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China Shock on Japanese Firms: Firms' differential reactions to the increase in Chinese imports

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China shock on Japanese firms: Firms' differential reactions to the increase in Chinese imports[1]

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Abstract

This study investigates the impact of import competition from China, using the firm/establishment level data from the Census of Manufacturer with a particular focus on firms' choice of multiple reactions. We find that product switching is an important reaction for firms facing increasingly harsh competition with imports from China. Firms tend to choose, first, employment adjustment only, and then with stronger import competition, product switching only, and finally, both of employment adjustment and product switching as import competition from China increases.

Keywords: Import competition, China, Japan, Employment adjustment, Product switching
JEL classification: D21, F15, F53

[1]This study is conducted as a part of the Project "Globalization and the Japanese Economy: Firm Adjustment and Global Trade Governance" undertaken at the Research Institute of Economy, Trade and Industry (RIETI). This study uses data from the questionnaire information based on the "Census of Manufacture" (Ministry of Economy, Trade and Industry) and "Economic Census for Business Activity" (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry). We also utilize the Census of Manufacture's plant-id converter, which are provided by RIETI. The author is grateful for helpful comments and suggestions by Shujiro Urata (Waseda Univ.), Kazunobu Hayakawa (Institute for Developing Economies), Kenta Yamanouchi (Kagawa Univ.), Makoto Yano (RIETI), Masayuki Morikawa (RIETI), Yasuyuki Todo (Waseda Univ.) and Discussion Paper seminar participants at RIETI.
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1. INTRODUCTION

Globalization has resulted in more integrated markets worldwide, thereby altering the competitive environment in which firms operate. Opening up to international trade puts domestic firms under more competitive pressure. Imports from low-wage countries have increased recently, and their impact has become a major research topic in international trade literature. Imports from China have increased since its accession to the World Trade Organization in 2001. In 2009 and 2010, China become the world's largest exporter in 2009 and the world's second-largest economy in 2010. China's rise and its consequences have sparked widespread concerns in many developed countries.

The early pioneering studies on the effects of a rapid increase in Chinese imports on the labor market focused on the U.S. labor market. However, imports from China may be even more remarkable in countries other than the United States, particularly in Korea and Japan, which are China's neighbors. Figure 1 shows the import penetration ratio from China for U.S., Japan, UK, France, Germany, and South Korea. Since the late 1990s, South Korea and Japan have had much higher and increasing import ratios from China. Because of this high penetration rate, studies on the Japanese labor market are especially important. Simultaneously, the number of Japanese manufacturing workers has significantly decreased. Table 1 shows the number and share of manufacturing workers, originally calculated using the population census. From 2000 to 2015, the proportion of manufacturing workers in total employment fell from 19% to 15%.

== Table 1 ==

Unlike previous studies that focused on the impact of Chinese import competition on employment adjustment, this study investigates how firms respond to import competition by combining innovation strategies such as product switching with employment adjustment. Furthermore, we investigate heterogeneity across firm types, for example single-product, multi-product, and subcontractor firms

The findings of this study are summarized as follows. First, product switching appears to be an important reaction for firms facing increasingly fierce competition from Chinese imports. Second, faced with the import competition from China, firms tend to choose, first, employment adjustment only, and then with stronger import competition, product switching only, and finally, with even more fierce competition, both of employment adjustment and product switching.

The remainder of this paper is organized as follows. Section 2 begins with a review of the literature. Section 3 provides an overview of the data and empirical specification. Section 4 presents the estimation results, and Section 5 concludes the paper.

2. LITERATURE

Numerous studies have been conducted to investigate the impact on employment of competitive pressures caused by imports from emerging market countries such as China. For example, Autor et al. (2013) found that an increase in Chinese imports to the U.S. had a significant negative impact on local labor markets (Acemoglu et al., 2016). Since these seminal works, studies on other developed countries have found that France (Malgouyres, 2017), Norway (Balsvik et al., 2015), Spain (Donoso et al., 2015), and Portugal (Branstetter et al., 2019) have all experienced significant negative effects on employment.

In contrast, empirical results from Germany and Japan differ from those from the U.S. and Europe. For example, Dauth et al. (2014) compared the impact of imports from Eastern Europe to those from China on local labor markets in Germany. They demonstrated that the negative impact of imports from Eastern Europe is greater than the negative impact of imports from China, and that the negative impact of import exposure is mitigated by increased exports. Meanwhile, Taniguchi (2018) investigated the effect of rising Chinese imports on the Japanese labor market. She found that the effect of Chinese imports is not negative, but rather positive, particularly when focusing on the import of intermediate goods. Moreover, Hayakawa et al. (2021) used Japanese firm/plant-level data set and found negative employment impacts on industries competing with Chinese imports, which are primarily driven by firm exit. They also discovered that increases in imports in the upstream industry have a positive effect on surviving firms.

Firms' responses to import competition are not limited to firm closures and employment adjustments. Firms may switch industries to avoid import competition, or they may combine employment adjustment with an industry change. Several previous studies have looked into the effects of import competition on firm exit strategies. Bernard et al. (2006) used U.S. manufacturing plant-level data set to investigate the impact of international competition through increases in low-wage country imports on plant survival, growth, and industry switching. They found that plant survival and growth are disproportionately lower in industries that are more exposed to low-wage imports. Furthermore, plants that are subjected to higher levels of imports from low-wage countries are more likely to switch industries.

