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Abstract

Using parent-foreign affiliate matched data on Japan from 1995 to 2009, this paper examines the effects of foreign direct investment (FDI) on domestic employment, especially in manufacturing. One of the contributions of this paper is that we utilize the matched data for each country in which Japanese multinational firms operate, which enables us to identify the differences in the impact of FDI between destinations. Results indicate that the *increases* in the investment goods price in China —but the *decreases* in it in the United States—negatively affected the domestic labor demand of multinationals in Japan. This contrast may reflect a difference in specialization patterns across countries. We also found that disemployment in Japan was driven mainly by substitution between capital and labor, rather than by the reallocation of labor from Japan to overseas.

Keywords: Foreign direct investment, Disemployment, Unconditional labor demand
JEL classification: F14, F16, F23, J23

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1 Introduction

With the growing activities of multinationals, one of the major concerns for policy makers in developed countries is disemployment caused by the multinationals, especially in the manufacturing sector.[1] For example, increased competition with foreign countries forces firms to relocate production sites overseas, which results in disemployment in the home country. In particular, the decline in manufacturing jobs is believed to have been the consequence of globalization. However, previous studies, including studies in Japan, have not necessarily confirmed this phenomenon of "exporting jobs".[2] One reason is that foreign direct investment (FDI) usually initiates increases in the production of final goods in foreign countries, which positively affects the production of intermediate inputs in the home country, resulting in the maintenance of, or an increase in, domestic labor demand. Such positive effects may offset or even exceed the negative effects.

This paper empirically examines how and the extent to which disemployment is related to FDI. It focuses on Japanese multinationals, especially in the manufacturing sector. An advantage of Japanese data is the availability of parent–foreign affiliate matched data. These data include information such as employment and wage bills at both the parent firm and foreign affiliate levels. This enables us to identify the relationship between global resource allocation by the multinational firms and changes in prices at home and in foreign countries.

Our study builds upon research by Yamashita and Fukao (2010) (hereafter Y&F) and Harrison and McMillan (2011) (hereafter H&M).[3] Y&F estimated the labor demand function for domestic manufacturing employment in Japan, to which they added the amount of FDI, conditional on the domestic output of each firm. Their study found "some evidence that expansion of overseas operations may have helped to maintain the level of home employment" (p. 88). However, they did not distinguish between destinations of FDI. Given the rapidly expanding Asian markets, the effects of FDI may vary according to its destination; that is, impacts may differ depending on whether FDI occurs in China, Vietnam, Thailand, or outside of Asian markets, such as in the United States (US). In addition, because changes in domestic output may result from FDI itself, the estimated coefficients of FDI may include a substantial bias that prevents evaluation of the magnitude of its effects.

To overcome such shortcomings in the literature, H&M estimated the unconditional labor demand function for domestic employment. H&M estimated domestic employment simply based on a price vector of domestic and foreign countries. Their results indicated that "offshoring to low-wage countries substitutes for domestic employment" (p. 857), but they also found that the wage differential between countries explained only a small proportion of the decline in US manufacturing employment. Other factors, such as falling investment goods prices and import competition, are quantitatively a more important determinant of

[1] In the literature, disemployment by multinationals is also called job offshoring, or the hollowing out of industries.

[2] See Desai, Foley, and Hines (2009), Matsuura (2011), and Tomiura (2012) for a survey.

[3] A recent study by Hayakawa, Matsuura, Motohashi, and Obashi (2013) also examined the effects of FDI on domestic employment in Japan. However, their analysis focused only on whether firms are multinationals, and global resource allocation by multinationals is beyond the scope of their paper.

falling US manufacturing employment. While H&M employed a sophisticated empirical framework, because of data constraints they used only three classifications for locations: the US, high-income countries, and low-income countries. However, as they stated, "in principle there could be as many factors and final goods prices as there are countries" (p. 863).

Extending these studies, the current study's contribution is twofold. First, we utilize parent–affiliate matched data at the affiliate level. Thus, the factor and final goods prices can be decomposed for each destination country. Distinguishing between the different effects for Asian countries such as China, Thailand, and Vietnam, we quantify the extent to which the price differential between Asian countries and Japan caused the "exporting of jobs." Second, this paper estimates the unconditional labor demand function for Japan à la H&M, to quantify the magnitude of the effect of FDI on domestic disemployment. Furthermore, our study covers the period between 1995 and 2009, making it the most current firm-level study on FDI and employment. Our study will shed new light on the mechanisms of disemployment in Japan.[4]

Our main findings are as follows. First, the effect of factor prices on domestic employment depends on the destination of FDI. Changes in Chinese wages had negative effects on domestic employment in Japan, but the size of this impact was almost the same as that of the changes in other East and Southeast Asian countries, such as Indonesia, the Philippines, and Thailand. The *increases* in the investment goods price in China but the *decreases* in the investment goods price in the US negatively affected the domestic labor demand of multinationals in Japan. This contrast may reflect the difference in specialization patterns caused by FDI across countries.

Second, in general, the negative effect of foreign wages on domestic employment is negligible. However, the decline in the price of investment goods has significantly larger negative effects on domestic employment than on foreign wages. These results together suggest that disemployment in Japan is mainly driven by substitution between capital and labor, rather than the reallocation of labor caused by FDI.

The rest of the paper is organized as follows. Section 2 describes the parent–foreign affiliate matched data in Japan. The empirical framework is presented in Section 3. In Section 4, we present the estimation results. Section 5 provides a summary and concluding remarks.

2 Parent–Foreign Affiliate Matched Data

To identify the relationship between global resource allocation by the multinational firms and changes in factor prices in host countries, we merge parent-level data with foreign affiliate-level data. For the parent-level data, we utilize the confidential database of the *Kigyou Katsudou Kihon Chousa Houkokusyo* (*Basic Survey of Japanese Business Structure and Activities*: *BSJBSA*), prepared annually by the Research and Statistics Department of the

[4]Like those of Y&F and H&M, our sample consists of multinationals. This means that this paper focuses on the intensive margin (i.e., existing foreign affiliates) rather than the extensive margin (i.e., newly established foreign affiliates).

Ministry of Economy, Trade, and Industry (METI) (1995–2009). This survey was first conducted in 1991, and has been conducted annually since 1994. The main purpose of the survey is to capture an overall statistical picture of Japanese corporate firms in light of their activity diversification, globalization, and strategies for research and development, as well as information technology.

The strength of both surveys is the sample coverage and the reliability of information. The survey is compulsory for firms with over 50 employees and firms with capital of more than 30 million yen (some nonmanufacturing industries such as construction, medical services, and transportation services are not included). One limitation is that some information on financial and institutional features is not available, and small firms (with fewer than 50 workers) are excluded.[5] Furthermore, the information on wage bills is available only at the aggregated level (total wage payments). Therefore, we cannot distinguish between the wages of skilled and unskilled workers.

