch	Kagawa	Tokuyama Customs Branch	Yamaguchi		
Takamatsu Airport Customs Branch	Kagawa	Tokuyama Customs Branch Hofu Branch	Yamaguchi		
Matsuyama Customs Branch	Ehime	Tokuyama Customs Branch Hirao Branch	Yamaguchi		
Matsuyama Customs Branch Imabari Branch	Ehime	Iwakuni Customs Branch	Yamaguchi		

B. Conversion table (JIP 2018 and categories in the freight statistics)

JIP	definition	Category	definition	JIP	definition	Category	definition
1	Agriculture	1	Agricultural and marine products	31	Smelting and refining of non-ferrous metals	4	Metal machinery industrial products
2	Agricultural services	1	Agricultural and marine products	32	Non-ferrous metal products	4	Metal machinery industrial products
3	Forestry	2	Hayashi products	33	Fabricated constructional and architectural metal products	4	Metal machinery industrial products
4	Fisheries	1	Agricultural and marine products	34	Miscellaneous fabricated metal products	4	Metal machinery industrial products
5	Mining	3	Mineral products	35	General-purpose machinery	4	Metal machinery industrial products
6	Livestock products	6	Light industrial products	36	Production machinery	4	Metal machinery industrial products
7	Seafood products	6	Light industrial products	37	Office and service industry machines	4	Metal machinery industrial products
8	Flour and grain mill products	6	Light industrial products	38	Miscellaneous business oriented machinery	4	Metal machinery industrial products
9	Miscellaneous foods and related products	6	Light industrial products	39	Ordnance	4	Metal machinery industrial products
10	Beverages	6	Light industrial products	40	Semiconductor devices and integrated circuits	4	Metal machinery industrial products
11	Prepared animal foods and organic fertilizers	9	Special items	41	Miscellaneous electronic components and devices	4	Metal machinery industrial products
12	Tobacco	6	Light industrial products	42	Electrical devices and parts	4	Metal machinery industrial products
13	Textile products (except chemical fibers)	6	Light industrial products	43	Household electric appliances	4	Metal machinery industrial products
14	Chemical fibers	5	Chemical industry products	44	Electronic equipment and electric measuring instruments	4	Metal machinery industrial products
15	Pulp, paper, and coated and glazed paper	6	Light manufacturing products	45	Miscellaneous electrical machinery equipment	4	Metal machinery industrial products
16	Paper products	7	Miscellaneous industrial products	46	Image and audio equipment	4	Metal machinery industrial products
17	Chemical fertilizers	5	Chemical industry products	47	Communication equipment	4	Metal machinery industrial products
18	Basic inorganic chemicals	5	Chemical industry products	48	Electronic data processing machines, digital and analog computer equipment and accessories	4	Metal machinery industrial products
19	Basic organic chemicals	5	Chemical industry products	49	Motor vehicles (including motor vehicles bodies)	4	Metal machinery industrial products
20	Organic chemicals	5	Chemical industry products	50	Motor vehicle parts and accessories	4	Metal machinery industrial products
21	Pharmaceutical products	5	Chemical industry products	51	Other transportation equipment	4	Metal machinery industrial products
22	Miscellaneous chemical products	5	Chemical industry products	52	Printing	7	Miscellaneous industrial products
23	Petroleum products	5	Chemical industry products	53	Lumber and wood products	2	Forestry products
24	Coal products	3	Mineral products	54	Furniture and fixtures	7	Miscellaneous industrial products
25	Glass and its products	5	Chemical industry products	55	Plastic products	5	Chemical industry products
26	Cement and its products	5	Chemical industry products	56	Rubber products	7	Miscellaneous industrial products
27	Pottery	5	Chemical industry products	57	Leather and leather products	7	Miscellaneous industrial products
28	Miscellaneous ceramic, stone and clay products	5	Chemical industry products	58	Watches and clocks	4	Metal machinery industry products
29	Pig iron and crude steel	4	Metal machinery industrial products	59	Miscellaneous manufacturing industries	7	Miscellaneous industrial products
30	Miscellaneous iron and steel	4	Metal machinery industrial products				

C. *ChinaImport* variable for final products

We need to consider the fact that final products are not consumed only within the prefecture where the goods are produced. We define the import shock of imports of final products from China as follows:

$$ChinaImport\_final_{mklt} = \sum_{i=1}^{40}(IM_{iklt} \cdot Share_{mikt}) \qquad (3)$$

where *m* represents the prefecture, *k* the industry, and *t* the year. That is, the China shock for final products is calculated as the value of imports from China in industry *k* in year *t* that passed customs in one of the 40 prefectures that have customs offices multiplied by the freight share from prefecture *m* to each prefecture.