Following Bernard et al. (2006), Greenaway et al. (2008) and Miranda et al. (2011) also examined the exit strategy in response to import competition. Greenaway et al. (2008) examined the impact of import competition on various firm strategies such as firm closure, switching industries and M&A using Swedish firm-level data in the period from 1980 to 1996 and estimating multinomial logit model. They revealed that greater exposure to import

competition causes firm closure and M&A, but no correlation with switching probability is found. They also distinguished between imports from different countries of origin and discovered that imports from non-OECD countries have a greater impact on corporate closures than imports from OECD countries, but the opposite is true for M&A. Meanwhile, Miranda et al. (2011) broadened the analysis to consider the impact of both import competition and expanding export opportunities in the case of an emerging country. They use d Estonian firm-level data from 1997 to 2005 and found that Estonian firms switch industry in response to expanding export opportunities rather than import exposure to. Interestingly, neither export nor import had any effect on firm exit in Estonia.

In summary, existing research has yielded conflicting results regarding the relationship between the impact of imports from low-income countries and firms' exit strategies. One possible explanation for the inconclusive findings is that most studies on firm exit strategies have focused on the 1990s and early 2000s. These were the times before the rapid increase in imports from developing countries, particularly China. According to the first group of studies, the impact of low-wage imports may have been more pronounced in the 2000s and 2010s. Against this backdrop, this paper examines the impact of import competition using data that spans the entire period of the emergence of China's competitive pressure.

3. DATA AND EMPIRICAL FRAMEWORK

3.1. *Data*

We used data from Japan's Census of Manufacture and the Economic Census for Business Activity, which were compiled by the Ministry of Economy, Trade, and Industry and the Ministry of Internal Affairs and Communications. The Census of Manufacture was conducted as part of the Economic Census for Business Activity in 2011 and 2015. It was conducted to clarify the actual conditions of the nation's manufacturing industry and to collect basic data for developing and analyzing industry-related policies. The censuses cover all manufacturing establishments in Japan with four or more employees, except 1998, 2000, 2003, 2005, and 2008, when all establishments are covered. The questionnaires must be completed by all establishments. The response rate is approximately 95%. Furthermore, this study uses data from plants with four or more employees, which number between 200,000 and 300,000 establishments each year. The total number of establishments decreased from approximately 350,000 in 1996 to around 200,000 in 2014. In this study, we use data from 1996, which is the

first year for which data are available, up to 2014.[1] The census provides plant-level information on the location, number of employees, cost of material input, and value of shipment by-product at six-digit level.[2] These data also enable us to identify firms that receive raw materials from client firms, process them, and receive processing fees; we refer to these firms as subcontractors, and we highlight the impact of import competition on subcontractors. Because the subcontractor product classification is only available at the four-digit level, we aggregate the six-digit product-level data to the four-digit level.

We aggregate establishment level data to the firm level as a unit of analysis because decisions such as employment adjustments are made at the firm level. The census datasets include a list of the names and locations of multiple plant firms' headquarters. However, because there is no consistent firm id number to track each firm over time, we create a permanent firm id based on firm name, location, and paid-up capital, and then create a firm-level panel dataset. The product code of the sales item with the largest share at the 4-digit level within a firm defined the firm's industry classification.

The data on production value, which are used to calculate the import penetration variable, are also derived from censuses. There are approximately 1200 "products" at the six-digit level in these censuses. The data on Japan's imports from China and the rest of the world are obtained from Japan Customs under the Ministry of Finance. These data are available at the tariff-line level in Japan, which is a nine-digit level. At the nine-digit level, there are approximately 9000 products. Each nine-digit code in trade data is converted to a single six-digit code in production data. Because our firm-product-level data set uses four-digit level product classifications, we aggregate six-digit level trade data into four-digit level. We use the converter table between nine-digit codes in trade data and six-digit codes in production data developed by Baek et al. (2019) and that of tariff-line-level codes in trade data over time constructed by Aoyagi and Ito (2019).

3.2. *Descriptive analyses*

Figure 2 depicts the number of employees in Japan's manufacturing sector calculated

[1] One may wonder why not using more recent data. This is primary because the list of headquarters names and locations for multi-plant companies is no longer available after 2015, making it impossible to aggregate establishment-level data to the firm level.

[2] Capital stock is available only for the establishments with 30 or more employees. Therefore, we cannot calculate Total Factor Productivity for small plants with less than 30 employees.

from the Census of Manufacture and the Economic Census for Business Activity. With the exception of around 2005-2006, the number of manufacturing employees has decreased over the sample period. It fell from ten million in 1996 to seven and a half million in 2014. Table 2 shows the number of employees in each industry in 1996, 2005 and 2014, as measured by an index based on the number of employees in 1996.There are two things worth mentioning. First, a huge heterogeneity exists in the trends in the number of employments across industries. Textiles, Electrical machinery, equipment and supplies, Information and communication electronics equipment have all experienced significant declines. In contrast, the level of employment in Food, Beverage, Tobacco, Plastic Products, and Transport equipment manufacturing industries does not vary significantly. Second, significant declines in the number of jobs are observed in most of industries between 1996 and 2005. For example, the number of employees in Textile and Electrical machinery declined significantly between 1996 and 2005, with employment in 2005 at 54% and 67% of employment in 1996, respectively. However, the declines were smaller from 2005 to 2014, at 41% and 65%, respectively, when compared to 1996.