For the foreign affiliate-level data, we utilize the confidential foreign affiliate-level database of the *Kaigai Jigyou Katsudou Kihon Chousa Houkokusyo* (*Basic Survey of Overseas Business Activities*: *BSOBA*). This survey is conducted annually at the end of March by the Research and Statistics Department of the METI. The *BSOBA* covers all firms that have foreign affiliates, except for the insurance/finance and real estate industries. The definition of a foreign affiliate in the survey is a company abroad where the Japanese parent firm has more than a 10% share of investment, or is a subsidiary in which the foreign affiliated company has a greater than 50% equity share. Response rates are around 70%, which implies that the *BSOBA* includes a relatively large proportion of the Japanese multinationals.[6]

The *BSOBA* includes yearly accounting information, including sales, wage bills, and the amount of investment for domestic headquarters as well as for each foreign affiliate. This data set also reports employment in each location, defined by the number of employment contracts that are over one month in length at the end of March. Employment contracts of less than one month (such as daily contracts) should be included if the employee was actually employed for more than 18 days in both February and March.

We construct parent–foreign affiliate matched data, using the concordance developed by the Research Institute of Economy, Trade, and Industry (RIETI). Each firm is traced throughout the period using information on its parent ID as a key. Furthermore, we match the parent–foreign affiliate matched data to information on prices, using the Japan Industry Productivity (JIP) 2012 database and the Penn World Table (PWT) Version 7.1.[7] To simplify the description, hereafter we refer to the parent–affiliate matched data as the METI

[5]In 2002, the *BSJBSA* covered approximately one-third of Japan's total labor force is employed in industries other than the public sector, finance industry, or other service industries (Kiyota, Nakajima, and Nishimura, 2009).

[6]The coverage of our data is presented in Table A1.

[7]The JIP database was compiled as part of a research project of the RIETI and Hitotsubashi University. The JIP2012 database consists of 52 manufacturing and 56 nonmanufacturing industries from 1970 to 2009. The JIP database provides us with the prices of final and investment goods in each industry for each year, as does the National Bureau of Economic Research (NBER) manufacturing database. For more details about the JIP database, see Fukao, Hamagata, Inui, Ito, Kwon, Makino, Miyagawa, Nakanishi, and Tokui (2007). We last accessed the PWT on June 18, 2013).

database. Firms for which employment or wage data are missing are excluded from the sample. Although these processes reduce the sample size by almost 50%, the available number of observations during the 15 years is 21,911 parent firm-years and 103,255 foreign affiliate-years.[8]

Table 1 presents a summary of employment by multinational firms. Employment in this paper is measured by the number of regular workers.[9] There are three key points arising from the interpretation of Table 1.[10] First, reflecting globalization, the number of multinationals increased over the period. The number of parent firms tripled from 861 in 1995 to 2,443 in 2009. The number of foreign affiliates increased from 4,269 in 1995 to 9,374 in 2009.

=== Table 1 ===

Second, at the aggregated level, employment by multinationals has increased in both domestic and foreign markets. It is remarkable that the employment of parent firms increased by 41% from 1995 to 2009, despite the prolonged recession that occurred during this period.[11] In the same period, aggregated overseas employment increased even more rapidly, by almost 120%. Although the ratio of foreign employment to domestic employment increased from 55% to 89%, the increase in domestic employment by multinationals in Japan contrasts greatly with the situation in the US, where multinational manufacturers reduced their domestic employment by approximately 30% during the 1980s and 1990s.[12]

By contrast, at the firm level, the average number of domestic employees per multinational firm declined continuously from the latter half of the 1990s. The average number of workers in parent firms was 1,188 in 2009, which is almost half the average number of workers in parent firms in 1995 (2,397 workers). Together with the almost constant average number of workers in foreign affiliates throughout the period, the results may suggest increasing substitution of domestic with foreign labor inputs within firms. This is why we pursue the micro level analysis. Of course, the alternative interpretation is that it reflects the entry of smaller multinationals. Because both interpretations are possible, more rigorous analysis is needed to determine whether FDI causes disemployment in Japan. In the next section, we present the empirical framework for our analysis.

[8]The coverage of our sample is presented in Table A1.

[9]In the BSJBSA (and other Japanese government statistics in general), regular workers are defined as workers who are employed for more than one month, or more than 18 days in the previous two months before the latest month-end closing of accounts. The term thus may include not only full-time but also part-time workers.

[10]The sample size for 2004 is small. This may be caused by the incompleteness of the concordance provided by the RIETI.

[11]According to the *Labor Force Survey*, the number of nonagricultural employees increased by 4% from 1995 to 2009.

[12]See Table 1 in H&M.

3 Empirical Framework

3.1 Model

To reveal substitution between domestic and foreign markets caused by FDI, the most straightforward procedure is to estimate the labor demand function at the micro level. However, the methodology for estimation varies among researchers. Some studies estimate conditional labor demand by regressing domestic employment on the domestic price vector, given the level of production. A typical example of this in the Japanese context is Y&F. Other studies examine an unconditional labor demand function that relates domestic employment to the price vectors of foreign as well as domestic countries, as in H&M. If parent–foreign affiliate matched data include information on the location of each foreign affiliate, the estimated coefficients obtained from the latter approach are generally less biased than those obtained from the former. This is because the latter approach implicitly takes into account a firm's decision regarding the location of production.

In this paper, we follow the latter approach and robustly estimate an unconditional labor demand function for domestic employment in Japan by regressing firm-level domestic employment data on the price vector that the firm may have faced. We begin by assuming that there are only two locations (domestic and foreign), but we generalize to multiple foreign countries in the empirical specification that follows.

Suppose that a firm i uses N_i domestic factors and N_i^* foreign factors of production $X_{1i}, ..., X_{Ni}, X_{1^*i}, ..., X_{N^*i}$ to produce total aggregate worldwide output Y_i. Output Y_i includes production at home and abroad, and the output can be exported or sold on domestic markets. Assume that factors are immobile between countries and both output and input prices are given.[13] Let the production function of firm i producing Y_i be:

$$Y_i = f(X_{1i}, ..., X_{Ni}, X_{1^*i}, ..., X_{N^*i}). \tag{1}$$

Based on the demand for $X_{1i}, ..., X_{Ni}, X_{1^*i}, ..., X_{N^*i}$, the associated domestic cost function C_i is written as:

$$C_i = g(p_{1i}, ..., p_{Ni}, p_{1^*i}, ..., p_{N^*i}), \tag{2}$$

where p_{Ni} and p_{N^*i} are the input prices of N and N^* at home and at the location of the foreign affiliate, respectively. Using Shepard's lemma, we can derive the conditional factor demand for the n-th input for firm i at home:[14]

$$X_{ni} = X_{ni}^d(p_{1i}, ..., p_{Ni}, p_{1^*i}, ..., p_{N^*i}, Y_i), \quad n = 1, ..., N. \tag{3}$$

One concern is that the global output Y_i is determined simultaneously with the demand for the n-th input. Thus, the estimation of equation (3) would have a significant simultaneity

[13] In this paper, we assume that, like standard static trade models, factor endowment is exogenously given and thus the effects of the changes in factor endowment are reflected in input prices.

