Further Development of International Production Networks and Job Reallocation in Japan

ANDO Mitsuyo

Professor, Faculty of Business and Commerce, Keio University

Abstract

Japan has been one of the major players of production networks in East Asia with active foreign direct investment (FDI) in the manufacturing industry. How have industrial and employment adjustments proceeded domestically? To investigate further development of production networks due to globalizing corporate activities and job reallocation in Japan, this paper analyzes the relationship between the enhancement of expanding foreign operations and domestic adjustments in terms of employment, mainly using the method of job creation and job destruction. In addition, the paper examines domestic adjustments to import competition. Our results demonstrate that Japan can retain domestic employment elastically because of the division of labor on a production process/task basis, rather than on an industry basis. While imports increase according to the development of production networks, their effective use activates domestic employment. Even in a manufacturing industry with active FDI, employment adjustments are relatively flexible, particularly at the firm level (among firms in the same manufacturing sector) and at the intra-firm section level (among intra-firm sections of the same firm), for instance by strengthening headquarters services, which contributes to maintaining or expanding domestic employment.

Keywords: production networks, foreign direct investment, multinational enterprise, domestic employment, manufacturing industry

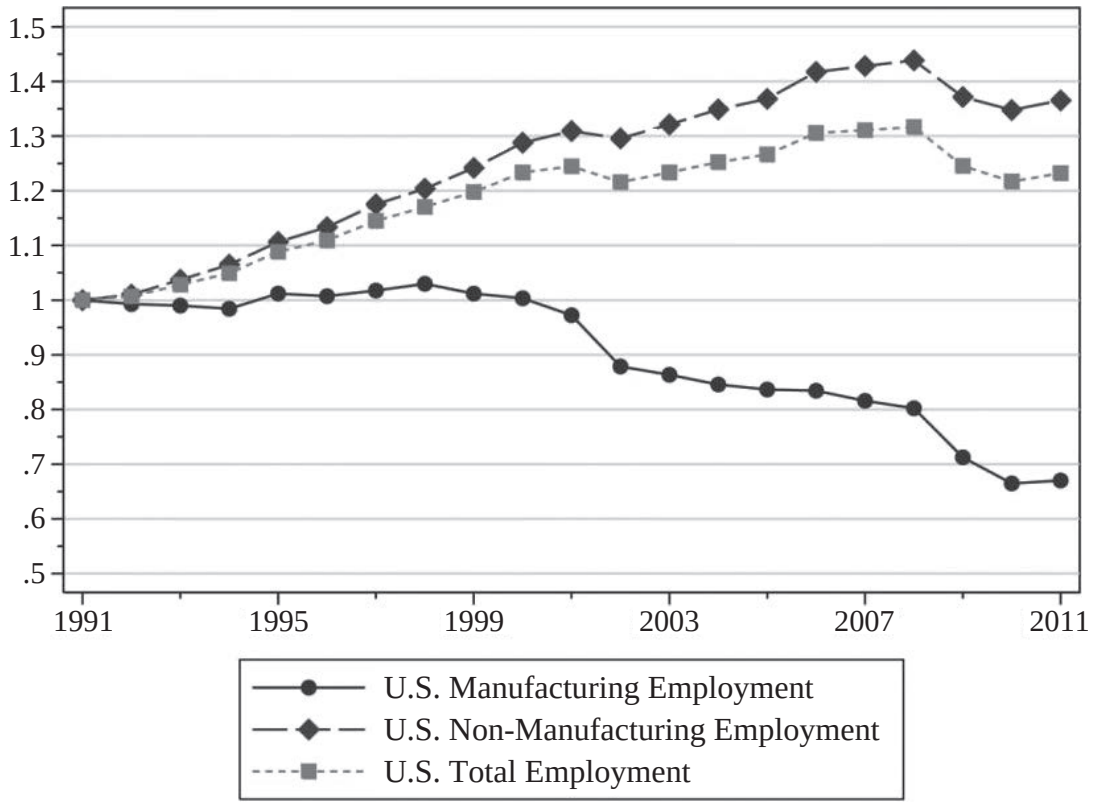
JEL Classification: F23, F61, F66

I. Introduction

The movement towards protectionism in the United States has been accelerated since the emergence of the Trump Administration. Academic papers such as Autor, et al (2016) and Acemoglu et al. (2016) analyzed the impacts of imports from China on the United States, and the journalism placed too much emphasis on their negative impacts. A key message of them, however, was the importance of industrial adjustments and the corresponding labor mobility. In the advancement of globalizing activities of firms and significant changes in the international competitive environment, adjustments of industrial structure and labor movements are critical issues. Particularly for developed countries with foreign direct investment (FDI) in developing countries, the possibilities of de-industrialization are serious policy issues. In the period from 1990 to 2011, the number of manufacturing employment steadily

declined during the 2000s, while both of the number of total employment and non-manufacturing employment tended to increase (Figure 1). These trends may indicate industrial adjustments for manufacturing to services and labor movements proceeded relatively rapidly, although we cannot strongly conclude this from Figure 1 alone.

Figure 1. US manufacturing/non-manufacturing employment between 1991-2011 (employment in 1991=1)

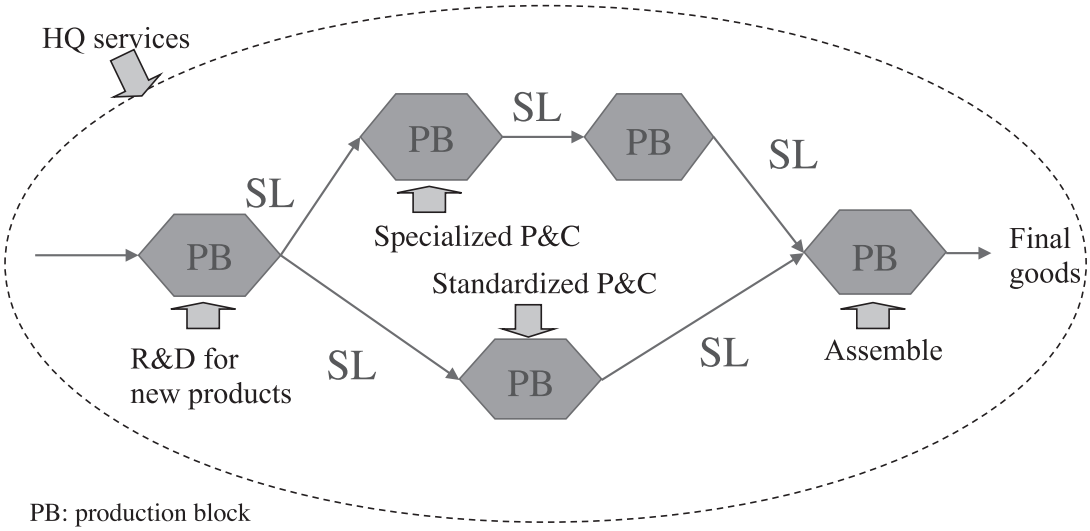


Data source: Acemoglu, Autor, Dorn, Hanson, and Price (2016).
Note: according to Acemoglue et al. (2016), manufacturing employment was 17 million in 1991, 17.1 million in 2000, and 11.4 million in 2011.

In an era with new international division of labor at the production process/task level (in other words, the second unbundling by Baldwin (2011)), how have industrial and employment adjustments proceeded in Japan, which has been one of the major players of production networks in East Asia with active FDI in the manufacturing industry? Baldwin (2016) stresses that under the second unbundling, the impacts of globalization differ among individuals/firms, depending on their task, because an international competition is a stage-by-stage type or even job-by-job type, rather than a sector-by-sector type.[1] In general, we can elastically retain domestic employment and operations under the international division of labor at the production/task level, not division of labor at the industry level like the past, without an extreme division making between all domestic or everything abroad. Let us consider

an example, using Figure 2. The figure illustrates five production processes, starting from R&D activities for new products, to production of standard/specific parts and components, and to production of final products by assembling them. Each production block is connected by service-link costs such as transport costs, telecommunication costs, and coordination costs and/or headquarters (HQ) services, and when these production blocks are fragmented into several countries, division of labor across borders as international production networks is formed. In the case of Japan, even if labor intensive production processes went to East Asian developing countries, where an inexpensive labor force is available, Japan can increase the number of tasks/jobs retained at home by intensifying the strength of Japan at the task level with complementary operations. For instance, this could be achieved in Japan by specializing production of key part and components or specific parts and components that require high technology or intensification of HQ services or R&D activities. Moreover, if effective utilization of international division of labor contributes to lowering prices of final products and, as a result, strengthening the international competition, the expansion of production activities can be realized. In general, international division of labor at the production process/task level can retain domestic operations including employment more elastically,

Figure 2. Fragmentation of production: an illustration



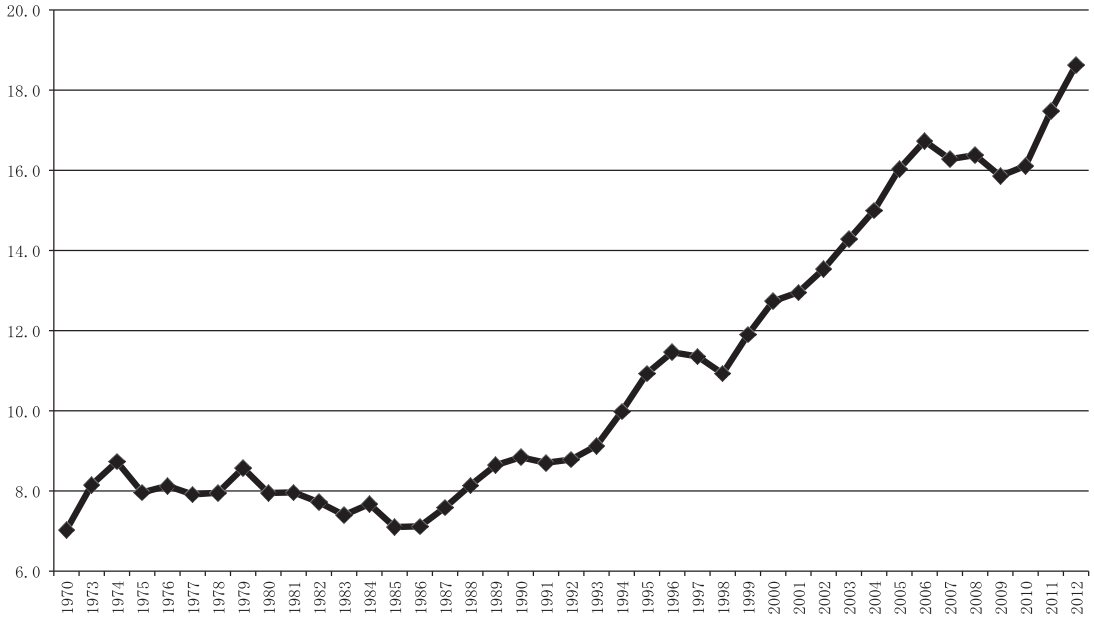
PB: production block
SL: service link
Data source: Ando and Kimura (2013a).