== Figure 2 and Table 2 ==

Table 3 shows changes in the Chinese import penetration into the Japanese market by industry. Change in Chinese import penetration is computed following Acemoglu et al. (2016). Specifically, the import penetration from China is computed as the difference of imports from China between year t and 0 ($Import_{pt}^{China} - Import_{p0}^{China}$) over "imports from the world in year 0 ($Import_{p0}^{World}$) plus production value in year 0 ($Prod_{p0}$)." It is multiplied by 100 to show percentage changes and is also divided by the length of years, i.e., $t-0$, to indicate annual changes. In symbol, as in Acemoglu et al. (2016), it is defined as

$$\Delta IMP_p \equiv \frac{100}{t-0} \times \left(\frac{Import_{pt}^{China} - Import_{p0}^{China}}{Prod_{p0} + Import_{p0}^{World}} \right). \quad (1)$$

The import penetration from China increased especially in industries, such as Textiles, Furniture and fixtures, Business oriented machinery, Electrical machinery, equipment and supplies, Information and communication electronics equipment.

== Table 3 ==

Faced with a rapid increase in competition from made-in-China goods, Japanese firms may try to survive by reducing their workforce or changing the composition of their products (product mix). Table 4 shows the number of products produced by firms during the sample period. The average is around 1.45. Of course, one is the bare minimum. The maximum was 51 in 1996 and gradually declined to 29 in 2014. The decline could be attributed to competition from Chinese imports, or it could simply be that firms have been concentrating on their core-

competency. Figure 3 depicts the number of firms based on the number of products they produce. The vast majority were single-product firms. The decrease in the number of single-product firms is much greater than the decrease in the number of multi-product firms.

== Table 4 and Figure 3 ==

As previously stated, this study includes subcontractor firms, namely, companies that receive processing fees. Table 5 displays the number of subcontractor firms, their share of the total number of firms, and the ones by product number. The number of subcontractors has decreased more dramatically than the total number of firms. Subcontractors' share of total firms has decreased from 30% in 1996 to 25.5% in 2014. Moreover, subcontractors are not necessarily single-product firms. Some subcontractors produce two or more products. However, 75%–80% of subcontractor firms are single-product firms.

== Table 5 ==

Next, we investigate firms' product switching behavior. Switching the main product of multi-product company is probably easier than switching the main product of single-product firms. Table 6 focuses on firms that were active in both 1996 and 2014. It shows the number and share of firms that changed their main product from 1996 to 2014. It reveals that 16.9% of single-product firms switched products, whereas 38.7% of multi-product firms switched products. The case for single-product firms is shown in the Table 7, which is divided into subcontractor and non-subcontractor firms (i.e., producing and selling themselves). Subcontractor companies are more likely to change their products than non-subcontractor firms. Subcontractor firms appear more foot loose.

== Table 6 and Table 7 ==

How do firms respond to China's increasingly harsh import competition? Table 8 shows the number of firms based on their reaction patterns. There are five different types of reactions. The first is neither employment adjustment nor product switching (denoted as "NoAdjust"). The second option is employment adjustment only (denoted as "EmplAdjustOnly"). The third option is product switching only (denoted as "ProdSwitchOnly"). The fourth is a combination of employment adjustment and product switching (abbreviated "BothEmplSwitch"). The fifth is exit (abbreviated "Exit"). Employment adjustment is defined as a decrease in the number of workers of more than 10%, whereas the product switch is defined as a change in the representative product (in terms of maximum sales values). The firms' reaction patterns are examined in three dimensions in this table. First, to assess the impact of Chinese import competition, we select industries with Chinese penetration rates in the top and bottom 10 percentile. Second, because single-product and multi-product firms may react differently, we focus on single-product firm reaction patterns.

Table 8's uppermost panel depicts the reaction patterns of all firms from 1996 to 2014. According to the left-side panel, 12.5% of firms chose "NoAdust"; 14.1%, "EmplAdjustOnly"; 5.6%, "ProdSwitchOnly"; 6.0% "BothEmplSwitch", and 61.8%, "Exit." The middle panel depicts the case for firms whose representative product's Chinese import penetration is in the bottom 10%, indicating low competition from Chinese imports. The right-side panel represents the case for the top 10%, i.e., high competition from Chinese imports. There are several notable differences between the bottom and top 10 percentile. The number of firms that took the "NoAdjust" action drops significantly from 12.4% in the bottom 10 percentile to 7.3% in the top 10 percentile. The number of "Exits" also rises significantly, from 64.2% in the bottom 10 percentile to 68.8% in the top 10 percentile. The number of firms that chose "ProdSwitchOnly" and "BothEmplSwitch" increased from 4.2% to 6.3% and 4.2% to 8.1%, respectively, whereas the number of firms that chose "EmplAdjustOnly" decreased from 14.7% to 9.5%. These figures show that when faced with fierce competition from Chinese imports, product switch is an important reaction. The second panel depicts the case of a single-product subsample. We observe remarkably similar patterns in all firms' cases.