[14] Similarly, the unconditional factor demand function for the n^*-th input for the firm i abroad can be obtained by substituting n with $n^*, n^* = 1, ..., N^*$.

problem. Following H&M, we solve this problem by assuming that global output Y_i is a function of the domestic output price P^h and the foreign output price P^f:[15]

$$Y_i = Y(P^h, P^f). \tag{4}$$

Substituting equation (4) into equation (3) yields:

$$X_{ni} = X_{ni}^d(p_{1i}, ..., p_{Ni}, p_{1^*i}, ..., p_{N^*i}, P^h, P^f), \quad n = 1, ..., N. \tag{5}$$

Focusing on two factors (labor and capital), we approximate equation (5) using the following log-linear form:

$$\begin{aligned} \ln L_{it}^h &= \alpha + \beta^h \ln P_{it}^h + \beta^f \ln P_{it}^f + \eta^h \ln w_{it}^h + \eta^f \ln w_{it}^f \\ &\quad + \omega^h \ln r_{it}^h + \omega^f \ln r_{it}^f + d_t + d_i + \varepsilon_{it}^h, \end{aligned} \tag{6}$$

where L_{it}^h denotes the employment level of firm i in home country h in year t; P_{it}^h and P_{it}^f are the final goods prices in year t of firm i for the home and foreign countries, respectively; w_{it}^h, w_{it}^f, r_{it}^h, and r_{it}^f represent domestic and foreign wages and capital prices, respectively; d_t and d_i indicate year and firm fixed effects, respectively; and ε_{it}^h is an error term.[16]

3.2 Variables

As explained in Section 2, for the domestic employment of parent firm i in year t (L_{iht}), we use data on employment in the parent firm from the METI database. For domestic and foreign wages, we calculate weighted average wage bills per person by country-industry-year, weighting this by employment share. The domestic and foreign wages are denoted by w_{jt}^h and w_{jt}^f, respectively, where j denotes the industry. The wage bills are from the METI database.[17]

As a proxy for the final goods prices for Japan and foreign countries, we use the price indices of output and consumption, respectively. The proxy for capital prices is the price of investment goods.[18] The information on final and investment goods prices is obtained from the JIP2012 database for Japan and from the PWT Version 7.1 for foreign countries.

[15]Note that, even in the case that the global output is a function of factor as well as output prices, we can obtain the same reduced form equation as equation (5). Our analysis thus is not substantially affected whether or not equation (4) includes factor prices.

[16]Although we utilize affiliate-level data, we control for parent firm fixed effects because the dependent variable is firm-level employment.

[17]Unfortunately, because the data do not include any information on the quality of human capital and its factor prices (e.g., educational attainments), we cannot distinguish between demand for skilled and unskilled labor. While the effect of FDI on the quality of domestic jobs (i.e., the skill composition in domestic markets) is another important issue, this paper focuses on the effect of FDI on the number of jobs because of the limited data available.

[18]It may be better to use the user cost of capital rather than the investment goods price index. However, because of the limited availability of these data, following H&M (2011), this paper utilizes the investment goods price. Appendix discusses about this issue in more detail.

The final goods prices in Japan (P^h_{jt}) are calculated by dividing each sector's nominal output by its real output. Similarly, the investment goods prices in Japan (r^h_{jt}) are calculated by dividing nominal investment by real investment. Following H&M, the final and investment goods prices in foreign countries (P^f_t and r^f_t) are measured by the price level of consumption and investment, respectively. All the final and investment goods prices at home and abroad are normalized to unity in 2000.

Note that the final goods price has a strong correlation with the investment goods price in both the home and foreign countries.[19] Therefore, including final and investment goods prices in a single equation causes a multicollinearity problem. To avoid this problem, while controlling for the effects of the changes in final goods prices, we utilize the relative final goods price (P^h_{jt}/P^f_t):

$$\begin{aligned} \ln L^h_{it} &= \alpha + \beta \ln(P^h_{jt}/P^f_t) + \eta^h \ln w^h_{jt} + \eta^f \ln w^f_{jt} \\ &\quad + \omega^h \ln r^h_{jt} + \omega^f \ln r^f_t + d_t + d_i + \varepsilon^h_{it}. \end{aligned} \tag{7}$$

We expect that as in a standard labor demand function, the home wage has negative effects on domestic labor demand, whereas the home investment goods price has positive effects. Foreign wages have two contradictory effects. Increases in foreign wages may reduce the labor demand in foreign countries, which increases the domestic labor demand. However, increases in foreign wages may cause a substitution from labor to capital, which decreases the labor demand in the home country. Similar opposing effects are expected in relation to foreign investment goods prices. Therefore, the coefficients of foreign wages and investment goods prices cannot be determined from theory.

In addition, the coefficient of the relative final goods prices is not determined. If the domestic final goods prices increase, firms have a strong incentive to increase their output, which results in increases in domestic labor demand. On the other hand, if the foreign final goods prices increase, domestic labor demand decreases (increases) if the foreign production substitutes for (complements) domestic production. As both effects are possible, the sign of the coefficients can be determined by empirical analysis.

One may be concerned that the foreign final goods price index does not necessarily capture the price of goods exported to Japan because it is aggregated at the country level. Tomiura (2003) estimated the conditional labor demand function using industry-level data. The results indicate that employment declined substantially as a result of intensified import competition and that employment sensitivity increased with each industry's share of imports. To control for such effects, we include the share of imports in each industry.[20] Following

[19] In our sample, the correlation between the (log of) final and investment goods prices is 0.5 for Japan and 0.9 for foreign countries.

[20] One may further ask why imports affect labor demand, because prices are given in the labor demand function. One explanation is that the product is differentiated across countries, as in the Armington assumption, which is often used to balance perfect competition and intraindustry trade in Computable General Equilibrium analysis. Note also that cheap products are not necessarily imported from abroad if there are high trade costs (e.g., transportation cost). The share of imports can thus control for some of the effects that are not captured by information on foreign prices.

Bernard, Jensen, and Schott (2006), each industry's share of imports is measured by its own imports divided by the total domestic demand (output + imports − exports). These data are obtained from the JIP2012 database.

We add the ratio of research and development investment to sales as a proxy for upgrading investment, following Y&F and H&M.[21] The R&D–sales ratio is defined as R&D expenditure divided by the parent firm's sales. The R&D ratios for the parent firm and its foreign affiliates are obtained from the *BSJBSA* and *BSOBA*, respectively. The summary statistics of variables are shown in Table 2.[22] The changes in independent variables between 1995 and 2009 are used to calculate the impacts of different aspects of globalization (in Tables 4 and 6 in the next section).[23]

=== Table 2 ===

4 Results and Discussion

4.1 Baseline results

Table 3 presents the estimated results of Equation (7), which shows how this research departs from previous studies. Column (1) shows the results without any controls. From column (2) to column (4), the ratio of R&D to the parent firm's sales and the import share are added to control for the effects of R&D investment and import competition.