[1] Baldwin (2016) emphasizes that a shift from the first unbundling with international division of labor at the industry level to the second unbundling changed the impacts of globalization as being (i) more individual (as the international competition is a stage-by-stage type or even job-by-job type, rather than a sector-by-sector type, the impacts differ among individuals, depending on their task), (ii) more sudden (as it is relatively easy to relocate some production processes/tasks, sudden changes can happen), (iii) less predictable (as how to fragment production processes and locate them is largely influenced by a firm-specific assets that each firm has, it is difficult to predict which stages go next and where to go next, and (iv) less controllable (as most of the technical advances derive from private, profit-motivated research and development (R&D), it is difficult for the government to control technology development, unlike tariff cutting).

rather than that at the industry level, but whether de-industrialization at home can be avoided or delayed in practice must be empirically examined.

Figure 3 presents import penetration (IP) ratios, which is one of the indices implying the degree of import competition, from the 1970s for Japan. It is apparent that the IP ratios continue to rise since the 1990s.[2] Such an increase in IP ratios may be simply interpreted as a strengthened import competition or lowering international competition of the relevant industry. International production networks, however, require both exports and imports among the production processes, and thus high IP ratios do not necessarily indicate the weakening international competition of a certain industry or a shrinkage of that industry. The relationship between the rise of IP ratios in the manufacturing industry and domestic employment must be empirically examined.

Figure 3. IP ratios for manufacturing in Japan (%)



Data: author's preparation, based on JIP database 2015.

Based on the concerns mentioned above, this paper focuses on the case of Japanese firms in the manufacturing industry and discusses production networks and domestic labor adjustments. Specifically, based on the results in a series of studies by Ando and Kimura (2012, 2015, and 2017), we investigate the evolving features of globalizing corporate activities and domestic adjustments in terms of employment using the job creation/job destruction (JC/JD) method and the Kolmogorov-Smirnov (KS) test, and the association between IP ratios and domestic employment. One of the important features of these studies is that they at-

[2] IP ratios in real terms are calculated as follows: imports/(outputs+imports-exports).

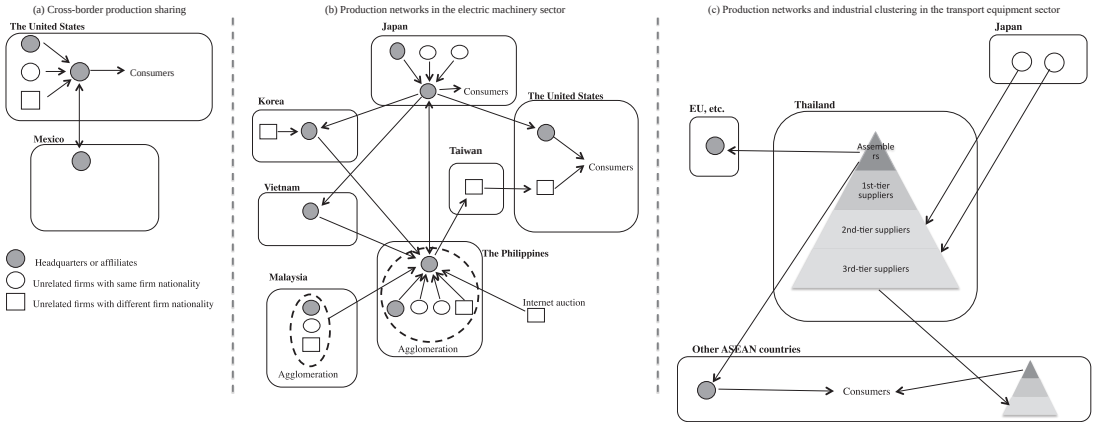
tempt to investigate the impacts of expanding globalizing activities of firms by focusing on whether or not a firm increases its number of foreign affiliate(s) (affiliates in East Asia) over a certain period as an indication of the decision of expanding international production networking and by decomposing firms into MNEs increasing the number of foreign affiliates (expanding MNEs: MNE1), MNEs not increasing the number (non-expanding MNEs: MNE2), and domestic firms with no foreign affiliate (local firms: Local). Another unique and noteworthy feature of their analysis is that they apply JC/JD method to changes in domestic employment at three different stages, i.e., the industry level, the firm level, and the intra-firm section level, with a distinction among three types of firms. The international trade literature has evolved over time in order to respond to the globalization and its distributional consequences. The traditional theory of comparative advantage worked for the world of the first unbundling in the words of Baldwin (2016), which primarily dealt with industrial adjustments and inter-industry labor movements. The new-new international trade theory initiated by Melitz (2003) expanded the scope of the international trade theory by introducing firm heterogeneity and provided a pathway to intra-industry/inter-firm reshufflings and labor movements. Furthermore, the fragmentation theory (Jones and Kierzkowski, 1990), two-dimensional fragmentation (Ando and Kimura, 2005), and the concept of the second unbundling (Baldwin, 2016) introduced the idea of intra-firm adjustments and labor movements. Given these literature and concepts, it is important to consider labor movements at three different stages, i.e., the industry level (inter-industry), the firm level (intra-industry and inter-firm), and the intra-firm section level (intra-firm).

The paper is organized as follows: the next section reviews the development of production networks, mainly in East Asia, and their features. Section 3 discusses how domestic adjustments proceeded in Japan, according to the emergence of new international division of labor and significant changes in environment of international competition, by focusing on the relationship between the extending pattern of globalizing activities and domestic employment or IP ratios and domestic employment as domestic adjustments to extending globalizing activities of firms. The conclusion is presented in the last section.

II. Development of production networks and their features

This section reviews development and restructuring patterns of production networks mainly in East Asia. Although it is not easy to empirically capture the structure of production networks at the aggregate level, one of the approaches based on the data that anyone can use is to employ data of trade in parts and components. Figure 4 shows an illustration of the example patterns of production networks. The major players in the manufacturing industry are machinery sectors, including general machinery, electric machinery, transport equipment, and precision machinery. While production networks in other sectors such as textile and apparel exist, those in machinery sectors are the most significant in terms of a large number of parts and components and utilization of two-dimensional fragmentation. Thus, let us check changes in machinery shares, particularly of machinery parts and components, in

Figure 4. Examples of the structure of production networks: an illustration

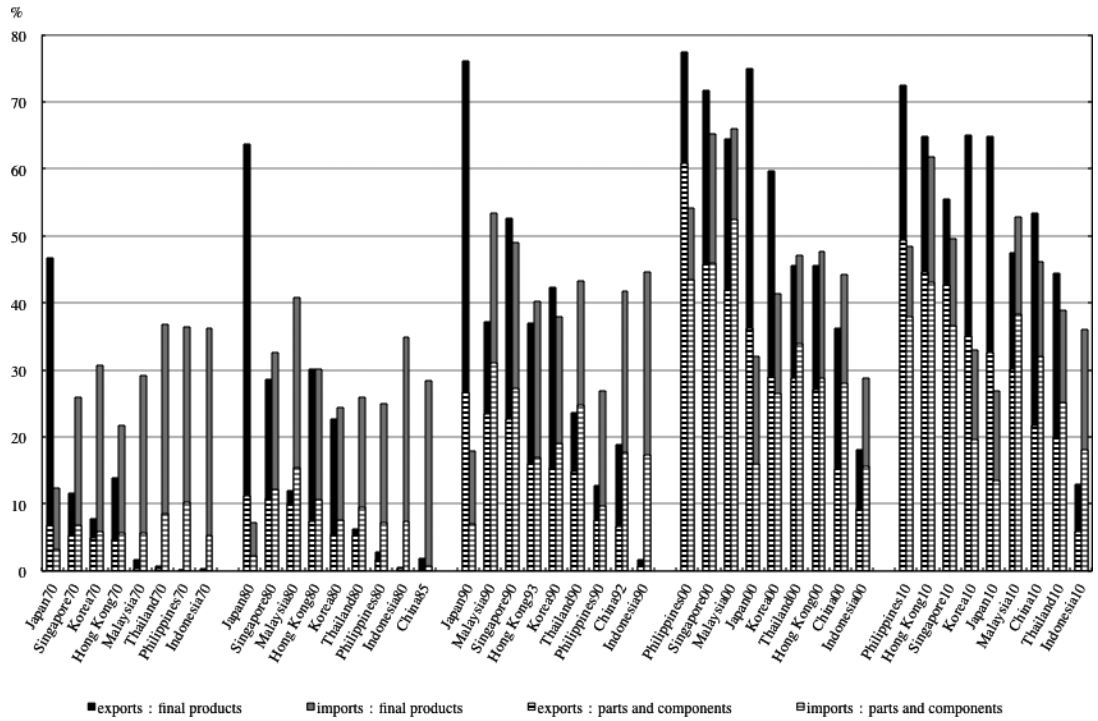


Data source: Kimura and Ando (2016).

total exports/imports by East Asian economies to see the degree of participation by each economy into the production networks. In 1970, the only country with a large share of machinery exports is Japan, and in addition, most of the machinery trade is of machinery final products. By 1980, however, Singapore, Hong Kong, and Korea started to enlarge machinery exports, while Malaysia started to export machinery parts and components (Figure 5). By 2010, many East Asian economies have both exports and imports in machinery parts and components, which is a typical pattern of production networks. From her study that distinguishes vertical intra-industry trade (IIT) from horizontal IIT based on unit price of exports/imports, Ando (2006) demonstrates that vertical back-and-forth transactions of parts and components have been rapidly expanded in East Asia, along with the development of production networks.