= Table 8 =

3.3. *Empirical framework*

To examine the firms' reaction patterns conditional on firm survival, we employ multinomial logit model as in the following equation.

$$\Pr(Y_f = j) = \exp(\beta_j X_f) / \left(1 + \sum_{k=1}^{l} \exp\ (\beta_k X_f)\right) \qquad (2)$$

where firm f chooses a reaction j given covariates of X_f. For firms' reaction j, treating "No adjustment" as base category, we use 1) "Employment Adjustment only", 2) "Product switching only", and 3) "Both employment adjustment and product switching." The definition of each category is the same as in Table 8. Covariates, X_f are the measure of changes in the import penetration, firm's productivity measure in 1996, and the cross term between these two measures. The log of shipment per workers is used as a productivity measure. To be comparable of shipments per capita across industries, our productivity indicator is defined as deviations from the mean at industry.

4. ESTIMATION RESULTS

We present the results of multinomial logit regression in equation (2) in this section. Panel (a) of Table 9 displays the estimation results for all firms from 1996 to 2014. For all three categories, Chinese import penetration has positive and significant coefficients. Furthermore, the size of the coefficients increases for only employment adjustment, only product switching, and both, in that order. This result indicates that, when compared to the base category of "No adjustment," firms chose in the order of Employment adjustment only, product switching only, and then both employment adjustment and product switching. As evidenced by the increasing negative coefficient estimates of Log of sales per worker in 1996, the higher the productivity, the less necessary it is to reduce employment or switch products. The negative coefficient estimate for the cross term indicates that the need for employment adjustment and/or product switching because of Chinese import competition is reduced if firms are more productive.

Subsample estimation results for single product and subcontractor firms are presented in panels (b) and (c). Although the results for single-product firms are qualitatively similar to those for all firms, the coefficients for subcontractors differ from those for other firms. For example, the subcontractors' coefficients for "product switching only" and "both" are smaller than those by "All firms" or "Single-product firms." This finding indicates that subcontractor firms are more likely than other firms to select "employment adjustment only" and less likely to select "product switching only" or "both."

== Table 9 ==

5. CONCLUDING REMARKS AND DISCUSSION

Using the firm/establishment level data from the Census of Manufacture, this study investigates the impact of import competition from China, especially focusing on firms' choice of multiple reactions. We find that product switching appears to be an important option for firms facing increasingly fierce competition from Chinese imports. Firms tend to choose employment adjustment only, product switching only, and then both employment adjustment and product switching as import competition from China increases.

Although this study adds to our understanding of how firms respond to import competition, more research is needed. First, although we discovered product switching is an effective strategy for escaping competitive pressure, more research is needed to determine what types of firms are more likely to switch their product. Second, this study investigates the effects

of import competition over a relatively long time, focusing on Japanese firms' domestic manufacturing plants. During this time, however, larger firms in particular have actively relocated their production facility to low-wage countries via foreign direct investment. Exploring the impact of offshoring or oversea production and comparing it to the impact of import competition might be interesting avenue for future research. Third, while the product switching in this paper is restricted to changes in primary products within manufacturing activities, some firms switch their business from manufacturing to service (servitization). In fact, the superior performance of factoryless goods producers (FGPs), non-manufacturing firms that outsource manufacturing processes entirely to other firms has attracted attention in advanced countries.[3] Linked with the data of service establishment and investigating what kind of firms switch from manufacturing to FGPs is also interesting agenda.

▪

[3] The characteristics of the FGPs has been investigated by Bernard and Fort (2015) for US and Morikawa (2015) for Japan. Matsuura (2021) examine the relationship between import competition and the servitization of manufacturing firms in Japan.

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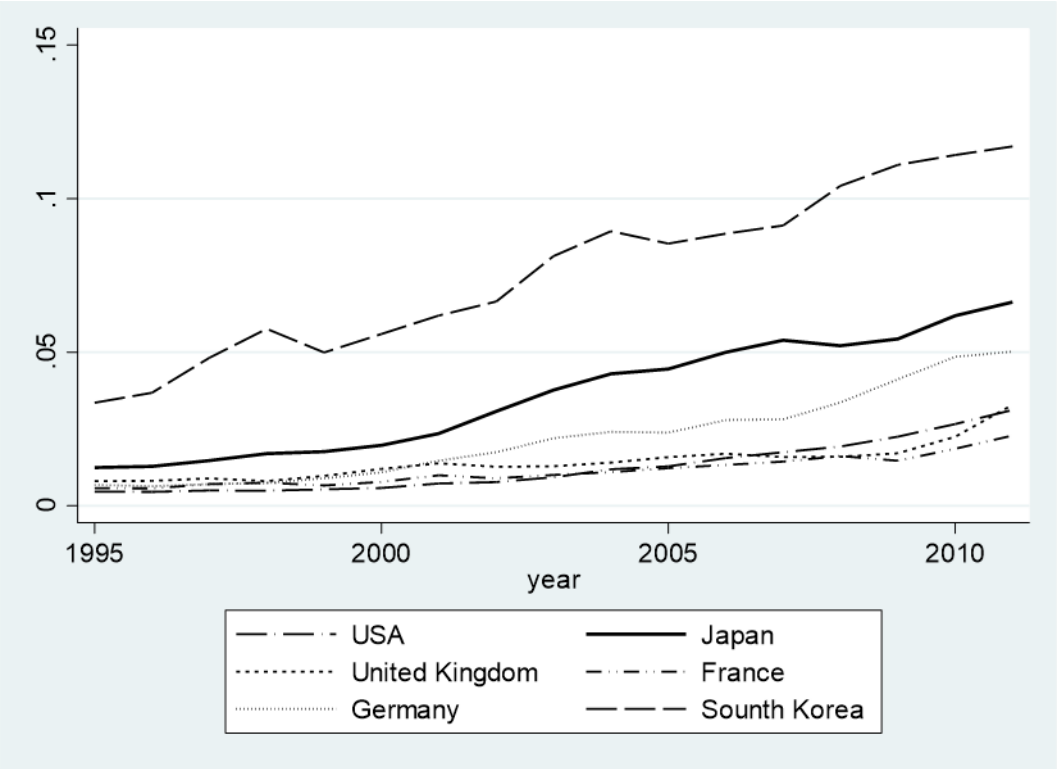
Figures and Tables