=== Table 3 ===

As column (1) indicates, the coefficients for employment elasticity with respect to domestic prices are precisely estimated as negative for labor but positive for capital. Generally, the elasticity of employment with respect to foreign prices is smaller than that for domestic prices. In particular, elasticity with respect to foreign wages is negative but rather small.[24] The effect of the capital price of foreign affiliates is estimated as negative, although the absolute value of the coefficient is small. This baseline result implies that the reallocation of employment between domestic headquarters and foreign affiliates dominates the effect of changes in the prices of foreign investment goods on total labor demand. In other words,

[21] Another concern is that our sample includes not only wholly owned foreign affiliates but also joint ventures (i.e., shared equity). However, information on equity shares is only available from 2000. Moreover, in 2009, minority-owned affiliates (i.e., less than 50% equity share) accounted for only 10.6% of all Japanese foreign affiliates, implying that the difference in the equity shares has little if any effect on our results. This paper thus did not control for the equity shares of the Japanese parent firms.

[22] Tables A2 and A3 present the variables that we used, by year, for all industry sectors and for the manufacturing sector only, respectively.

[23] Tables A4 and A5 summarize the number of foreign affiliates, by country-year and by industry-year, respectively.

[24] The small effect of wages may come from the substitution between skilled and unskilled jobs, although we cannot distinguish between them because of the limited data availability discussed above.

these estimated coefficients generally suggest that domestic employment is affected by capital prices in both the domestic and foreign countries rather than by labor prices.[25]

Domestic employment is negatively related to the R&D ratio of the domestic headquarters and that of the foreign affiliates, as indicated in column (2). It is plausible that R&D investment at home and abroad leads directly to substitution from labor to capital. Moreover, once the effects of R&D are controlled for, the coefficient of the foreign affiliate wage becomes insignificant. This implies that the effects of foreign wages on domestic labor demand, if any, are negligible.

As shown in column (3), the import share of industry is also negatively related to domestic employment, and is an appropriate control for the effect of import penetration on disemployment. An additional interesting point in column (3) is that adding import share as an explanatory variable reduces the elasticity of employment with respect to the domestic capital price. One implication is that some portion of employment loss resulting from a decrease in the capital price will be accelerated by increasing imports. To put this another way, a parent firm can change its operations to become more capital intensive provided that it can import the intermediate input from abroad. Without flexibility of imports, the change in the capital intensity induced by the capital price may be restricted.

The regression result in Table 1 suggests that capital prices have a greater influence on changes in domestic employment caused by multinationals than other factors. To evaluate the cause of actual disemployment resulting from FDI, we conducted a simulation using the summary statistics in Table 2 and the estimated coefficients in Table 3. Column (1) in Table 4 is a copy of the coefficients in Table 3, whereas column (2) is the actual average change in each explanatory variable. Therefore, the linear combination of the two columns decomposes into the actual change in average domestic employment, which is shown in column (3). When we use the baseline specification, most of the decline in average domestic employment comes from changes in the price of domestic investment goods. This suggests that the prolonged period of deflation and/or the rapid technological growth caused most of the decline in domestic employment by multinationals, whereas the substitution mechanism between domestic and foreign inputs had, at most, a secondary impact on disemployment resulting from FDI.

=== Table 4 ===

Column (3) shows that the substitution between inputs induced disemployment among multinationals mainly through a decrease in the investment goods price. The domestic price of labor decreased by 15.6% and accounted for an additional 1.6% of the decline in domestic employment. However, the decline in the investment goods price induced a massive substitution from labor to capital and resulted in a 10.8% reduction in domestic employment. By contrast, the effect of the price change in foreign countries was negligible: $--0.03\%$. These interpretations do not change even when we employ an alternative specification.

[25] One may be concerned about the low R-squared value for the regression results. However, in panel data analysis with a large cross-section of observations, we frequently observe low R-squared values. Indeed, H&M also reported low R-squared values (0.04–0.05 in Tables 4 and 5), and the sample size in our analysis is 20 times greater than that of H&M.

4.2 Disemployment in the manufacturing sector

As shown above, the main driving force of the decline in domestic employment caused by FDI was the effect of the domestic capital price, which explains a greater proportion of the decline than the wage change does. The next natural question is whether there is a difference between industries. More specifically, the manufacturing sector may be affected by FDI to a greater extent, and the implications from the estimation of unconditional labor demand functions may suggest different economic mechanisms in the industry. To answer this question, we restricted the sample to manufacturing data and conducted the same estimation and simulation as in Tables 3 and 4. The results are shown in Tables 5 and 6, respectively.

=== Tables 5 and 6 ===

The main message from Table 5 is the same as that from Table 3; that is, the economic mechanism of substitution that we have discussed can also be applied to the manufacturing sector. One significant difference between Table 3 (all sectors) and Table 5 (manufacturing only) is the coefficient of the domestic investment goods price. The estimated coefficient is 0.984 for manufacturing, which is larger than that for all firms (0.698). As a result, the impact of the changes in the domestic investment goods price is much larger for manufacturing ($--15.1\%$) than for all industries ($--10.8\%$).

As the results show, the substitution between labor and capital is more important in explaining disemployment in the manufacturing sector resulting from FDI. That is, the main driving force of the total decline in domestic employment is the decline in the domestic investment goods price. These interpretations remain unchanged even when we employ an alternative specification. Labor market competition between the domestic and foreign countries did not play a major role in deindustrialization in Japan in recent years.[26]

4.3 Country decomposition of the foreign price vector

One may be concerned that the single foreign price vector may offset the effects of prices in different countries because foreign countries include both developed countries such as the US and developing countries such as China.

To address this concern, we decompose foreign prices into the 15 major FDI destinations and other countries: China, the US, Thailand, Hong Kong, Singapore, Taiwan, Malaysia, Indonesia, the United Kingdom, Germany, Korea, the Philippines, Australia, France, Canada,

[26]To confirm our interpretation of the substitution from labor to capital, we estimated the same equation as in Table 3 but replaced the dependent variable with capital stock, as shown in Table A6. Although our data only provide the nominal book value of capital stock, the estimated results confirm that the price of investment goods negatively affects the capital stock, which supports our interpretation.

and the rest of the world.[27] The regression equation is as follows:

$$\begin{aligned}\ln L_{it}^{h} &= \alpha + \sum_{c=1}^{16} \beta^{c} \ln(P_{jt}^{h}/P_{t}^{c}) + \eta^{h} \ln w_{jt}^{h} + \sum_{c=1}^{16} \eta^{c} \ln w_{t}^{c} \\ &\quad + \omega^{h} \ln r_{jt}^{h} + \sum_{c=1}^{16} \omega^{c} \ln r_{t}^{c} + d_{t} + d_{i} + \varepsilon_{it}^{h}. \end{aligned} \tag{8}$$

Table 7 presents the estimation results of equation (8). There are three notable findings. First, while the coefficient of foreign wages is significantly negative, that of the interaction term between foreign affiliate wages and the country dummy for China is insignificant. Similarly, the interaction terms between foreign wages and the dummies for many East and Southeast Asian countries, such as Indonesia, the Philippines, and Thailand, do not have significant coefficients. These results together imply that changes in Chinese wages have had negative effects on domestic employment, but they are almost the same in terms of elasticity as the effects of the changes in other East and Southeast Asian countries. China is a giant trading partner for Japan, but the underlying economic mechanism between the two countries may not be different from those between Japan and other Asian countries.

=== Table 7 ===

Second, the investment goods prices in the US have a significantly positive coefficient. Given that investment goods prices declined from 1995 to 2009 in the US, this result means that the decline in the investment goods prices in the US negatively affected the labor demand of multinationals in Japan. This result suggests that the decline in the price of capital in the US caused the substitution from labor to capital in the domestic headquarters.