When we arrange countries, by highest export ratios of machinery parts and components, including those in other regions, we notice two significant differences between trends for the initial 1990s and 2010. First, many countries in the world expand trade in parts and components, resulting in much larger shares of machinery trade. This indicates that the second unbundling has proceeded throughout the world. Second, most countries with higher ratios of exports in machinery parts and components are East Asian economies in 2010, while those are developed countries at the beginning of the 1990s. In other words, in East Asia, trade in machinery parts and components have expanded more rapidly than countries in other regions, and back-and-forth transactions have been activated. Note that only a few developing countries, such as Mexico and some countries in Central and Eastern Europe (CEE), show high shares of exports in machinery parts and components. For instance, Mexico has formed a simple cross border production sharing based on intra-firm transactions between a parent firm in the United States and its affiliates in Mexico. However, international production networks in East Asia involve many developing countries at different income levels as well as various patterns of arm's length transactions.

Figure 5. Machinery trade as a share of total exports and imports for each East Asian economy



Data source: Kimura and Ando (2016).
Note: data for 1970 and 1980 are based on the SITC classification and data for 1990 and 2010 are based on the HS classification (data for 1990 of the Philippines is of the SITC).
Data for China for 1980 is from 1985, and data for China and Hong Kong for 1990 are from 1992 and 1993, respectively.

Recently, production networks in East Asia have further developed in terms of extent and depth. Within the region, re-structuring patterns of transactions among those countries that had already been involved in the production networks has proceeded, along with selection and concentration accelerated since the Global Financial Crisis (GFC) as a trigger, while East Asian late comers (Cambodia, Laos, Myanmar, and Vietnam (CLMV)), particularly Vietnam, have started to be involved in the networks rapidly (Ando (2013)). “Thailand plus one” is a typical example, which is a form of supply chains in Thailand where many Japanese firms agglomerate with Cambodia, Myanmar, or Laos. In general, transactions at the production processes tend to be formed in a region, but recently, a supply of parts and components from East Asia has played an important role for production in North America or Europe. With both regions, East Asian countries strengthen the link from the production side while maintaining the link as important consumption sites for production networks in East Asia. Ando and Kimura (2013b, 2014) demonstrate that Mexico/CEE countries expand imports in machinery parts and components from East Asia with new transactions and play a role of bridge between production networks in East Asia and those in North America/Eu-

rope, which is particularly apparent in the electric machinery sector.

Let us briefly refer to the robustness of production networks as another feature. We cannot deny that production networks can become channels to transmit external shocks of demand/supply more significantly, as many more countries/firms are connected within the networks. Indeed, we observed negative effects temporally when faced with the Asian Financial Crisis (AFC), the GFC, or the Great East Japan Earthquake (EJE). What is important, however, is that machinery parts and components trade are less likely to be discontinued and are likely to recover even if they stop once.[3] Production networks have a nature of accelerating recovery of the entire economy from shocks, even though it may seem to be paradoxical.

III. Globalizing activities of Japanese manufacturing firms and domestic employment

This section focuses on Japanese manufacturing firms and examines domestic adjustments to their globalizing activities. Figure 6 presents the trend of domestic operations in terms of the number of firms and employment by Japanese manufacturing firms, based on the firm-level statistics from *The Basic Survey of Japanese Business Structure and Activities (Kikatsu* hereafter*),* which is conducted by the Ministry of Economy, Trade and Industry (METI), Government of Japan. Figure 6 shows that while both the number of manufacturing firms and their employment decreased in the 1990s, they have slightly increased since 2002/2003.[4]

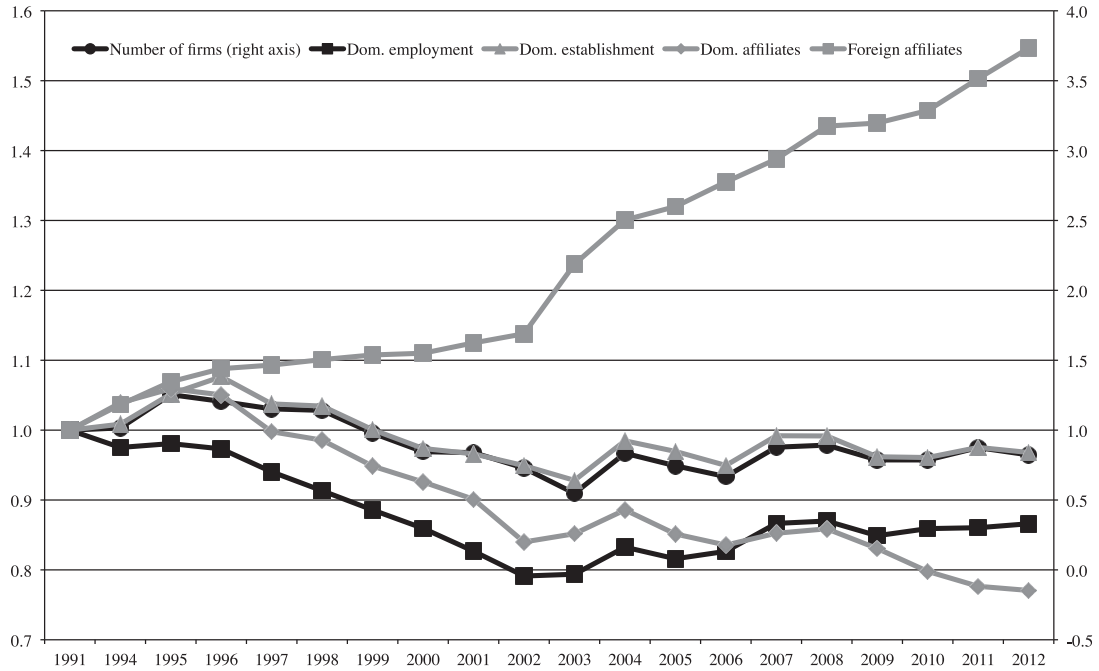
In addition, while the number of manufacturing firms and domestic establishments in 2012 was the same as the initial levels from the 1990s, with only a slight decline, the number of affiliates significantly changed. The number of foreign affiliates has steadily increased, most rapidly in the 2000s, while the number of domestic affiliates has decreased. It is important to note that the number of affiliates in this figure is calculated as a simple aggregation based on data at the firm level. Thus, the possibility of duplicate counting must be considered when multiple firms invest to establish one foreign affiliate; nonetheless, the figure confirms how aggressively Japanese manufacturing firms have invested abroad, particularly in the 2000s. As Table 1 demonstrates, more than 10 percent of Japanese manufacturing MNEs further expanded foreign operations by increasing the number of foreign affiliates (MNE1) for each period since 2000 (14 percent for 2000-2004, 12 percent for 2004-2008, and 14 percent for 2008-2012).

Over 90 percent of Japanese MNEs go to East Asia (Table 2). In addition, while more than half of the manufacturing firms investing in East Asia are small and medium-sized en-

[3] For the robustness of production networks facing crises, see Obashi (2011) for the AFC, Ando and Kimura (2012) and Okubo, Kimura, and Teshima (2014) for the GFC, and Ando and Kimura (2012) and Todo, Nakajima, and Matous (2013) for the EJE.

[4] The *Kikatsu* does not cover very small firms because the sample in the survey covers firms with more than 50 workers, capital of more than 30 million yen, and having establishments in mining, manufacturing, wholesale/retail trade, and restaurants. Another data source, the Economic Census, which covers small manufacturing establishments with no fewer than four employments, presents a declining trend of domestic employment in the manufacturing sector after 2007.

Figure 6. Corporate structure and domestic opertaions of Japanese manufacturing firms (1991 = 1)



Data: author's preparation, based on data available from the *Kikatsu*.
Note: as the number of affiliates in this figure is calculated as a simple aggregation based on the data at the firm level, the possibility of duplicate counting must be considered when multiple firms invest to establish one foreign affiliate.

Table 1. The number of manufacturing firms by the type and industry

	2000-2004				2004-2008				2008-2012			
	Local	MNE1	MNE2	All	Local	MNE1	MNE2	All	Local	MNE1	MNE2	All
The number of firms	7825	1425	1267	10517	7922	1278	1734	10934	7789	1527	1805	11121
(% in all)	(74.4)	(13.5)	(12.0)	(100.0)	(72.5)	(11.7)	(15.9)	(100.0)	(70.0)	(13.7)	(16.2)	(100.0)
(SME %)	(83.6)	(42.4)	(50.5)	(74.1)	(85.7)	(43.2)	(58.4)	(76.4)	(84.5)	(47.0)	(58.3)	(75.1)

Data source: Ando and Kimura (2017).
Note: data are based on balanced panel data for each period.

Table 2. Composition of manufacturing MNEs in Japan and their affiliates, 2012

	Number of firms with affiliates in each region: ratio to the total number of MNEs (%)				By-size share of firms with affiliates in each region (%)			
	All	E. Asia	N.America	Europe	All	E. Asia	N.America	Europe
All firms	100.0	93.3	35.6	21.0	100.0	100.0	100.0	100.0
SMEs	100.0	91.8	18.4	7.0	53.7	52.8	27.7	18.0
Large firms	100.0	95.1	55.6	37.2	46.3	47.2	72.3	82.0

Data source: Ando and Kimura (2017).

terprises (SMEs) with employment of fewer than 300, the majority of manufacturing firms investing in North America and Europe are large firms with employment of no fewer than 300. Japanese FDI in East Asia is mainly in manufacturing sectors, and manufacturing operations by SMEs are particularly active there.[5] This type of investing patterns by SMEs must contribute to the industry clustering in manufacturing sectors, by supplying parts and components to their own affiliates or affiliates of other firms.

In the rest of this section, as the impacts of production networks on investing countries (developed countries) since the 2000s when the production networks have further expanded, we discuss the relationship between expanding foreign operations by Japanese manufacturing firms and their domestic adjustments in terms of employment in sub-section III-1 and the relationship between import competition and domestic employment in sub-section III-2.