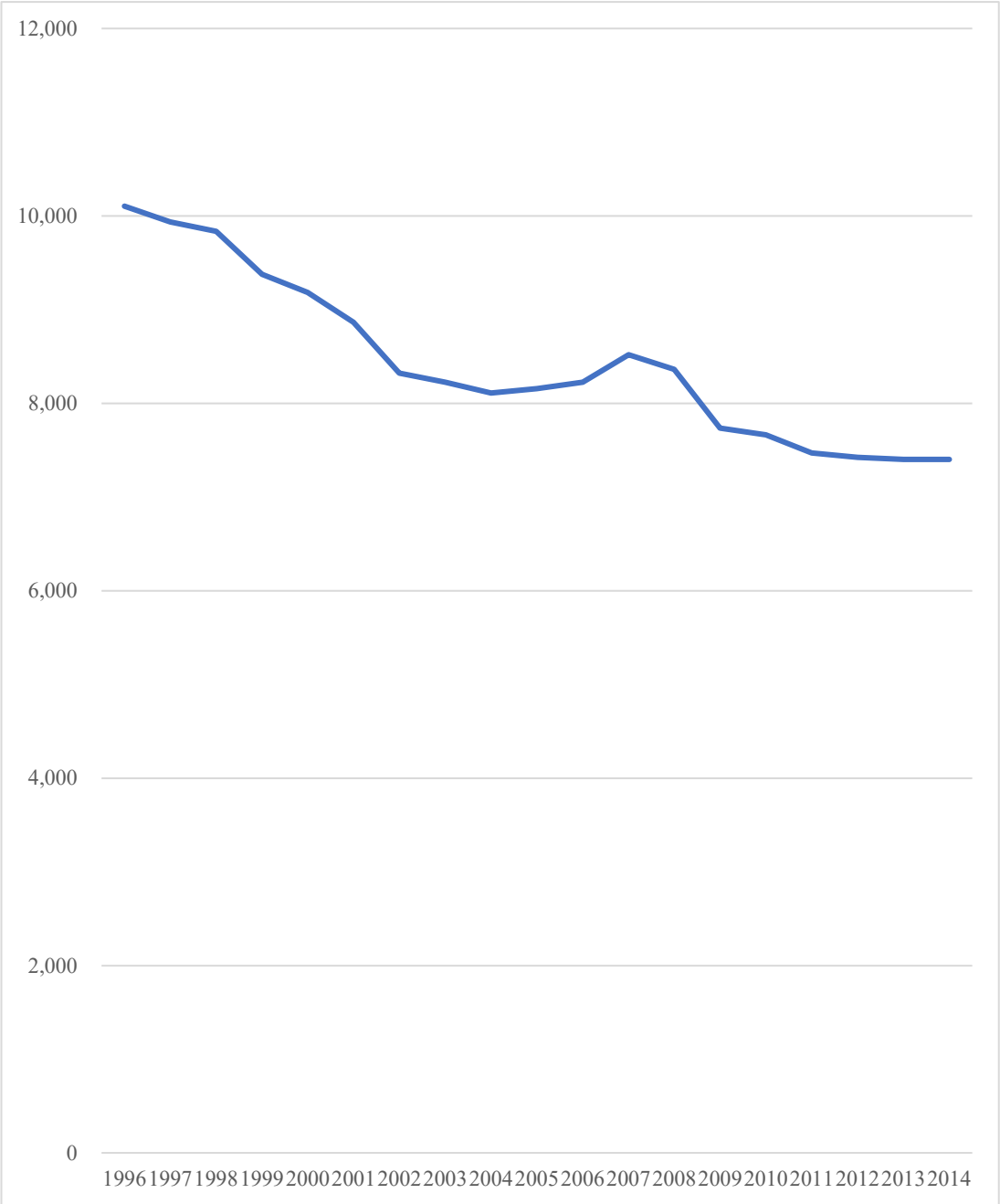
Figure 1: Import Penetration Ratio from China



Note: Chinese import penetration is computed as Import from China / Domestic demand, where Domestic demand = Domestic production + imports from the world–exports to the world