Table C.1 Estimation results (total employment, by product type)

	All establishments				Independent establishments			
	Change in employment							
Change in *ChinaImport* (intermediate)	0.00002	***			0.00002	***		
	[0.0000]				[0.0000]			
Change in *ChinaImport* (final)	-0.00002	***			-0.00002	***		
	[0.0000]				[0.0000]			
Change in *ChinaImport* (capital)	0.00001	***			0.00002	***		
	[0.0000]				[0.0000]			
Change in import shock variable of US (intermediate)	0.00000				-0.00001			
	[0.0001]				[0.0000]			
Change in import shock variable of US (final)	-0.00007	***			-0.00011	***		
	[0.0001]				[0.0000]			
Change in import shock variable of US (capital)	0.00000				0.00001			
	[0.0000]				[0.0000]			
Change in *ChinaImport* (intermediate), lag			0.00001	**			0.00000	
			[0.0000]				[0.0000]	
Change in *ChinaImport* (final), lag			-0.00002	***			-0.00002	***
			[0.0000]				[0.0000]	
Change in *ChinaImport* (capital), lag			0.00000				0.00001	**
			[0.0000]				[0.0000]	
Change in import shock variable of US (intermediate), lag			0.00001				0.00000	
			[0.0000]				[0.0000]	
Change in import shock variable of US (final), lag			0.00005	***			0.00011	***
			[0.0000]				[0.0000]	
Change in import shock variable of US (capital), lag			-0.00001				-0.00001	
			[0.0000]				[0.0000]	
Log of the number of employees	0.0221	***	0.0221	***	0.0263	***	0.0264	***
	[0.0001]		[0.0001]		[0.0001]		[0.0002]	
Log of value-added productivity	-0.0205	***	-0.0205	***	-0.0223	***	-0.0222	***
	[0.0001]		[0.0002]		[0.0002]		[0.0002]	
Export dummy	-0.0141	***	-0.0140	***	-0.0112	***	-0.0113	***
	[0.0005]		[0.0006]		[0.0008]		[0.0008]	
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes	
Observations	2,584,862		2,330,268		1,685,323		1,503,322	
R-squared	0.030		0.030		0.034		0.034	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table C.2 Estimation results (male workers, by product type)

	All establishments				Independent establishments			
	Change in employment of male workers							
Change in *ChinaImport* (intermediate)	0.00002	***			0.00002	***		
	[0.0000]				[0.0000]			
Change in *ChinaImport* (final)	-0.00002	***			-0.00002	***		
	[0.0000]				[0.0000]			
Change in *ChinaImport* (capital)	0.00001	***			0.00002	***		
	[0.0000]				[0.0000]			
Change in import shock variable of US (intermediate)	-0.00003				-0.00001			
	[0.0000]				[0.0000]			
Change in import shock variable of US (final)	-0.00008	***			-0.00009	***		
	[0.0000]				[0.0000]			
Change in import shock variable of US (capital)	0.00004				0.00000			
	[0.0000]				[0.0000]			
Change in *ChinaImport* (intermediate), lag			0.00002	***			0.00001	**
			[0.0000]				[0.0000]	
Change in *ChinaImport* (final), lag			-0.00002	***			-0.00001	***
			[0.0000]				[0.0000]	
Change in *ChinaImport* (capital), lag			0.00001				0.00001	**
			[0.0000]				[0.0000]	
Change in import shock variable of US (intermediate), lag			-0.00001				0.00000	
			[0.0000]				[0.0000]	
Change in import shock variable of US (final), lag			-0.00008	***			-0.00008	***
			[0.0000]				[0.0000]	
Change in import shock variable of US (capital), lag			-0.00002				0.00001	
			[0.0000]				[0.0000]	
Log of the number of employees	0.0297	***	0.0297	***	0.0340	***	0.0339	***
	[0.0002]		[0.0002]		[0.0002]		[0.0002]	
Log of value-added productivity	-0.0285	***	-0.0281	***	-0.0287	***	-0.0281	***
	[0.0003]		[0.0003]		[0.0003]		[0.0003]	
Export dummy	-0.0186	***	-0.0180	***	-0.0150	***	-0.0143	***
	[0.0008]		[0.0008]		[0.0012]		[0.0012]	
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes	
Observations	2,603,065		2,603,065		1,689,022		1,689,022	
R-squared	0.018		0.018		0.020		0.020	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