III-1. Expanding foreign operations and domestic employment

There are two main approaches to investigate whether or not firms investing abroad shrink domestic employment, using the micro-data of Japanese firms/establishments.[6] One approach is to examine the impacts of FDI at the firm level on domestic employment.[7] This approach is quite meaningful in a sense that it allows us to analyze the causality strictly, but at the same time, it prevents us from capturing the whole picture because it requires drop off of many samples in the process of the analysis. In most cases, firms that already had FDI are dropped from the dataset in order to compare firms with the first FDI and purely domestic firms (without FDI). Moreover, the sample size is reduced further when the typical econometric method such as propensity score matching is applied. Another approach is to focus on MNEs only and estimate a labor demand function to quantify the effects of foreign operations on domestic employment.[8] This approach has an advantage in a sense that the study covers firms already had foreign affiliates, but a disadvantage in a sense that it is not easy to consider purely domestic firms.

To complement these studies, Ando and Kimura (2015) apply the job creation (JC)/destruction (JD) method to the micro data of Japanese manufacturing firms and attempt to provide a bird's eye portrait of the dynamism of globalizing firms, instead of capturing rigorous causality. Specifically, the paper regards whether or not a firm increases the number of foreign affiliate(s) in a certain period as an indicator for the decision of expanding international production networking and decomposes firms into MNEs increasing the number of foreign affiliates (expanding MNEs: MNE1), MNEs not increasing the number (non-expanding

[5] The sectoral composition of foreign affiliates of Japanese manufacturing firms shows that more than 70 percent of their affiliates in East Asia are manufacturing affiliates, and the corresponding figure reaches over 80 percent when focused on only affiliates of Japanese manufacturing SMEs.

[6] Some studies examine whether or not domestic operations left in Japan have shifted to more capital-intensive/ human capital-intensive ones.

[7] For instance, Hijzen, Inui, and Todo (2007), Edamura, Hering, Inui, and Poncet (2011), Hayakawa, Matsuura, Motohashi, and Obashi (2013), and Tanaka (2012a).

[8] See Yamashita and Fukao (2010) and Kiyota and Kambayashi (2014).

MNEs: MNE2), and domestic firms with no foreign affiliates (local firms: Local). Then, the paper analyzes changes in domestic operations (domestic employment, domestic establishment, and domestic affiliates) and trade by three types of Japanese manufacturing firms. Regarding domestic employment, we have to interpret the results, considering the nature of data, such as the sample threshold based on the firm size and a difficulty in capturing entry and exit of firms. As far as this database is concerned, however, the paper provides several interesting insights; for instance, domestic employment by Japanese manufacturing firms tends to increase slightly since 2002, multinational SMEs expanding foreign operations (MNE1/SMEs) are likely to increase domestic employment, and MNE1 tend to increase employment in the HQ services section (Table A.1). In addition, Ando and Kimura (2017) extend this study and apply the JC/JD method to changes in domestic employment at three different stages, i.e., the industry level, the firm level, and the intra-firm section level, to capture the features of globalizing activities of firms and domestic adjustments of employment. They demonstrate that reallocation of domestic employment by Japanese manufacturing firms are active not only at the sectoral level but also among firms in the same sector or intra-firm sections.

This subsection discusses reallocation of domestic employment by Japanese manufacturing firms, based mainly on the results of JC/JD method analysis in Ando and Kimura (2017). We, however, also consider other results, such as the Kolmogorov-Smirnov test (KS test) for the distributions of net changes in employment (Ando and Kimura, 2015) and analysis of features of firms expanding operations in East Asia from the perspective of a skill shift (or shift of domestic activities/tasks) (Ando and Kimura 2012, 2013). Note that the periods for analysis are slightly different due to the differences in the available data at the time of analysis.

III-1-1. The JC/JD method

Let us briefly explain the JC/JD method. The relationship between net and gross changes is in general as follows:

$$\text{Net change rate } (NetG) = \text{gross job creation rate } (JC) - \text{gross job destruction rate } (JD).$$

For instance, the rate of gross job creation (JC_T) and the rate of gross job destruction (JD_T) in the period T (from t_0 to t) at the firm level are calculated by:

$$JC_T = \Sigma_{i(g_{iT}>0)} w_{iT} g_{iT}$$

$$JD_T = \Sigma_{i(g_{iT}<0)} w_{iT} |g_{iT}|,$$

where g_{iT} and w_{iT} are changes in employment and a weight for firm i in period t, respectively, calculated as below:

$$g_{iT} = \frac{(x_{it} - x_{it0})}{(x_{it} + x_{it0})/2}$$

$$w_{iT} = \frac{x_{it} + x_{it0}}{\Sigma_i (x_{it} + x_{it0})}.$$

Thus, the rate of net/gross changes is the employment-weighted rate of changes.[9]

Also, the relationship among net and gross changes at three different stages (industry level (J). firm level (I), and intra-firm section level (S)) can be expressed as below:[10]

$$NetG = JC_T^J - JD_T^J = JC_T^I - JD_T^I = JC_T^S - JD_T^S.$$

Table 3 summarizes the results of changes in domestic employment at three stages, (a) industry level, (b) firm level, and (c) intra-firm section level, for three sample periods (the period 2000-2004 (after the 1997-1998 AFC), 2004-2008 (before the GFC), and 2008-2012 (after the GFC)).[11] The *Kikatsu* provides information on the allocation of workers in intra-firm sections such as HQ services and manufacturing activities, while it does not provide data at the establishment level. Three intra-firm sections are defined as follows: headquarters services (HQ), manufacturing activities (MFG), and other intra-firm sections (Other). The

Table 3. Changes in domestic employment by Japanese manufacturing firms at three stages

	NetG	JC			JD (-)		
		(a) Industry level	(b) Firm level	(c) Intra-firm section level	(a) Industry level	(b) Firm level	(c) Intra-firm section level
i) 2000-2004							
All firms	-0.058	0.005	0.070	0.137	-0.063	-0.129	-0.195
SMEs	-0.020	0.008	0.082	0.143	-0.028	-0.102	-0.163
Large firms	-0.070	0.004	0.067	0.135	-0.074	-0.137	-0.205
ii) 2004-2008							
All firms	0.041	0.046	0.100	0.172	-0.005	-0.059	-0.131
SMEs	0.055	0.057	0.113	0.200	-0.003	-0.059	-0.146
Large firms	0.037	0.044	0.096	0.162	-0.007	-0.059	-0.126
iii) 2008-2012							
All firms	0.007	0.016	0.077	0.143	-0.010	-0.071	-0.136
SMEs	0.012	0.017	0.085	0.170	-0.005	-0.073	-0.158
Large firms	0.005	0.017	0.075	0.134	-0.012	-0.070	-0.129

Data source: Ando and Kimura (2017).
Note: data are based on balanced panel data for each period.

[9] See, for instance, Davis, Haltiwanger, and Schuh (1996) and Hijzen, Upward, and Wright (2010) for the analysis using this method. The advantage of calculating changes like this is that we can treat positive and negative changes equally as the rates of changes fall in the range between -2 and 2.

[10] See Ando and Kimura (2017) for the details.

[11] In using *Kikatsu* data, it is difficult to identify explicitly entries and exits of firms. Although Ando and Kimura (2015) attempted to incorporate them with some definitions for entries and exits, there should be problems for too big gross changes. Thus, Ando and Kimura (2017) use only balanced panel data without incorporating entries and exits of firms. See Ando and Kimura (2015) for the treatment of entries and exits or merger and acquisition (M&A) of firms.

results not only for all firms but also for SMEs and large firms are presented separately. Furthermore, Table 4 summarizes the corresponding results for three types of firms, that is, MNE1, MNE2, and Local, separately. Considering the fact that about 90 percent of MNE1 (firms increasing the number of foreign affiliates) increase the number of affiliates in East Asia, we could regard them as those that expand production networking. Figure 7 illustrates some results in Tables 3 and 4. Note that Figure 7 (c) presents the decomposition of JC/JD by three intra-firm sections.

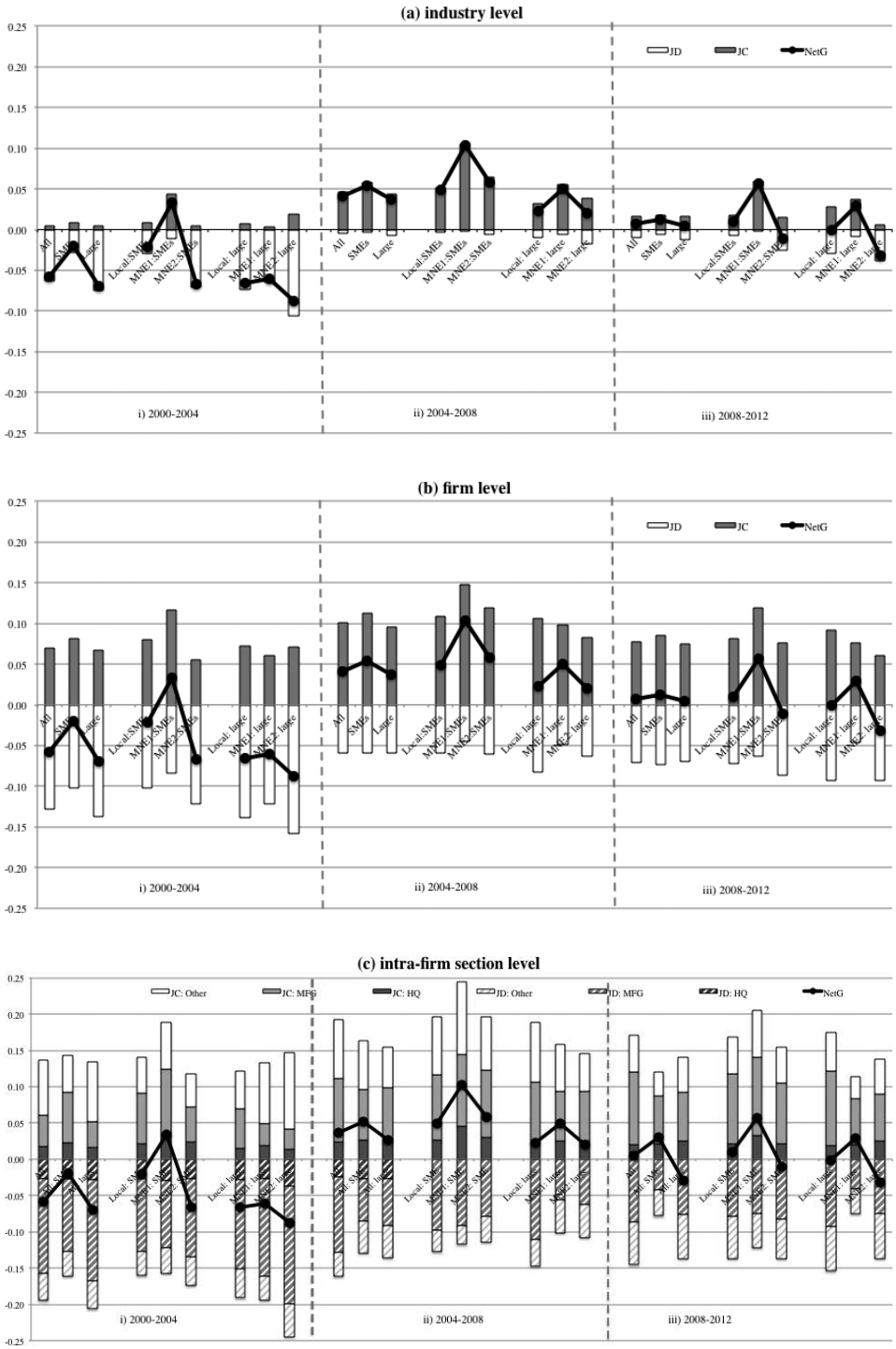
These results provide several interesting insights. First, de-industrialization advances in the early 2000s, but a shrinkage of the manufacturing industry is not observed afterwards. While the net changes are net job destruction for the period from 2000 to 2004, they are net job creation from 2004 to 2008 (before the GFC) and from 2008 to 2012 (after the GFC). Indeed, these results do not incorporate entries and exits of firms, but as far as we interpret