Third, the investment goods price in China has a significantly negative coefficient, in contrast to the result for the US. Even though the investment goods price increased in China from 1995 to 2009, labor demand did not return in Japan. The increases in the investment goods price in China resulted in a decline in the price of labor relative to capital, which caused a shift in demand from capital to labor in China. Furthermore, the decline in the relative price of labor in China decreased wages there compared with Japan, which might have caused the substitution of employment in Japan with employment in China. Differences in the specialization patterns of production across countries may result in different impacts of the investment goods prices.

5 Concluding Remarks

Using parent–foreign affiliate matched data for Japan from 1995 to 2009, this paper examined the effects of FDI on domestic employment. An unconditional labor demand function is

[27] The order is based on the number of foreign affiliates (Table A4). These 15 countries cover 86% of foreign affiliates in total. Countries in Latin America, Africa, the Middle East, the rest of Oceania, the rest of Asia, and the rest of Europe are classified as the rest of the world.

estimated to control for the simultaneity between the demand for domestic labor and the production of global output.

The contribution of our paper is twofold. First, we utilized parent–affiliate matched data at the affiliate level. Thus, the factor and final goods prices could be decomposed for each destination country. Distinguishing the difference of effects between Asian countries such as China, Vietnam, and Thailand, we quantified the extent to which the price differential between Asian countries and Japan caused the export of jobs. Second, this paper estimated the unconditional labor demand function in Japan à la H&M, to quantify the effect of FDI on domestic disemployment. Therefore, it contributes to the literature by adding another national perspective to the available evidence. Furthermore, our study covers the period between 1995 and 2009, making it the most current firm-level study of FDI and employment. Our study has shed new light on the mechanism of disemployment in Japan.

Our main findings are as follows. First, the changes in Chinese wages had negative effects on domestic employment in Japan, but the size of this impact is almost the same as that of changes in other East and Southeast Asian countries, such as Indonesia, the Philippines, and Thailand. In addition, the *increases* in the investment goods price in China but the *decreases* in the investment goods price in the US negatively affected the domestic labor demand of multinationals in Japan. This contrast may reflect a difference in specialization patterns caused by FDI across countries.

Second, in general, the negative effect of foreign wages on domestic employment is negligible. However, the decline in the price of investment goods has significantly larger negative effects on domestic employment than on foreign wages. Seen in combination, these results suggest that the disemployment in Japan is mainly driven by substitution between capital and labor, rather than the reallocation of labor caused by FDI.

It is worth mentioning the following caveats. First, following Y&F and H&M, this study focused on the intensive margin (i.e., when the multinational operates existing foreign affiliates). However, a recent study by Muendler and Becker (2010) found that employment levels generally respond the most at the extensive margin (i.e., when the multinational firm enters a foreign market) in the case of German manufacturing multinationals. Because such a mechanism would cause an underestimation of the effect of FDI on employment when we only use existing foreign affiliates, it thus may be important to take into account the extensive margin simultaneously to examine multinational labor substitution.

Moreover, although we focused on changes in domestic investment goods prices, the changes in domestic final goods prices may be also important. A high correlation between final and investment goods prices implies that final goods prices also declined in Japan. Firms that face stronger deflationary pressures may be more likely to reduce their labor demand. Although this is another possible interpretation of our results, it is difficult to distinguish the differences because the final goods price is measured by relative prices. An alternative approach is needed to address this issue. Some of these issues will be explored in the next stage of our research.

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Appendix

One of the concerns in our analysis is the use of the investment goods price indices as aproxy of capital prices. Theoretically, the user cost of capital is a more appropriate variable than the investment goods price indices. According to Jorgenson (1963), the user cost of capital c is defined as:

$$c = p_k \left(\frac{1-uv}{1-u}\delta + \frac{1-uw}{1-u}r + \frac{1-ux}{1-u}\frac{dp_k}{p_k} \right), \tag{A-1}$$

where p_k is the price of capital goods; u is the rate of direct taxation; v is the proportion of replacement chargeable against income for tax purposes; w is the proportion of interest; x is the proportion of capital losses chargeable against income; δ is the depreciation rate. Note, however, that it is difficult to obtain relevant data for all sample countries throughout the period.[28] Because of the limited availability of the data, we assume zero tax rates (i.e., $u = 0$). Equation (A-1) is then rewritten as:

$$c = p_k \left(\delta + r + \frac{dp_k}{p_k} \right), \tag{A-2}$$

We estimate the same equation as in Table 3 but replaced the domestic and foreign investment goods prices with domestic and foreign user cost of capital defined as (A-2). For p_k, we use investment goods prices used in the main text. We assume $\delta = 0.0774$, following Ogawa and Kitasaka (1998, p.213, Table A-2). For r, we utilize interest rate (lending rate) obtained from *International Financial Statistics* (on-line version) by the International Monetary Fund. Interest rate for Taiwan is obtained from the *Taiwan Statistical Databook 2013* by the Council for Economic Planning and Development (Taiwan). To take the logarithm, we drop countries with $c < 0$.

Table A7 presents the estimation results which correspond to Tables 3 and 5. Table A8 presents the simulation results which correspond to Tables 4 and 6. Three messages stand out from this table. First, the number of observations declined significantly. For example, the number of observations in Table 3 is 103,255 whereas that in Table A7 is 83,576 because of the limited availability of the interest rate. Together with the assumption of zero tax rates, we interpret the results only as a guide.

=== Tables A7 and A8 ===

[28]The difficulty in obtaining the user cost of capital is also pointed out by Kiyota, Matsuura, Urata, and Wei (2008), who utilized the same parent–foreign affiliate matched data for Japan.

Second, Tables A7 and A8 indicate that the user cost of capital has negatively significant effect on employment while foreign wage has insignificant effect in the manufacturing sector. These results imply that some of our main messages remain unchanged even when we use the user cost of capital instead of the investment goods prices. The substitution between capital and labor has significant effects on domestic employment.

Finally, in terms of magnitude, the effects of capital price become rather small. The impact of the decline in the user cost of capital is -0.315% in the baseline specification while it is -0.336% in the alternative specification. The impact is still larger than that of the relative final goods price (-0.203%) but is smaller than that of imports (-0.883%). The magnitude may be sensitive to the measurement of the capital price. Thus, the numbers should be interpreted carefully.