Source: Figure 1 in Hayakawa et al. (2021)

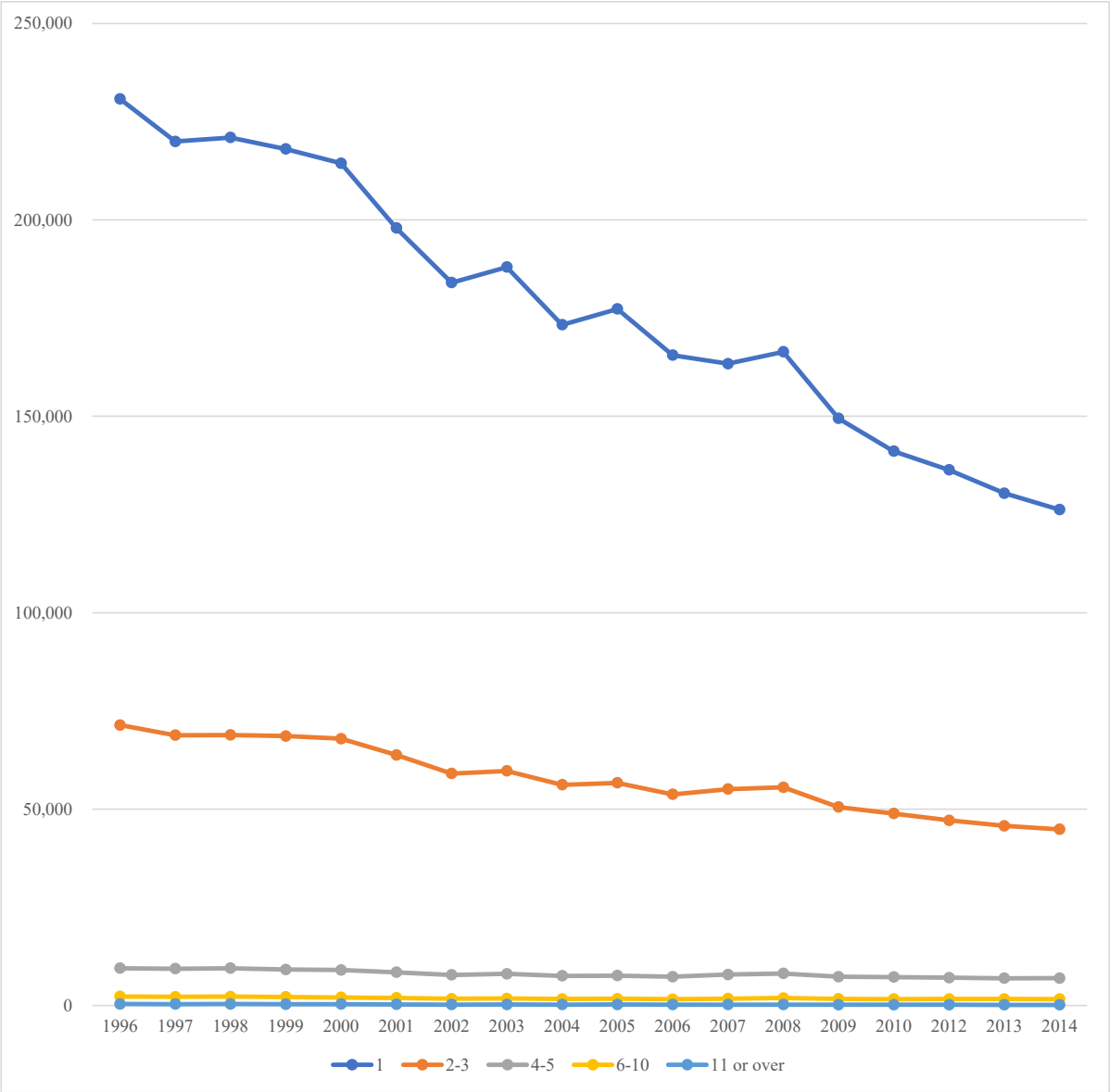
Figure 2: Number of employees in manufacturing sector in Japan



Source: Authors' computation from the Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)

Unit: 1,000 persons

Figure 3: Number of firms by number of products



Source: Authors' computation from Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)

Table 1: Number of Workers in Japan, 2000-2015

	2000	2005	2010	2015
Total	63,032,271	61,530,202	59,607,700	58,890,810
Manufacturing	12,202,064	10,485,635	9,465,070	9,077,510
Manufacturing share (%)	19	17	16	15

Source: Table 1 in Hayakawa et al. (2021)