Table 4. Changes in domestic employment by Japanese manufacturing firms at three stages for each type of firm

Type of firm	NetG	JC			JD (-)		
		(a) Industry level	(b) Firm level	(c) Intra-firm section level	(a) Industry level	(b) Firm level	(c) Intra-firm section level
i) 2000-2004							
SMEs							
Local	-0.021	0.008	0.081	0.140	-0.029	-0.102	-0.161
MNE1	0.034	0.044	0.117	0.189	-0.010	-0.083	-0.155
MNE2	-0.066	0.005	0.055	0.118	-0.071	-0.122	-0.184
Large firms							
Local	-0.066	0.007	0.073	0.122	-0.073	-0.139	-0.188
MNE1	-0.060	0.004	0.061	0.133	-0.064	-0.122	-0.194
MNE2	-0.088	0.018	0.071	0.147	-0.106	-0.159	-0.234
ii) 2004-2008							
SMEs							
Local	0.049	0.052	0.108	0.196	-0.003	-0.060	-0.147
MNE1	0.103	0.104	0.147	0.245	-0.001	-0.044	-0.142
MNE2	0.058	0.064	0.119	0.196	-0.006	-0.061	-0.138
Large firms							
Local	0.022	0.032	0.105	0.189	-0.009	-0.083	-0.167
MNE1	0.050	0.055	0.098	0.159	-0.006	-0.048	-0.109
MNE2	0.020	0.038	0.083	0.146	-0.018	-0.063	-0.126
iii) 2008-2012							
SMEs							
Local	0.010	0.017	0.082	0.169	-0.007	-0.072	-0.159
MNE1	0.057	0.059	0.120	0.205	-0.002	-0.063	-0.148
MNE2	-0.010	0.015	0.076	0.154	-0.026	-0.086	-0.165
Large firms							
Local	-0.001	0.029	0.092	0.174	-0.030	-0.093	-0.175
MNE1	0.029	0.037	0.076	0.114	-0.008	-0.047	-0.085
MNE2	-0.032	0.006	0.061	0.138	-0.038	-0.093	-0.170

Data source: Ando and Kimura (2017).
Note: data are based on balanced panel data for each period.
The largest figures among 3 types of firms for JC/JD (-)/NetG are highlighted.
See the text for the type of firms (MNE1, MNE2, Local).

Figure 7. Changes in domestic employment by Japanese manufacturing firms at three levels



Data source: author's preparation, using the results in Ando and Kimura (2017).
Note: see the text for the type of firms (MNE1, MNE2, Local).

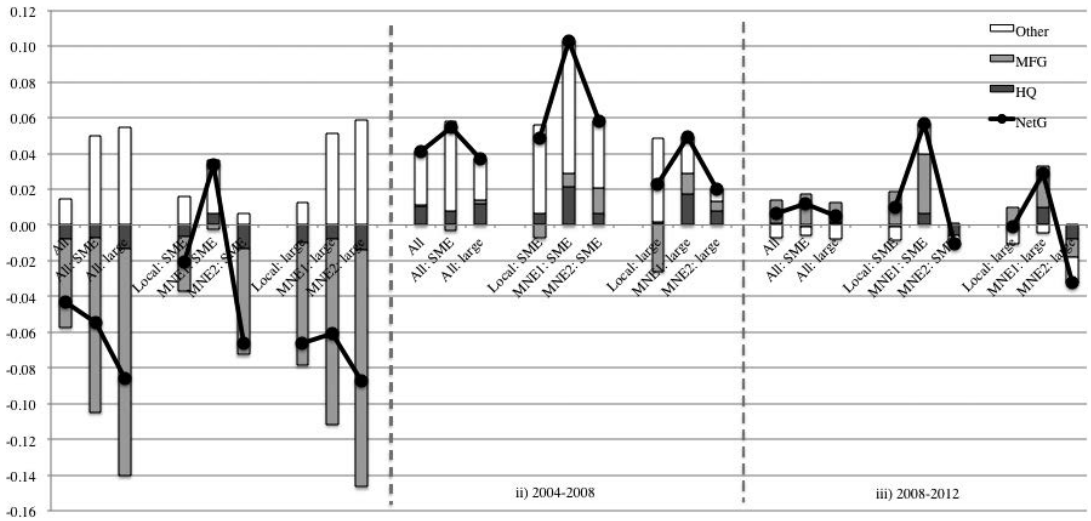
our results based on the *Kikatsu,* we can say that manufacturing employment tends to increase after the drastic decline at the beginning of the 2000s.

Second, there exist differences between SMEs and large firms. SMEs actively contribute to net job creation (or less net job destruction), compared with large firms, in all periods, while the net job destruction is enormously large for large firms in the early 2000s. Smaller gross job destruction for SMEs, compared with that for large firms, contributes to net job creation (or smaller net job destruction).

Third, regardless of whether large firms or SMEs, MNE1 tend to have larger net change rates for employment, compared with other firms (MNE2 or Local). The net changes by three types of firms in Table 4 and Figure 7 clearly show that the net changes are the largest for MNE1. Moreover, in the case of SMEs, gross JC is the largest and gross JD is the smallest for MNE1 among three types of firms in all periods. Even in the early 2000s when manufacturing employment significantly declined, MNE1/SMEs enlarged domestic employment.

Fourth, MNE1 tend to intensify HQ services in all periods, except the case of large firms in the early 2000s, which experienced a huge shrinkage of manufacturing industry, and MNE1/SMEs also maintain or expand manufacturing activities in addition to HQ services. While manufacturing activities significantly shrunk in the early 2000s, MNE1 are likely to expand them, regardless of the firm size, since the latter half of the 2000s. Figure 8, which shows JC/JD by three intra-firm sections, demonstrates that in the case of MNE1, unlike other types of firms, both HQ services and manufacturing sections contribute to net job creation (or less net job destruction). From 2000 to 2004, MNE1/SMEs almost maintain manufacturing activities and intensify HQ services, unlike other types of SMEs, while large firms,

Figure 8. Changes in employment by intra-firm sections



Data source: author's preparation, using the results in Ando and Kimura (2017).
Note: see the text for the type of firms (MNE1, MNE2, Local).

regardless of the type of firms, shrunk domestic manufacturing activities.

Fifth, both gross job creation and gross job destruction at firm and intra-firm section levels are much larger than net changes in all periods, indicating the restructuring dynamism, firm heterogeneity, and active adjustments within firms. As Figure 1 shows, manufacturing employment in the United States has significantly shrunk, particularly since the 2000s, while its non-manufacturing employment has expanded, suggesting that the US economy seems to have relatively fast adjustments in intra-industry as well as inter-industry labor replacements from manufacturing to non-manufacturing. On the other hand, Japanese manufacturing firms seem to be relatively flexible in replacing workers within firms in the same sectors or within intra-firm sections of a firm in order to respond to changes in international competitive environment and its own globalizing activities.

III-1-2. The Kolmogorov-Smirnov (KS) test for changes in domestic operations and trade

Next, we shed light on distribution functions of net change rates and see the results of the KS test that is applied to their net change rates to examine whether MNE1 are different from MNE2 or Local. Note that Ando and Kimura (2015) study the following four periods, considering the data availability in the timing of analysis and the possible effects of the GFC: the period 1998-2002, 2002-2006, 2006-2008, and 2008-2010. Two steps are required to investigate whether or not net changes in domestic employment are larger for MNE1 than those for MNE2 or Local. Specifically, the first step (two-sided test) is to determine whether both cumulative distribution functions (CDFs) are identical or not; we are interesting in rejecting the equality of distributions. The second step (one-sided test) is to determine whether one CDF dominates the other CDF or not. What we expect is that the null hypothesis in the two-sided test can be rejected and, at the same time, the null hypothesis in the one-sided test cannot be rejected. The KS test is conducted for SMEs and large firms separately to compare MNE1 with MNE2 and Local, respectively to examine whether net changes of domestic employment are large for MNE1 than those for other types of firms.[12]

Table 5 presents the results of the KS test for net changes in domestic employment of MNE1 and MNE2 or MNE1 and Local. MNE1/SMEs tend to have higher growth rates of domestic employment as a whole and employment engaged in HQ services, compared with other SMEs, except the last period. Net change rates of employment engaged in manufacturing activities tend to be larger for MNE1/SMEs than other SMEs until the middle of the 2000s, but it does not stand any more in the latter 2000s. As for large firms, MNE1/large firms tend to expand HQ services, compared with other large firms, except the first period. Growth rates for MNE1/large firms tend to be higher than those for other large firms during the middle of the 2000s. Regarding manufacturing activities, MNE1/large firms have higher change rates than other large firms only in the first period. In sum, the results of the KS test

[12] See, for instance, Delgado, Farinas, and Ruano (2002), Arnold and Hussinger (2010), and Tanaka (2012b) for the detailed explanation and the application of the KS test to examine stochastic dominance between two groups.