Table 1. Employment by Japanese Multinationals: All Industry

Year	Total employment: Parent firms Number (a)	Parent firms Employment (b)	Foreign affiliates Number (c)	Foreign affiliates Employment (d)	Ratio (d)/(b)	Firm average employment: Parent (e)	Total affiliate (f)	Ratio (f)/(e)	Change (1995 = 100): Parent (g)	Total affiliate (h)
1995	861	2,064,165	4,269	1,139,513	55.2%	2,397	267	11.1%	100	100
1996	1,005	2,306,102	5,175	1,306,238	56.6%	2,295	252	11.0%	96	94
1997	1,080	2,348,916	5,441	1,363,629	58.1%	2,175	251	11.5%	91	94
1998	1,049	2,284,461	5,369	1,328,727	58.2%	2,178	247	11.3%	91	93
1999	1,142	2,332,828	6,106	1,600,938	68.6%	2,043	262	12.8%	85	98
2000	1,161	2,438,220	6,668	1,887,604	77.4%	2,100	283	13.5%	88	106
2001	1,131	2,169,811	6,113	1,700,079	78.4%	1,918	278	14.5%	80	104
2002	1,335	2,519,639	7,127	1,991,938	79.1%	1,887	279	14.8%	79	104
2003	1,527	2,602,070	7,700	2,219,749	85.3%	1,704	288	16.9%	71	108
2004	977	2,078,539	5,753	1,917,247	92.2%	2,127	333	15.7%	89	125
2005	1,885	2,881,118	8,655	2,667,107	92.6%	1,528	308	20.2%	64	115
2006	1,965	2,795,222	8,878	2,805,332	100.4%	1,423	316	22.2%	59	118
2007	1,992	2,398,859	7,844	2,203,573	91.9%	1,204	281	23.3%	50	105
2008	2,358	2,606,192	8,783	2,149,489	82.5%	1,105	245	22.2%	46	92
2009	2,443	2,901,472	9,374	2,577,646	88.8%	1,188	275	23.1%	50	103
All years total	21,911	36,727,614	103,255	28,858,809	78.6%	1,676	279	16.6%		

Source: The METI Database.

Table 2. Summary Statistics of Dependent and Independent Variables: All Industry

	N	Mean	Standard deviations	Changes in mean, 1995-2009
Home employment (log)	103,255	7.469	1.534	-0.810
Domestic wage (log)	103,255	1.907	0.232	-0.156
Foreign wage (log)	103,255	0.539	1.300	0.300
Domestic investment goods price (log)	103,255	-0.047	0.065	-0.154
Foreign investment goods price (log)	103,255	0.087	0.182	-0.0031
Relative final goods price (log)	103,255	-0.077	0.234	-0.093
Parent R&D-sales ratio	103,255	0.030	0.037	0.0073
Affiliate R&D-sales ratio	103,255	0.0002	0.002	0.00012
Imports (share)	103,255	0.090	0.109	0.053

Sources: The METI Database, the JIP2012 Database, and Penn World Table (ver 7.1).

Table 3. Estimation Results of Labor Demand: All Industry

	(1) lnLh	(2) lnLh	(3) lnLh	(4) lnLh
Domestic wage (log)	-0.100***	-0.100***	-0.103***	-0.103***
	(0.010)	(0.010)	(0.010)	(0.010)
Foreign wage (log)	-0.001*	-0.001	-0.001*	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Domestic investment goods price (log)	0.698***	0.675***	0.639***	0.619***
	(0.030)	(0.030)	(0.031)	(0.031)
Foreign investment goods price (log)	-0.036***	-0.037***	-0.038***	-0.039***
	(0.006)	(0.006)	(0.006)	(0.006)
Relative final goods price (log)	-0.061***	-0.062***	-0.064***	-0.065***
	(0.005)	(0.005)	(0.005)	(0.005)
Parent R&D-sales ratio		-0.360***		-0.340***
		(0.064)		(0.064)
Affiliate R&D-sales ratio		-2.256**		-2.232**
		(1.017)		(1.023)
Imports (share)			-0.168***	-0.163***
			(0.015)	(0.015)
Constant	7.730***	7.741***	7.747***	7.756***
	(0.018)	(0.018)	(0.018)	(0.018)
Fixed effect				
Parent firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	103,255	103,255	103,255	103,255
R-squared	0.0004	0.0010	0.0001	0.0013

Note: Robust standard errors in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10% levels, respectively. R-squared excludes firm fixed effect.

Sources: The METI Database, the JIP2012 Database, and Penn World Table (ver 7.1).

Table 4. Calculating the Impact of Different Aspects of Globalization on Parent Labor Demand: All Industry

Baseline (Column (1) in Table 3)	Impact of 1 % increase in factor	Actual change in sample	Percentage change in labor demand	Keeping only significant coefficient
	(1)	(2)	(3) = (1) * (2) * 100	(4)
Domestic wage (log)	-0.100	-0.156	1.558	1.558
Foreign wage (log)	-0.001	0.300	-0.030	-0.030
Domestic investment goods price (log)	0.698	-0.154	-10.774	-10.774
Foreign investment goods price (log)	-0.036	-0.0031	0.011	0.011
Relative final goods price (log)	-0.061	-0.093	0.568	0.568
Net impact of above all variables			-8.666	-8.666

Alternative specification (Column (4) in Table 3)	Impact of 1 % increase in factor	Actual change in sample	Percentage change in labor demand	Keeping only significant coefficient
	(1)	(2)	(3) = (1) * (2) * 100	(4)
Domestic wage (log)	-0.103	-0.156	1.605	1.605
Foreign wage (log)	-0.001	0.300	-0.030	
Domestic investment goods price (log)	0.619	-0.154	-9.554	-9.554
Foreign investment goods price (log)	-0.039	-0.0031	0.012	0.012
Relative final goods price (log)	-0.065	-0.093	0.606	0.606
Parent R&D-sales ratio	-0.340	0.0073	-0.247	-0.247
Affiliate R&D-sales ratio	-2.232	0.00012	-0.027	-0.027
Imports (share)	-0.163	0.053	-0.864	-0.864
Net impact of above all variables			-8.499	-8.469

Sources: Table 2 and Table 3.

Table 5. Estimation Results of Labor Demand: Manufacturing

	(1) lnLh	(2) lnLh	(3) lnLh	(4) lnLh
Domestic wage (log)	-0.103***	-0.101***	-0.107***	-0.106***
	(0.012)	(0.012)	(0.012)	(0.012)
Foreign wage (log)	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Domestic investment price (log)	0.984***	0.936***	0.918***	0.876***
	(0.035)	(0.035)	(0.037)	(0.037)
Foreign investment price (log)	-0.061***	-0.061***	-0.060***	-0.061***
	(0.007)	(0.007)	(0.007)	(0.007)
Relative final goods price (log)	-0.084***	-0.084***	-0.084***	-0.084***
	(0.006)	(0.006)	(0.006)	(0.006)
Parent R&D-sales ratio		-0.537***		-0.521***
		(0.067)		(0.067)
Affiliate R&D-sales ratio		-0.896**		-0.897**
		(0.453)		(0.454)
Imports (share)			-0.147***	-0.138***
			(0.017)	(0.017)
Constant	7.812***	7.829***	7.834***	7.849***
	(0.023)	(0.023)	(0.023)	(0.024)
Fixed effect				
Parent firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	69,713	69,713	69,713	69,713
R-squared	0.0008	0.004	0.0009	0.003

Note: Robust standard errors in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10% levels, respectively. R-squared excludes firm fixed effect.

Sources: The METI Database, the JIP2012 Database, and Penn World Table (ver 7.1).