Table 2: Trends in the number of employees by industry

Industry code (2-digit)	Industry Description	1996	2005	2014
09	MANUFACTURE OF FOOD	1.00	1.01	1.01
10	MANUFACTURE OF BEVERAGES,TOBACCO AND FEED	1.00	0.99	1.02
11	MANUFACTURE OF TEXTILE PRODUCTS	1.00	0.54	0.41
12	MANUFACTURE OF LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE	1.00	0.60	0.44
13	MANUFACTURE OF FURNITURE AND FIXTURES	1.00	0.67	0.51
14	MANUFACTURE OF PULP, PAPER AND PAPER PRODUCTS	1.00	0.80	0.65
15	PRINTING AND ALLIED INDUSTRIES	1.00	0.53	0.40
16	MANUFACTURE OF CHEMICAL AND ALLIED PRODUCTS	1.00	0.75	0.76
17	MANUFACTURE OF PETROLEUM AND COAL PRODUCTS	1.00	0.64	0.74
18	MANUFACTURE OF PLASTIC PRODUCTS, EXCEPT OTHERWISE CLASSIFIED	1.00	0.96	0.88
19	MANUFACTURE OF RUBBER PRODUCTS	1.00	0.73	0.64
20	MANUFACTURE OF LEATHER TANNING, LEATHER PRODUCTS AND FUR SKINS	1.00	0.57	0.42
21	MANUFACTURE OF CERAMIC, STONE AND CLAY PRODUCTS	1.00	0.67	0.57
22	MANUFACTURE OF IRON AND STEEL	1.00	0.67	0.67
23	MANUFACTURE OF NON-FERROUS METALS AND PRODUCTS	1.00	0.70	0.67
24	MANUFACTURE OF FABRICATED METAL PRODUCTS	1.00	0.76	0.63
25	MANUFACTURE OF GENERAL-PURPOSE MACHINERY	1.00	0.73	0.60
26	MANUFACTURE OF PRODUCTION MACHINERY	1.00	0.78	0.73
27	MANUFACTURE OF BUSINESS ORIENTED MACHINERY	1.00	0.80	0.64
28	ELECTRONIC PARTS, DEVICES AND ELECTRONIC CIRCUITS	1.00	0.75	0.52
29	MANUFACTURE OF ELECTRICAL MACHINERY, EQUIPMENT AND SUPPLIES	1.00	0.67	0.65
30	MANUFACTURE OF INFORMATION AND COMMUNICATION ELECTRONICS EQUIPMENT	1.00	0.68	0.34
31	MANUFACTURE OF TRANSPORTATION EQUIPMENT	1.00	0.89	0.84
32	MISCELLANEOUS MANUFACTURING INDUSTRIES	1.00	0.78	0.58
	MANUFACTURE, Total	1.00	0.76	0.68

Source: Authors' computation from Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)

Table 3: Changes in Chinese import penetration

Industry code (2-digit)	Industry Description	China import penetration (Annual average percent)
09	MANUFACTURE OF FOOD	0.36
10	MANUFACTURE OF BEVERAGES,TOBACCO AND FEED	0.06
11	MANUFACTURE OF TEXTILE PRODUCTS	2.08
12	MANUFACTURE OF LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE	0.34
13	MANUFACTURE OF FURNITURE AND FIXTURES	2.46
14	MANUFACTURE OF PULP, PAPER AND PAPER PRODUCTS	0.56
15	PRINTING AND ALLIED INDUSTRIES	0.07
16	MANUFACTURE OF CHEMICAL AND ALLIED PRODUCTS	0.91
17	MANUFACTURE OF PETROLEUM AND COAL PRODUCTS	0.18
18	MANUFACTURE OF PLASTIC PRODUCTS, EXCEPT OTHERWISE CLASSIFIED	1.69
19	MANUFACTURE OF RUBBER PRODUCTS	2.12
20	MANUFACTURE OF LEATHER TANNING, LEATHER PRODUCTS AND FUR SKINS	1.84
21	MANUFACTURE OF CERAMIC, STONE AND CLAY PRODUCTS	0.79
22	MANUFACTURE OF IRON AND STEEL	0.64
23	MANUFACTURE OF NON-FERROUS METALS AND PRODUCTS	1.10
24	MANUFACTURE OF FABRICATED METAL PRODUCTS	1.33
25	MANUFACTURE OF GENERAL-PURPOSE MACHINERY	1.40
26	MANUFACTURE OF PRODUCTION MACHINERY	0.65
27	MANUFACTURE OF BUSINESS ORIENTED MACHINERY	9.94
28	ELECTRONIC PARTS, DEVICES AND ELECTRONIC CIRCUITS	1.67
29	MANUFACTURE OF ELECTRICAL MACHINERY, EQUIPMENT AND SUPPLIES	2.72
30	MANUFACTURE OF INFORMATION AND COMMUNICATION ELECTRONICS EQUIPMENT	2.37
31	MANUFACTURE OF TRANSPORTATION EQUIPMENT	0.46
32	MISCELLANEOUS MANUFACTURING INDUSTRIES	1.77

Note: Indicators of Chinese import penetration is defined in equation (1)

Source: Authors' computation from Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)

Table 4: Number of products firms produce

year	Number of Firms	mean	min	max	sd
1996	314,367	1.44	1	51	1.04
1997	300,696	1.45	1	48	1.04
1998	301,950	1.45	1	48	1.06
1999	298,256	1.45	1	48	1.03
2000	293,737	1.45	1	60	1.04
2001	272,323	1.45	1	46	1.01
2002	252,800	1.44	1	38	0.99
2003	257,812	1.45	1	49	1.02
2004	238,880	1.45	1	40	1.00
2005	243,516	1.45	1	43	1.01
2006	228,412	1.45	1	38	1.00
2007	228,295	1.47	1	42	1.02
2008	232,203	1.48	1	43	1.04
2009	209,182	1.48	1	36	1.02
2010	199,002	1.49	1	32	1.02
2012	192,354	1.49	1	32	1.03
2013	184,885	1.50	1	33	1.04
2014	179,812	1.51	1	29	1.04