Table 5. KS test for changes in domestic employment

	MNE1 v.s. MNE2				MNE1 v.s. Local			
	Two-sided		One-sided		Two-sided		One-sided	
	Coef.	P value	Coef.	P value	Coef.	P value	Coef.	P value
(i) SMEs								
Dom employment								
1998-2002	0.117	0.001	0.001	1.000	0.090	0.001	0.020	0.684
2002-2006	0.127	0.000	0.002	0.998	0.157	0.000	0.006	0.962
2006-2008	0.081	0.066	0.007	0.975	0.080	0.038	0.018	0.827
2008-2010	0.059	0.256	0.010	0.947	0.038	0.698	0.017	0.816
HQ employment								
1998-2002	0.083	0.030	0.013	0.909	0.067	0.024	0.015	0.812
2002-2006	0.121	0.000	0.006	0.980	0.113	0.000	0.005	0.969
2006-2008	0.076	0.100	0.013	0.919	0.098	0.005	0.013	0.910
2008-2010	0.085	0.030	0.028	0.638	0.062	0.136	0.035	0.433
Mfg employment								
1998-2002	0.104	0.003	0.007	0.976	0.057	0.089	0.043	0.181
2002-2006	0.083	0.017	0.000	1.000	0.106	0.000	0.034	0.304
2006-2008	0.062	0.300	0.044	0.410	0.058	0.274	0.057	0.163
2008-2010	0.053	0.423	0.039	0.459	0.051	0.346	0.051	0.188
(ii) large firms								
Dom employment								
1998-2002	0.080	0.019	0.000	1.000	0.073	0.015	0.073	0.009
2002-2006	0.144	0.000	0.003	0.993	0.145	0.000	0.016	0.769
2006-2008	0.098	0.002	0.007	0.971	0.091	0.003	0.023	0.665
2008-2010	0.087	0.009	0.000	1.000	0.060	0.127	0.027	0.575
HQ employment								
1998-2002	0.041	0.580	0.016	0.831	0.027	0.883	0.020	0.692
2002-2006	0.113	0.000	0.008	0.956	0.086	0.001	0.017	0.753
2006-2008	0.087	0.010	0.018	0.798	0.091	0.003	0.027	0.571
2008-2010	0.094	0.004	0.013	0.890	0.118	0.000	0.020	0.735
Mfg employment								
1998-2002	0.093	0.004	0.000	1.000	0.093	0.001	0.093	0.001
2002-2006	0.081	0.017	0.012	0.898	0.054	0.106	0.018	0.720
2006-2008	0.057	0.218	0.005	0.983	0.056	0.192	0.021	0.734
2008-2010	0.045	0.490	0.008	0.962	0.053	0.252	0.053	0.138

Data source: Ando and Kimura (2015).
Note: data are based on balanced panel data for each period.
The cases are highlighed if the results suggest stochastic dominance (the growth rates are higher for MNE1 than those for MNE2 or Local).

suggest that MNE1, particularly MNE1/SMEs tend to expand domestic employment, and both SMEs and large firms are likely to intensify the HQ services.

III-1-3. Expanding operations in East Asia

As mentioned above, most manufacturing firms increasing the number of foreign affiliates increase the number of affiliates in East Asia. Thus, let us discuss the features of firms expanding production networking in East Asia (firms expanding operations in East Asia, hereafter), based on the results in Ando and Kimura (2012). Note that we call firms that decrease the number of affiliates in East Asia as firms shrinking operations in East Asia and firms without changing the number of affiliates in East Asia as firms maintaining operations in East Asia. Table 6 presents patterns of production networking by Japanese manufacturing firms for 2007-2009 under the GFC in the two-year balanced panel data. The table also presents globalizing patterns for 1998-2002 and 2002-2006 in the two-year balanced panel data as normal periods for comparison. Around 10 percent of manufacturing firms in the dataset

enlarged their activities in East Asia during four years of normal periods, and even six percent expanded in a short period of two years under the GFC. Moreover, regarding SMEs, firms expanding operations in East Asia have a higher proportion of firms increasing domestic employment and higher growth rates of employment at the firm level, which contribute to net job creation.

Table 6. Changes in domestic employment by type of firm

	1998-2002				2002-2006				2007-2009			
	# of firms	Share of firms increasing	Average growth rates at the firm level	Aggregate change	# of firms	Share of firms increasing	Average growth rates at the firm level	Aggregate change	# of firms	Share of firms increasing	Average growth rates at the firm level	Aggregate change
1) Manufacturing firms												
No entry in East Asia	80%	32%	-3.7%	-128,527	77%	51%	5.2%	60,913	77%	41%	-0.5%	-3,500
Expansion in East Asia (i+ii)	9%	33%	-4.2%	-160,084	13%	64%	12.6%	116,235	6%	52%	2.8%	-9,579
- (i) Expansion in East Asia	5%	29%	-8.1%	-142,988	7%	62%	10.1%	99,970	4%	53%	2.5%	-10,996
- (ii) Expansion in East Asia (with 1st FDI)	4%	38%	0.2%	-17,096	5%	67%	16.1%	16,265	2%	50%	3.3%	1,417
Steady in East Asia	7%	25%	-9.3%	-69,561	8%	54%	4.5%	13,861	14%	43%	-1.4%	-1,773
Shrinkage in East Asia (i + ii)	3%	25%	-10.1%	-113,890	3%	50%	1.4%	-40,715	4%	40%	-3.9%	-5,576
- (i) Shrinkage in East Asia	2%	23%	-10.2%	-104,182	1%	48%	2.2%	-35,154	3%	42%	-2.9%	-2,487
- (ii) Shrinkage in East Asia (withdrawal)	1%	29%	-9.7%	-9,708	2%	52%	0.7%	-5,561	1%	33%	-6.5%	-3,089
Total	10,712	32%	-4.3%	-472,062	10,466	53%	6.0%	150,294	11,680	42%	-0.6%	-20,428
2) Manufacturing SMEs												
No entry in East Asia	89%	33%	-2.7%	-38,565	85%	52%	6.0%	40,767	85%	39%	-0.7%	-8233
Expansion in East Asia (i+ii)	5%	45%	2.1%	344	7%	67%	16.9%	12,769	3%	43%	1.3%	425
- (i) Expansion in East Asia	2%	46%	0.5%	-92	3%	63%	12.5%	4,461	1%	40%	-0.9%	-117
- (ii) Expansion in East Asia (with 1st FDI)	4%	44%	2.7%	436	4%	70%	19.6%	8,308	2%	45%	3.0%	542
Steady in East Asia	5%	30%	-7.2%	-5,588	6%	58%	5.8%	3,060	10%	38%	-2.1%	-3380
Shrinkage in East Asia (i + ii)	1%	32%	-2.2%	-1,512	2%	55%	5.2%	820	2%	34%	-5.2%	-1762
- (i) Shrinkage in East Asia	0%	28%	-10.9%	-665	1%	56%	13.6%	899	1%	36%	-3.7%	-792
- (ii) Shrinkage in East Asia (withdrawal)	1%	34%	-5.7%	-847	1%	54%	0.9%	-79	1%	32%	-6.7%	-970
Total	7,909	34%	-2.6%	-44,586	7,956	54%	6.7%	57,416	8,870	39%	-0.9%	-12,950

Data source: Ando and Kimura (2012).
Note: data are based on balanced panel data for each period.
Figures for the number of firms show ratios in total number of firms.

Let us check the results of the logit regression analyses and OLS regression analyses to quantitatively investigate the relationship econometrically between expansion of production networking and domestic adjustments. Table 7 shows features of firms expanding operations in East Asia, compared to other types of firms. These variables include: whether or not a firm increases domestic employment or not (1 if a firm increases and 0 otherwise), changes in domestic employment (growth rates), and changes in trade with East Asia (gap in ratios of exports to/imports from East Asia in total sales/total purchases). The table also presents the results of corresponding analysis for changes in the relative and absolute size of HQ and manufacturing activities over time. Specifically, the absolute indicator is whether or not a firm increases the number of employees engaged in HQ services/manufacturing activities (1 if a firm increases and 0 otherwise). The relative indicator for this is changes (gap) in the ratio of employment engaged in each activity in total employment. Logit estimation analysis was conducted for binary variables for total employment or employment engaged in intra-firm sections, while OLS estimation analysis was conducted for a growth rate of domestic employment or a change in exports to/imports from East Asia as a share of total sales/purchases. All estimations include the following control variables, firm size, capital-labor

Table 7. Production networking in East Asia by Japanese manufacturing firms and changes in their domestic employment and trade

	(1)	(2)	(3)	(4)	(5)	(6)	(5)	(6)
	d. employment						exports to E.Asia	imports from E.Asia
			HQ services		manufacturing activities			
			absolute size	relative size	absolute size	relative size		
	[logit]	[OLS]	[logit]	[OLS]	[logit]	[OLS]	[OLS]	[OLS]
1998-2002								
Expansion in East Asia	0.344 ***	0.043 ***	0.230 ***	-0.004	0.230 ***	-0.008	0.021 ***	0.032 ***
Steady in East Asia	-0.088	-0.015	0.093	0.006	-0.118	-0.014 **	0.006 ***	0.028 ***
Shrinking in East Asia	0.034	0.005	-0.093	-0.006	0.054	-0.006	-0.001	0.028 **
2002-2006								
Expansion in East Asia	0.574 ***	0.066 ***	0.334 ***	0.000	0.220 ***	-0.014 **	0.017 ***	0.037 ***
Steady in East Asia	0.049	-0.004	0.001	-0.004	-0.014	-0.003	0.011 ***	0.011 ***
Shrinking in East Asia	0.096	-0.008	-0.110	-0.003	-0.065	0.004	0.004	0.015 **
2007-2009								
Expansion in East Asia	0.284 ***	0.036 ***	0.174 *	0.006 *	0.002	-0.014 *	0.018 ***	0.025 ***
Steady in East Asia	-0.015	-0.006	-0.004	-0.004 **	0.017	-0.002	0.008 ***	0.012 ***
Shrinking in East Asia	-0.263 **	-0.033 ***	0.027	0.008 **	-0.313 ***	-0.014	0.007 *	0.025 ***

Data source: Ando and Kimura (2012).
Note: ***indicates that the results are statistically significant at the 1 percent level, **at the 5 percent level, and *at the 10 percent level.
Data are based on balanced panel data for each period.
This table excepts only the coefficients for variables of three types of firms.
Regressions are as follows:
(1) dependent variable: 1 if a firm increases in the number of domestic employments and 0 otherwise
(2) dependent variable: growth rate of the number of domestic employment
(3) dependent variable: 1 if a firm increases in the number of domestic employment engaged in HQ services and 0 otherwise
(4) dependent variable: a change in the ratio of employment engaged in HQ services in total employment
(5) dependent variable: a change in the ratio of expoprts to East Asia in total sales
(6) dependent variable: a change in the ratio of imports from East Asia in total purchases

ratio, foreign sales, R&D expenditure, and advertisement expenditure, foreign capital ratio, industry dummies, but Table 7 omits their results and shows only the coefficients of variables with our concern.