Table C.3 Estimation results (female workers, by product type)

	All establishments				Independent establishments			
	Change in employment of female workers							
Change in *ChinaImport* (intermediate)	0.00002	***			0.00002	***		
	[0.0000]				[0.0000]			
Change in *ChinaImport* (final)	-0.00003	***			-0.00003	***		
	[0.0000]				[0.0000]			
Change in *ChinaImport* (capital)	0.00002	***			0.00002	***		
	[0.0000]				[0.0000]			
Change in import shock variable of US (intermediate)	0.00020	*			0.00002			
	[0.0000]				[0.0000]			
Change in import shock variable of US (final)	-0.00006	**			-0.00008	***		
	[0.0000]				[0.0000]			
Change in import shock variable of US (capital)	0.00002				0.00003	**		
	[0.0000]				[0.0000]			
Change in *ChinaImport* (intermediate), lag			0.00001	***			0.00001	
			[0.0000]				[0.0000]	
Change in *ChinaImport* (final), lag			-0.00003	***			-0.00003	***
			[0.0000]				[0.0000]	
Change in *ChinaImport* (capital), lag			0.00000				0.00000	
			[0.0000]				[0.0000]	
Change in import shock variable of US (intermediate), lag			0.00001				0.00003	**
			[0.0000]				[0.0000]	
Change in import shock variable of US (final), lag			-0.00005	**			-0.00006	**
			[0.0000]				[0.0000]	
Change in import shock variable of US (capital), lag			-0.00001				0.00003	**
			[0.0000]				[0.0000]	
Log of the number of employees	0.0292	***	0.0292	***	0.0345	***	0.0344	***
	[0.0002]		[0.0002]		[0.0003]		[0.0003]	
Log of value-added productivity	-0.0313	***	-0.0307	***	-0.0313	***	-0.0307	***
	[0.0003]		[0.0003]		[0.0003]		[0.0004]	
Export dummy	-0.0148	***	-0.0139	***	-0.0116	***	-0.0103	***
	[0.0010]		[0.0010]		[0.0015]		[0.0016]	
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes	
Observations	2,512,852		2,512,852		1,640,353		1,463,008	
R-squared	0.013		0.013		0.015		0.015	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively.

We also calculate the *IM* stands for the amount of imports in 100,000,000,000 yen for calculating the import shock of imports from China as the value of coefficient on *ImportShock* variables are quite small. Again, we include $ChinaImport\_final$ as import shock variable for final products.

Table C.4 Estimation results (total employment, by product type)

	All establishments				Independent establishments			
	Change in employment							
Change in *ChinaImport* (intermediate)	0.0167	***			0.017	***		
	[0.002]				[0.002]			
Change in *ChinaImport* (final)	-0.0240	***			-0.024	***		
	[0.003]				[0.002]			
Change in *ChinaImport* (capital)	0.015	***			0.018	***		
	[0.003]				[0.004]			
Change in import shock variable of US (intermediate)	0.000				-0.007			
	[0.000]				[0.007]			
Change in import shock variable of US (final)	-0.069	***			-0.115	***		
	[0.014]				[0.016]			
Change in import shock variable of US (capital)	-0.001				-0.006	***		
	[0.006]				[0.007]			
Change in *ChinaImport* (intermediate), lag			0.004	**			0.002	
			[0.002]				[0.002]	
Change in *ChinaImport* (final), lag			-0.022	***			-0.022	***
			[0.001]				[0.002]	
Change in *ChinaImport* (capital), lag			0.005	*			0.008	**
			[0.003]				[0.003]	
Change in import shock variable of US (intermediate), lag			0.009				0.002	
			[0.006]				[0.007]	
Change in import shock variable of US (final), lag			0.050	***			-0.108	***
			[0.013]				[0.016]	
Change in import shock variable of US (capital), lag			-0.013				-0.012	
			[0.006]				[0.007]	
Log of the number of employees	0.022	***	0.022	***	0.026	***	0.026	***
	[0.000]		[0.000]		[0.000]		[0.000]	
Log of value-added productivity	-0.021	***	-0.020	***	-0.022	***	-0.022	***
	[0.000]		[0.000]		[0.000]		[0.000]	
Export dummy	-0.014	***	-0.014	***	-0.011	***	-0.011	***
	[0.000]		[0.000]		[0.001]		[0.001]	
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes	
Observations	2,584,862		2,584,862		1,685,323		1,685,323	
R-squared	0.030		0.030		0.034		0.034	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. The *IM* stands for the amount of imports in 100,000,000,000 yen for calculating the import shock of imports from China.