Source: Authors' computation from Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)

Table 5: Number of subcontractor firms, the share in total number of firms, and the ones by the number of products produced

	1996		2005		2014	
Number of firms	314,367		243,516		179,812	
Number of subcontractors	94,488	(30.1%)	65,892	(27.1%)	45,881	(25.5%)
Number of subcontractors by the number of product they produce						
1	75,267	(79.7%)	51,435	(78.1%)	34,552	(75.3%)
2-3	16,891	(17.9%)	12,735	(19.3%)	9,759	(21.3%)
4-5	1,733	(1.8%)	1,337	(2.0%)	1,213	(2.6%)
6-10	501	(0.5%)	332	(0.5%)	337	(0.7%)
11 or over	96	(0.1%)	53	(0.1%)	20	(0.0%)

Note: Figures in parentheses are the share of subcontractors in total number of firms or the share of firms by the number of products in the total number of subcontractors.

Source: Authors' computation from Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)

Table 6: Product switching, Single product vs. multi-product firms

	Switching		No switching		Total
Single-product firms	22,064	(16.9%)	108,543	(83.1%)	130,607
Multi-product firms	22,436	(38.7%)	35,476	(61.3%)	57,912
Total	44,500		144,019		

Source: Authors' computation from Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)

Table 7: Product switching, Single-product firms – Subcontractors or not

	Switching		No switching		Total
Subcontractors	9,726	(26.1%)	27,601	(73.9%)	37,327
Non-subcontractors	12,338	(13.2%)	80,942	(86.8%)	93,280
	22,064		108,543		

Source: Authors' computation from Census of Manufacture (Ministry of Economy, Trade and Industry) and Economic Census for Business Activity (Ministry of Internal Affairs and Communications and Ministry of Economy, Trade and Industry)-

Table 8: Firms' reaction patterns

All firms		**China penetration bottom 10 percentile**		**China penetration top 10 percentile**	
NoAdjust	12.5%	NoAdjust	12.4%	NoAdjust	7.3%
EmplAdjustOnly	14.1%	EmplAdjustOnly	14.7%	EmplAdjustOnly	9.5%
ProdSwitchOnly	5.6%	ProdSwitchOnly	4.2%	ProdSwitchOnly	6.3%
BothEmplSwitch	6.0%	BothEmplSwitch	4.6%	BothEmplSwitch	8.1%
Exit	61.8%	Exit	64.2%	Exit	68.8%

Single product firms		**China penetration bottom 10 percentile**		**China penetration top 10 percentile**	
NoAdjust	12.8%	NoAdjust	12.5%	NoAdjust	7.7%
EmplAdjustOnly	14.0%	EmplAdjustOnly	14.4%	EmplAdjustOnly	9.3%
ProdSwitchOnly	4.2%	ProdSwitchOnly	3.3%	ProdSwitchOnly	4.8%
BothEmplSwitch	3.7%	BothEmplSwitch	2.9%	BothEmplSwitch	5.2%
Exit	65.4%	Exit	66.8%	Exit	73.0%

Note 1: Employment adjustment is defined as more than 10 % decrease in number of workers.
Note 2: Product switch is defined as a change of representative product (in terms of maximum sales values).

Table 9: Estimation – Multinomial logit, short term (1996-2014)

Panel (a) All firms

VARIABLES	Employment adjustment only	Product switching only	Both employment adjustment and product switching
China penetration 1996-2014	0.134***	0.285***	0.269***
	(0.0406)	(0.0361)	(0.0359)
Cross term of Chine penetration x Log of sales per worke	-0.0183**	-0.0274***	-0.0244***
	(0.00558)	(0.00489)	(0.00486)
Log of sales per worker in 1996	-0.207***	-0.216***	-0.445***
	(0.0105)	(0.0130)	(0.0130)
Observations	120,124		

Panel (b) Single-product firms

VARIABLES	Employment adjustment only	Product switching only	Both employment adjustment and product switching
China penetration 1996-2014	0.158***	0.226***	0.205***
	(0.0475)	(0.0447)	(0.0450)
Cross term of Chine penetration x Log of sales per worke	-0.0231***	-0.0193**	-0.0160*
	(0.00668)	(0.00620)	(0.00626)
Log of sales per worker in 1996	-0.189***	-0.267***	-0.499***
	(0.0122)	(0.0166)	(0.0176)
Observations	79,912		

Panel (c) Subcontractor firms

VARIABLES	Employment adjustment only	Product switching only	Both employment adjustment and product switching
China penetration 1996-2014	0.160*	0.201***	0.150**
	(0.0694)	(0.0573)	(0.0563)
Cross term of Chine penetration x Log of sales per worke	-0.0234*	-0.0205*	-0.0117
	(0.0105)	(0.00842)	(0.00824)
Log of sales per worker in 1996	-0.279***	-0.205***	-0.534***
	(0.0236)	(0.0249)	(0.0254)
Observations	29,172		

Note: Standard errors in parentheses. *** p<0.001, ** p<0.01, * p<0.05, + p<0.1. Base category is "No Adjustment." The coefficient in this table indicates the marginal effect.