The results suggest that manufacturing firms expanding operations in East Asia are more likely to increase their domestic employment and to intensify transactions with East Asia in terms of both export and imports.[13] Their annual growth rates of domestic employment, which can be calculated from the estimates, are likely to be higher than those for other manufacturing firms by as much as one to two percent. This implies that firms expanding operations in East Asia partially offset job destruction and contribute to job creation in some cases. Also, firms expanding operations in East Asia tend to relatively intensify transactions with East Asia through both exports and imports, which is particularly true for the case of machinery firms. It indicates further expansion of production fragmentation by Japanese manufacturing firms, particularly machinery firms, and complementary relationship between trade and FDI.

[13] See Ando and Kimura (2012) for the corresponding analysis of domestic establishments or affiliates and for the results only for firms in machinery industries.

However, there also exists a weakening tendency of strengthening manufacturing activities and a possible sign of industrial structure adjustments over times, while HQ functions are intensified. Regarding HQ services, firms expanding operations in East Asia tend to have a higher probability of increasing employment in all periods and also to relatively expand this section under the GFC. Therefore, firms expanding operations in East Asia are more likely to intensify HQ services, and such a tendency is becoming strong. On the other hand, regarding manufacturing activities, the coefficients for changes in the absolute size are positive and statistically significant for two normal periods, but they are insignificant for the GFC period. In addition, the coefficients for changes in the relative size are negative and statistically significant for the second normal period and the GFC period. Considering the facts that manufacturing activities tend to shrink on the relative term, while firms expanding operations in East Asia intensify manufacturing activities, and that firms shrinking operations in East Asia have negative coefficients for changes in manufacturing activities in the absolute size, the strength Japan could have and the kinds of functions it could maintain significantly affect the size of manufacturing activities at home.

III-2. Import competition and domestic employment

Let us look at Japan in Figure 5. In 1970, most machinery trade was exports of final products, and the shares of machinery parts and components trade are quite small for both exports and imports. Although export ratios of machinery parts and components became large in 1990, export shares of machinery final products were still high. Since the 2000s, however, machinery parts and components occupy half of machinery trade for both exports and imports, and the import ratio of parts and components double from 1970. The timing of this kind of change coincides with the rapid formation of production networks with quick expansion of vertical back-and-forth transactions in East Asia.

As discussed in the introduction, manufacturing IP ratios in Japan have tended to rise rapidly since the 1990s (Figure 3). The rise is particularly significant in some manufacturing sectors (Table 8). High IP ratios do not necessarily indicate the shrinkage of domestic activities due to weakening international competition because production-networking firms tend to increase both exports and imports through production processes. Thus, we discuss domestic adjustments to import competition, using the results by Ando and Kimura (2017), which analyze the relationship between import competition and domestic employment at the firm level by using IP ratios at the industry level, with a distinction of the types of firms (MNE1, MNE2, and Local) for the periods 2000-2004, 2004-2008, and 2008-2012.[14]

Table 9 presents the results. IP ratios are either the initial level or the change (gap) in IP ratios for each period. The table also shows the results for IP variables with a distinction among three types of firms. The results provide several interesting findings. In general, the

[14] See Tomiura (2004) for the relationship between import competition and employment during and after the recent bubble period in Japan. Tomiura (2009) provides analysis on import competition based on IP ratios and employment in Japan.

Table 8. By-sector IP ratios for manufacturing in Japan (%)

	1970	1975	1980	1985	1990	1995	2000	2005	2010	2011	2012
Food processing	2.8	3.9	4.7	5.0	7.1	11.6	11.6	11.5	11.3	12.2	12.8
Beverages, tobacco, and animal feed	0.7	2.7	4.9	4.2	7.6	8.3	6.3	8.2	7.4	9.9	10.4
Textile and apparel	1.4	4.2	6.0	5.9	10.6	19.0	29.3	43.9	47.3	47.9	49.4
Wood and wood products	3.3	5.2	7.5	7.6	13.3	17.5	22.1	26.9	27.4	29.1	29.7
Furniture and fixtures	0.1	0.9	1.5	2.1	3.6	5.4	10.5	17.4	22.8	21.4	20.7
Pulp, paper, and paper products	1.3	2.0	3.6	2.9	3.4	4.5	4.9	5.7	5.8	6.2	7.0
Publishing and printing	0.0	0.0	0.0	0.2	0.4	0.5	0.4	0.7	0.7	0.8	0.9
Chemicals	3.1	4.7	6.6	7.4	8.2	8.6	9.7	11.6	14.5	15.6	17.1
Petroleum and coal products	9.1	5.2	7.6	9.4	13.1	9.7	10.9	11.7	13.3	18.9	18.0
Plastic products	0.1	0.4	0.4	0.4	0.9	1.8	3.3	5.2	7.0	7.3	7.2
Rubber products	0.2	1.6	2.8	3.3	5.8	8.6	11.5	14.7	16.4	16.4	16.5
Leather and leather products	2.6	6.4	8.4	10.7	28.0	37.2	46.3	60.8	66.0	65.5	67.2
Ceramics, clay, and stone products	0.3	0.8	1.1	2.1	3.1	3.0	4.4	6.5	8.4	8.6	8.4
Iron and steel	0.9	0.5	0.8	1.3	2.0	2.5	2.6	2.9	5.1	6.5	6.7
Nonferrous metal	6.4	15.7	16.6	19.4	21.9	24.1	25.1	29.2	37.7	39.2	43.8
Metal products	0.4	1.0	1.1	1.3	1.8	1.9	2.5	5.1	6.7	7.3	7.5
General machinery	3.3	5.3	4.0	3.2	3.9	4.4	7.5	9.7	10.1	10.7	11.7
Electric machinery	1.8	4.8	4.1	4.4	6.1	11.2	16.9	25.3	17.0	16.6	21.0
Transport equipment	1.6	3.2	3.0	2.6	4.0	4.5	5.1	5.4	6.5	7.0	6.3
Precision machinery	6.1	18.0	14.4	9.6	12.6	20.0	25.9	36.7	40.8	40.1	40.9
Other manufacturing	28.7	30.0	30.2	25.6	29.7	34.9	34.5	38.5	42.1	45.9	46.0
All manufacturing	7.0	8.0	8.0	7.1	8.8	10.9	12.7	16.0	16.1	17.5	18.6

Data: author's preparation, based on JIP database 2015.

Table 9. Domestic adjustments to import penetration

Dependent variable: changes in domestic employment (%)

	(1)	(2)	(3)	(4)	(5)	(6)
	2000-2004	2000-2004	2004-2008	2004-2008	2008-2012	2008-2012
a) Import penetration: level						
Firm size (log)	-3.65 ***	-3.97 ***	-0.77 ***	-1.31 ***	-1.10 ***	-1.28 ***
	-13.88	*-14.29*	*-3.21*	*-5.16*	*-4.72*	*-5.23*
Import penetration	-0.23 ***		-0.08 ***		-0.06 ***	
	-7.6		*-3.91*		*-2.83*	
Import peneration*Local		-0.26 ***		-0.13 ***		-0.06 ***
		-7.79		*-5.53*		*-2.61*
Import peneration*MNE1		0.09		0.20 ***		0.13 ***
		1.6		*4.69*		*3.54*
Import peneration*MNE2		-0.40 ***		-0.11 ***		-0.20 ***
		-7.24		*-2.9*		*-5.91*
Constant	16.02 ***	17.68 ***	7.69 ***	10.49 ***	5.05 ***	5.97 ***
	11.15	*11.68*	*5.91*	*7.67*	*3.98*	*4.49*
Adj R2	0.024	0.028	0.002	0.007	0.003	0.007
Number of observations	10517	10517	10934	10934	11121	11121
b) Import penetration: change (gap)						
Firm size (log)	-3.72 ***	-3.94 ***	-0.79 ***	-1.26 ***	-1.05 ***	-1.13 ***
	-14.25	*-14.53*	*-3.28*	*-5.06*	*-4.53*	*-4.77*
Import penetration	-1.10 ***		-0.11		0.30 ***	
	-12.59		*-0.79*		*4.04*	
Import peneration*Local		-1.17 ***		-0.47 ***		0.26 ***
		-12.11		*-3.09*		*2.86*
Import peneration*MNE1		-0.16		2.26 ***		0.74 ***
		-0.84		*7.43*		*4.21*
Import peneration*MNE2		-1.61 ***		-0.51 *		0.09 ***
		-8.77		*-1.91*		*0.54*
Constant	16.81 ***	17.91 ***	6.78 ***	9.25 ***	3.58 ***	3.98 ***
	11.85	*12.21*	*5.27*	*6.95*	*2.87*	*3.14*
Adj R2	0.033	0.028	0.001	0.008	0.003	0.004
Number of observations	10517	10517	10934	10934	11121	11121

Data source: Ando and Kimura (2017).
Note: figures in italic are t statistics.
Note: data are based on balanced panel data for each period.
See the text for the type of firms (MNE1, MNE2, Local).

levels of IP ratios tend to be negatively correlated with changes in domestic employment for all periods, but such a trend has weakened overtime. Moreover, although changes in IP ratios are negatively associated with changes in domestic employment with statistical significance in the period 2000-2004, the coefficient becomes insignificant in the period 2004-2008 and turns to be positive with statistical significance in the period 2008-2012. If high IP ratios simply indicate high import competition, an increase in imports would affect domestic industries and reduce domestic employment. However, this is not the case. Rather, the results suggest that although imports increase along with further development of production networks, globalizing corporate activities contribute to the expansion of domestic employment by effectively utilizing the networks.