Table C.5 Estimation results (male workers, by product type)

	All establishments				Independent establishments			
	Change in employment of male workers							
Change in *ChinaImport* (intermediate)	0.021	***			0.023	***		
	[0.003]				[0.004]			
Change in *ChinaImport* (final)	-0.023	***			-0.016	***		
	[0.002]				[0.003]			
Change in *ChinaImport* (capital)	0.014	***			0.017	***		
	[0.004]				[0.005]			
Change in import shock variable of US (intermediate)	0.003				-0.009			
	[0.086]				[0.010]			
Change in import shock variable of US (final)	-0.081	***			-0.091	***		
	[0.021]				[0.027]			
Change in import shock variable of US (capital)	0.003				-0.002			
	[0.009]				[0.011]			
Change in *ChinaImport* (intermediate), lag			0.016	***			0.090	**
			[0.003]				[0.004]	
Change in *ChinaImport* (final), lag			-0.021	***			-0.014	***
			[0.002]				[0.003]	
Change in *ChinaImport* (capital), lag			0.005				0.011	**
			[0.004]				[0.005]	
Change in import shock variable of US (intermediate), lag			-0.006				0.005	
			[0.009]				[0.010]	
Change in import shock variable of US (final), lag			-0.078	***			-0.076	***
			[0.021]				[0.026]	
Change in import shock variable of US (capital), lag			-0.021	**			-0.008	
			[0.010]				[0.011]	
Log of the number of employees	0.030	***	0.030	***	0.034	***	0.034	***
	[0.000]		[0.000]		[0.000]		[0.000]	
Log of value-added productivity	-0.029	***	-0.028	***	-0.029	***	-0.028	***
	[0.000]		[0.000]		[0.000]		[0.000]	
Export dummy	-0.019	***	-0.018	***	-0.015	***	-0.014	***
	[0.000]		[0.000]		[0.000]		[0.000]	
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes	
Observations	2,603,065		2,603,065		1,689,022		1,689,022	
R-squared	0.018		0.018		0.020		0.021	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. The *IM* stands for the amount of imports in 100,000,000,000 yen for calculating the import shock of imports from China.

Table C.6 Estimation results (female workers, by product type)

	All establishments				Independent establishments			
	Change in employment of female workers							
Change in *ChinaImport* (intermediate)	0.024	***			0.022	***		
	[0.003]				[0.004]			
Change in *ChinaImport* (final)	-0.028	***			-0.028	***		
	[0.003]				[0.003]			
Change in *ChinaImport* (capital)	0.021	***			0.020	***		
	[0.005]				[0.006]			
Change in import shock variable of US (intermediate)	0.017				0.018			
	[0.010]				[0.012]			
Change in import shock variable of US (final)	-0.061	**			-0.080	**		
	[0.025]				[0.031]			
Change in import shock variable of US (capital)	0.016				0.032	**		
	[0.012]				[0.014]			
Change in *ChinaImport* (intermediate), lag			0.015	***			0.006	
			[0.004]				[0.005]	
Change in *ChinaImport* (final), lag			-0.028	***			-0.027	***
			[0.002]				[0.003]	
Change in *ChinaImport* (capital), lag			0.004				0.003	
			[0.005]				[0.006]	
Change in import shock variable of US (intermediate), lag			0.011				0.030	**
			[0.010]				[0.013]	
Change in import shock variable of US (final), lag			-0.053	**			-0.063	**
			[0.024]				[0.030]	
Change in import shock variable of US (capital), lag			-0.012				0.030	**
			[0.011]				[0.014]	
Log of the number of employees	0.029	***	0.029	***	0.035	***	0.034	***
	[0.000]		[0.000]		[0.000]		[0.000]	
Log of value-added productivity	-0.031	***	-0.031	***	-0.031	***	-0.031	***
	[0.000]		[0.000]		[0.000]		[0.000]	
Export dummy	-0.015	***	-0.014	***	-0.012	***	-0.010	***
	[0.001]		[0.001]		[0.001]		[0.002]	
Year dummies	Yes		Yes		Yes		Yes	
Industry dummies	Yes		Yes		Yes		Yes	
Prefecture dummies	Yes		Yes		Yes		Yes	
Observations	2,512,852		2,512,852		1,640,353		1,640,353	
R-squared	0.013		0.013		0.015		0.015	

Note: Cluster-robust standard errors (at the establishment level) are reported in parentheses. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. The *IM* stands for the amount of imports in 100,000,000,000 yen for calculating the import shock of imports from China.