Table 6. Calculating the Impact of Different Aspects of Globalization on Parent Labor Demand: Manufacturing

Baseline (Column (1) in Table 5)	Impact of 1 % increase in factor	Actual change in sample	Percentage change in labor demand	Keeping only significant coefficient
	(1)	(2)	(3) = (1) * (2) * 100	(4)
Domestic wage (log)	-0.103	-0.168	1.731	1.731
Foreign wage (log)	-0.001	0.077	-0.008	
Domestic investment goods price (log)	0.984	-0.153	-15.072	-15.072
Foreign investment goods price (log)	-0.061	-0.0097	0.059	0.059
Relative final goods price (log)	-0.084	-0.104	0.871	0.871
Net impact of above all variables			-12.418	-12.411

Alternative specification (Column (4) in Table 5)	Impact of 1 % increase in factor	Actual change in sample	Percentage change in labor demand	Keeping only significant coefficient
	(1)	(2)	(3) = (1) * (2) * 100	(4)
Domestic wage (log)	-0.106	-0.168	1.781	1.781
Foreign wage (log)	-0.001	0.077	-0.008	
Domestic investment goods price (log)	0.876	-0.153	-13.418	-13.418
Foreign investment goods price (log)	-0.061	-0.0097	0.059	0.059
Relative final goods price (log)	-0.084	-0.104	0.871	0.871
Parent R&D-sales ratio	-0.521	0.00351	-0.183	-0.183
Affiliate R&D-sales ratio	-0.897	0.00016	-0.014	-0.014
Imports (share)	-0.138	0.072	-0.995	-0.995
Net impact of above all variables			-11.906	-11.899

Sources: Table 4 and Table 5.

Table 7. Country Decomposition of Foreign Price Vector

	All industry		Manufacturing	
	wages	investment goods	wages	investment goods
Domestic (log)	-0.104***	0.653***	-0.109***	0.943***
	(0.010)	(0.033)	(0.012)	(0.038)
Foreign (log)	-0.004***	-0.018	-0.003*	-0.052***
	(0.001)	(0.012)	(0.002)	(0.015)
China	-0.001	-0.097***	-0.005*	-0.096***
	(0.002)	(0.016)	(0.003)	(0.018)
United States	0.002	0.291***	0.001	0.102
	(0.002)	(0.091)	(0.002)	(0.104)
Thailand	-0.002	-0.099***	-0.004	-0.084***
	(0.004)	(0.020)	(0.004)	(0.023)
Hong Kong	0.010***	0.084***	0.008**	0.109***
	(0.003)	(0.019)	(0.004)	(0.023)
Singapore	0.002	0.019	0.001	0.049*
	(0.003)	(0.026)	(0.003)	(0.029)
Taiwan	0.003	-0.063	0.006	-0.025
	(0.003)	(0.041)	(0.004)	(0.047)
Malaysia	0.000	0.041	-0.004	0.050
	(0.004)	(0.030)	(0.005)	(0.033)
Indonesia	0.002	-0.039**	-0.004	-0.017
	(0.003)	(0.019)	(0.003)	(0.020)
United Kingdom	0.004	-0.086**	0.002	-0.069
	(0.003)	(0.040)	(0.003)	(0.043)
Germany	0.003	-0.031	-0.000	-0.028
	(0.003)	(0.028)	(0.003)	(0.031)
Korea	0.009**	-0.023	0.010**	-0.044
	(0.004)	(0.031)	(0.004)	(0.033)
Philippines	0.004	-0.013	0.001	-0.052
	(0.005)	(0.042)	(0.005)	(0.049)
Australia	-0.007*	-0.000	-0.012**	0.051
	(0.004)	(0.040)	(0.005)	(0.049)
France	-0.005	0.024	-0.013**	0.091*
	(0.005)	(0.042)	(0.006)	(0.047)
Canada	0.012***	0.005	0.003	0.157**
	(0.004)	(0.060)	(0.005)	(0.064)
Observations	103,255		69,713	
R-squared	0.0008		0.001	

Note: Coefficients on wages and investment goods prices are reported. We also include parent firm and year fixed effects; relative final goods price; relative final goods price times country dummies; and constant term. These variables are not reported to save space. Robust standard errors in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10% levels, respectively. Countries in Latin America, Africa, Middle East, other Oceania, other Asia, and other Europe are classified as the rest of the world. R-squared excludes firm fixed effect.

Sources: The METI Database, the JIP2012 Database, and Penn World Table (ver 7.1).

Table A1. Coverage of the Data

	Source				In sample			
	Parent firms							
Year	Universe (a)	Responded (b)	In operation (c)	Foregin affiliates (d)	Number of parent firms (e)	Coverage (e)/(c)	Number of foregin affiliates (f)	Coverage (f)/(d)
1995	3,959	2,390	n.a.	10,416	861	n.a.	4,269	0.41
1996	3,860	2,281	n.a.	12,657	1,005	n.a.	5,175	0.41
1997	3,862	2,448	n.a.	13,166	1,080	n.a.	5,441	0.41
1998	3,841	2,151	n.a.	13,017	1,049	n.a.	5,369	0.41
1999	3,539	2,244	n.a.	13,939	1,142	n.a.	6,106	0.44
2000	3,430	2,157	2,039	14,991	1,161	0.57	6,668	0.44
2001	3,371	2,092	1,886	12,476	1,131	0.60	6,113	0.49
2002	3,741	2,423	2,166	13,322	1,335	0.62	7,127	0.53
2003	4,060	2,638	2,416	13,875	1,527	0.63	7,700	0.55
2004	4,377	2,856	2,657	14,996	977	0.37	5,753	0.38
2005	4,564	3,176	2,940	15,850	1,885	0.64	8,655	0.55
2006	4,663	3,426	3,268	16,370	1,965	0.60	8,878	0.54
2007	4,948	3,503	3,378	16,732	1,992	0.59	7,844	0.47
2008	5,718	3,956	3,725	17,658	2,358	0.63	8,783	0.50
2009	6,001	4,456	4,203	18,201	2,443	0.58	9,374	0.52
2000-09	44,873	30,683	28,678	154,471	16,774	0.37	76,895	0.50

Note: n.a.: not available.
Source: The METI Database.

Table A2. Changes in Depndent and Independent Variables, 1995-2009: All Industry

Year	Home employment (log)	Domestic wage (log)	Foreign wage (log)	Domestic investment goods price (log)	Foreign investment goods price (log)	Relative final goods price (log)	Parent R&D-sales ratio	Affiliate R&D-sales ratio	Imports (share)
1995	8.159	1.950	0.480	0.034	0.172	-0.099	0.027	0.0001	0.048
1996	8.105	1.990	0.814	0.025	0.161	-0.124	0.025	0.0001	0.058
1997	8.095	1.982	0.909	0.032	0.134	-0.071	0.028	0.0001	0.061
1998	8.067	1.994	0.732	0.026	0.047	0.014	0.031	0.0001	0.060
1999	7.970	1.989	0.773	0.011	0.034	-0.023	0.029	0.0001	0.062
2000	7.960	2.063	0.833	0.000	0.000	0.000	0.028	0.0001	0.069
2001	7.878	2.074	0.889	-0.018	-0.040	0.025	0.032	0.0002	0.073
2002	7.776	2.066	0.936	-0.039	-0.041	-0.008	0.032	0.0002	0.082
2003	7.663	2.050	0.912	-0.069	0.028	-0.057	0.031	0.0002	0.087
2004	7.918	2.047	0.893	-0.080	0.064	-0.083	0.030	0.0002	0.099
2005	7.521	1.979	0.942	-0.097	0.069	-0.079	0.028	0.0002	0.096
2006	7.491	1.879	0.977	-0.082	0.091	-0.089	0.030	0.0002	0.106
2007	7.385	1.887	1.093	-0.085	0.146	-0.132	0.027	0.0002	0.109
2008	7.317	1.858	0.892	-0.094	0.210	-0.172	0.033	0.0002	0.107
2009	7.348	1.794	0.780	-0.120	0.169	-0.192	0.034	0.0002	0.101
Changes in Mean, 1995-2009	-0.810	-0.156	0.300	-0.154	-0.003	-0.093	0.007	0.0001	0.053
N	103,255	103,255	103,255	103,255	103,255	103,255	103,255	103,255	103,255