Regarding the results of IP variables decomposed by the type of firms, coefficients for interaction terms with Local and MNE2 are negative and statistically significant except for the case of gap during the period 2008-2012. On the other hand, all coefficients for interaction terms with MNE1 are positive (some are statistically significant and others are not). This indicates that an increase in imports does not necessarily mean decreased international competition and the shrinkage of domestic activities in the environment of the existence of international production networks and their accelerating globalizing activities within the networks based on international fragmentation. Although we observe negative effects of import competition on domestic employment in the initial 2000s, such a trend is weakened, and the expansion of globalizing corporate activities within international production networks rather contributes to the expansion of complementary activities at home and in domestic employment.

IV. Concluding remarks

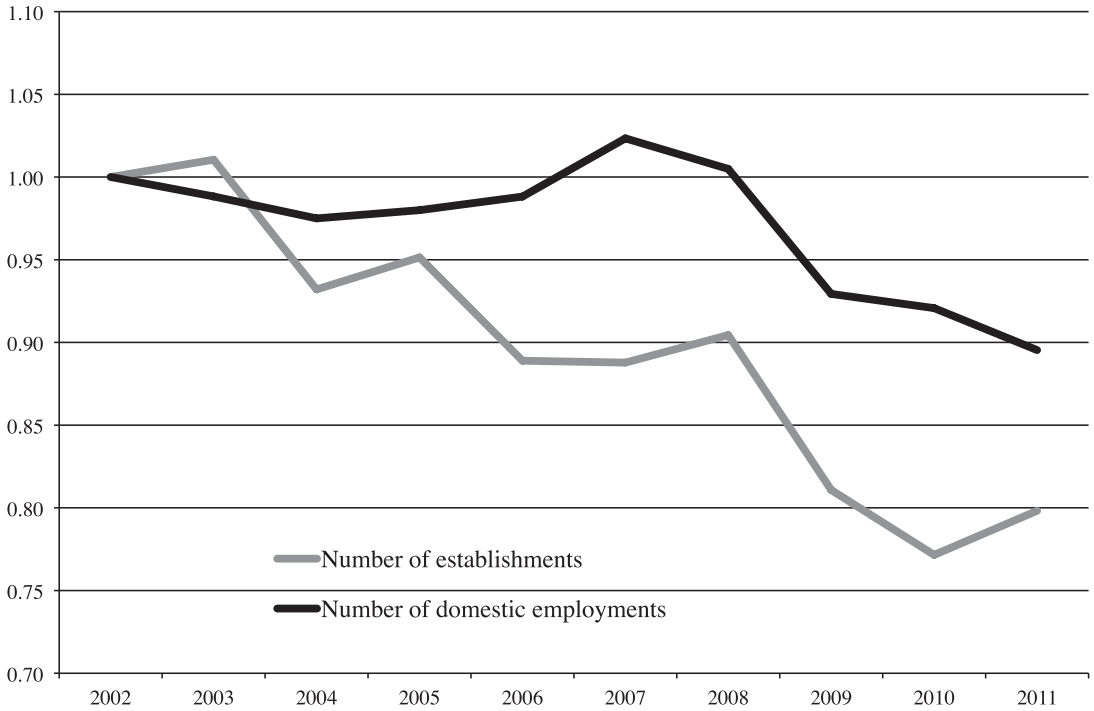
This paper discussed how industrial and employment adjustments have proceeded at home in an era with new international division of labor at the production process/task level, while Japan has been one of the major players of production networks in East Asia with active FDI in the manufacturing industry. The major findings are as follows: (i) de-industrialization advances in the early 2000s, but shrinkage of manufacturing industry is not observed afterwards, (ii) while the net job destruction is enormously large for large firms in the early 2000s, SMEs have much larger net changes than large firms do in all periods, and smaller gross job destruction for SMEs, compared with large firms, contributes more to net job creation (or smaller net job destruction), (iii) MNE1 tends to have larger net change rates for employment, compared with other types of firms (MNE2 or Local), and such a tendency is particularly true for MNE1/SME, (iv) MNE1 tends to intensify HQ services, and also MNE1/SME almost maintain manufacturing activities or expand in addition to HQ services, unlike other types of SMEs, (v) both gross job creation and gross job destruction at firm and intra-firm section levels are much larger than net changes in all periods, indicating the restructuring dynamism, firm heterogeneity, and active adjustments within firms, and suggesting that Japanese manufacturing firms, unlike the case of the US economy, seem to be rela-

tively flexible in replacing workers among firms in the same sectors or among intra-firm sections in order to respond to changes in the international competitive environment and its own globalizing activities, and (vi) globalizing activities of Japanese manufacturing firms contribute to expanded complementary activities at home, even though we cannot completely ignore negative effects of import competition on domestic employment.

Considering the results above, we can say that in the case of Japanese manufacturing firms, international division of labor at the production process/task level has retained domestic employment and operations more elastically than international division of labor at the industry level. Both exports and imports increase along with the development of international production networks, but their effective utilization contributes to the activation of domestic employment. Even in the manufacturing industry where FDI is active, domestic employment can remain or be expanded due to relatively flexible labor movements not only among firms in the same sector but also among intra-firm sections, including intensification of HQ services. It must be possible to realize both globalizing activities of firms and expansion of domestic employment, but whether and what Japan can retain with some strengths significantly influences the size of manufacturing activities at home in the future.

As already mentioned, the *Kikatsu* does not cover very small firms because the survey has a size-based cutoff that excludes firms with fewer than 50 workers. Research using other databases such as the Economic Census that covers small manufacturing establishments with no fewer than four employments or establishment-level statistics, may have different results. We expect that we can have a deeper discussion on this important topic with further research from different points of views or angles.

Figure A.1. Number of manufacturing establishments and employments (based on Economic Census): 2002=1



Data source: 2012 Economic Census (Overview of the results) (available from Statistics Bureau's website http://www.stat.go.jp/data/e-census/2012/pdf/gaiyos.pdf)
Note: Targeted establishments in this figure are those with no less than 4 employees.

Table A.1. Changes in domestic employment by Japanese manufacturing firms

	MNE1			MNE2			Local		
	C	D (-)	Net G	C	D (-)	Net G	C	D (-)	Net G
(i) SMEs									
Dom employment									
1998-2002	0.072	-0.126	-0.054	0.046	-0.168	-0.123	0.058	-0.130	-0.061
2002-2006	0.129	-0.052	0.077	0.085	-0.084	0.001	0.092	-0.072	0.020
2006-2008	0.072	-0.046	0.026	0.049	-0.060	-0.010	0.054	-0.054	-0.001
2008-2010	0.051	-0.058	-0.007	0.046	-0.072	-0.026	0.051	-0.058	-0.007
HQ employment									
1998-2002	0.183	-0.269	-0.087	0.140	-0.293	-0.154	0.143	-0.295	-0.152
2002-2006	0.249	-0.137	0.112	0.180	-0.187	-0.007	0.188	-0.171	0.017
2006-2008	0.177	-0.124	0.053	0.138	-0.123	0.015	0.131	-0.130	0.001
2008-2010	0.140	-0.146	-0.006	0.095	-0.142	-0.047	0.123	-0.132	-0.009
mfg employment									
1998-2002	0.114	-0.183	-0.069	0.075	-0.231	-0.156	0.102	-0.165	-0.063
2002-2006	0.145	-0.147	-0.002	0.119	-0.152	-0.033	0.113	-0.150	-0.038
2006-2008	0.124	-0.126	-0.003	0.094	-0.120	-0.026	0.099	-0.110	-0.011
2008-2010	0.106	-0.129	-0.023	0.104	-0.104	0.000	0.104	-0.095	0.009
(ii) large firms									
Dom employment									
1998-2002	0.045	-0.164	-0.119	0.043	-0.166	-0.123	0.076	-0.126	-0.061
2002-2006	0.113	-0.064	0.049	0.077	-0.097	-0.020	0.135	-0.076	0.060
2006-2008	0.057	-0.030	0.027	0.050	-0.046	0.005	0.079	-0.041	0.037
2008-2010	0.051	-0.035	0.016	0.045	-0.051	-0.006	0.073	-0.054	0.019
HQ employment									
1998-2002	0.106	-0.332	-0.227	0.098	-0.294	-0.196	0.124	-0.286	-0.162
2002-2006	0.172	-0.124	0.048	0.143	-0.190	-0.048	0.190	-0.174	0.016
2006-2008	0.107	-0.060	0.047	0.131	-0.084	0.048	0.148	-0.116	0.032
2008-2010	0.115	-0.053	0.062	0.144	-0.088	0.057	0.136	-0.131	0.005
mfg employment									
1998-2002	0.050	-0.225	-0.175	0.035	-0.270	-0.235	0.107	-0.188	-0.082
2002-2006	0.100	-0.144	-0.043	0.098	-0.194	-0.097	0.168	-0.158	0.010
2006-2008	0.089	-0.069	0.020	0.090	-0.082	0.007	0.123	-0.107	0.016
2008-2010	0.067	-0.064	0.004	0.081	-0.082	0.000	0.127	-0.079	0.047

Data source: Ando and Kimura (2015).
Note: data are based on balanced panel data for each period.
C, D (-), and Net G refer to gross (job) creation, gross (job) destruction, and net change.
The largest figures among 3 types of firms for C/D (-)/Net G are highlighted.
See the text for the type of firms (MNE1, MNE2, Local).

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