Sources: The METI Database, the JIP2012 Database, and Penn World Table (ver 7.1).

Table A3. Changes in Depndent and Independent Variables, 1995-2009: Manufacturing

Year	Home employment (log)	Domestic wage (log)	Foreign wage (log)	Domestic investment goods price (log)	Foreign investment goods price (log)	Relative final goods price (log)	Parent R&D-sales ratio	Affiliate R&D-sales ratio	Imports (share)
1995	7.994	1.878	0.333	0.043	0.189	-0.093	0.037	0.0002	0.073
1996	7.917	1.922	0.529	0.030	0.175	-0.117	0.035	0.0002	0.088
1997	7.845	1.929	0.579	0.035	0.139	-0.059	0.038	0.0002	0.093
1998	7.841	1.910	0.479	0.030	0.041	0.039	0.043	0.0003	0.097
1999	7.762	1.911	0.437	0.013	0.033	-0.014	0.041	0.0002	0.096
2000	7.836	1.972	0.459	0.000	0.000	0.000	0.041	0.0002	0.103
2001	7.727	1.996	0.465	-0.019	-0.041	0.030	0.045	0.0003	0.112
2002	7.630	1.984	0.545	-0.040	-0.041	-0.003	0.044	0.0003	0.122
2003	7.536	1.972	0.546	-0.069	0.033	-0.055	0.043	0.0003	0.124
2004	7.707	1.953	0.492	-0.079	0.068	-0.078	0.039	0.0002	0.140
2005	7.368	1.907	0.477	-0.090	0.072	-0.086	0.036	0.0002	0.141
2006	7.351	1.810	0.557	-0.075	0.095	-0.101	0.038	0.0004	0.156
2007	7.222	1.807	0.565	-0.080	0.152	-0.144	0.035	0.0003	0.161
2008	7.148	1.778	0.538	-0.081	0.219	-0.162	0.041	0.0003	0.154
2009	7.171	1.710	0.410	-0.110	0.179	-0.196	0.041	0.0004	0.145
Changes in Mean, 1995-2009	-0.823	-0.168	0.077	-0.153	-0.010	-0.104	0.004	0.0002	0.072
N	69,713	69,713	69,713	69,713	69,713	69,713	69,713	69,713	69,713

Sources: The METI Database, the JIP2012 Database, and Penn World Table (ver 7.1).

Table A4. Number of Foreign Affiliates, by Country-Year

Country	Year															Total	Cum. Share (%)	Rank
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009			
China	301	508	617	660	769	838	769	1,037	1,300	1,033	1,833	2,040	2,007	2,384	2,592	18,688	18.1	1
United States	941	1,067	1,085	1,030	1,151	1,233	1,147	1,283	1,338	940	1,378	1,359	1,167	1,282	1,304	17,705	35.2	2
Thailand	260	311	346	334	425	479	431	554	597	428	678	702	634	715	758	7,652	42.7	3
Hong Kong	264	322	331	314	381	389	346	422	450	315	515	512	434	478	502	5,975	48.4	4
Singapore	295	348	342	338	366	405	371	399	400	295	480	459	405	406	416	5,725	54.0	5
Taiwan	235	275	292	296	343	373	326	386	404	301	455	460	372	409	434	5,361	59.2	6
Malaysia	222	264	260	258	302	346	306	335	353	272	349	361	313	325	331	4,597	63.6	7
Indonesia	155	201	217	238	252	284	260	302	315	240	338	345	287	318	328	4,080	67.6	8
United Kingdom	220	247	248	233	255	279	267	289	321	239	314	300	243	251	256	3,962	71.4	9
Germany	231	257	255	221	258	280	243	279	267	211	289	301	239	251	273	3,855	75.2	10
Korea	139	157	168	167	191	219	206	227	254	181	299	301	281	286	308	3,384	78.4	11
Philippines	54	108	121	119	144	154	155	176	184	147	199	209	173	207	210	2,360	80.7	12
Australia	114	141	137	138	138	151	145	154	154	131	148	134	113	119	144	2,061	82.7	13
France	86	101	113	113	131	139	119	126	145	103	162	141	106	114	118	1,817	84.5	14
Canada	95	112	115	115	120	123	107	118	120	80	120	112	89	90	105	1,621	86.0	15
Netherlands	85	100	92	84	94	110	104	114	126	91	121	122	95	99	105	1,542	87.5	16
Brazil	81	86	80	64	77	87	75	94	102	71	101	85	79	88	98	1,268	88.8	17
Vietnam	5	16	33	46	52	60	52	75	77	59	91	127	140	169	195	1,197	89.9	18
Italy	43	59	63	60	69	79	70	77	72	60	75	70	58	58	66	979	90.9	19
India	24	31	44	51	51	58	61	64	73	58	68	78	66	100	127	954	91.8	20
Others	419	464	482	490	537	582	553	616	648	498	642	660	543	634	704	8,472	100.0	
Total	4,269	5,175	5,441	5,369	6,106	6,668	6,113	7,127	7,700	5,753	8,655	8,878	7,844	8,783	9,374	103,255	100.0	

Note: Top 20 countries are reported. Rank is based on total (from 1995 to 2009).
Source: METI Database.

Table A5. Number of Foreign Affiliates, by Industry-Year

Country	Year															Total	Cum. Share (%)	Rank
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009			
Wholesale	1,266	1,486	1,586	1,538	1,789	1,836	1,645	1,821	2,077	1,588	2,238	2,346	1,897	2,190	2,365	27,668	26.8	1
Motor vehicles	363	433	487	538	545	631	585	642	756	630	812	859	743	899	935	9,858	36.3	2
Electronic parts	344	448	474	377	522	566	452	535	534	383	600	613	617	577	608	7,650	43.8	3
Miscellaneous machinery	154	241	224	216	234	274	280	355	355	254	384	414	432	448	474	4,739	48.3	4
Miscellaneous chemical products	95	146	112	127	192	238	218	243	294	172	323	328	263	325	331	3,407	51.6	5
Basic organic chemicals	109	103	137	141	103	132	174	254	240	244	291	303	209	246	341	3,027	54.6	6
Precision machinery & equipment	88	107	124	147	143	179	181	231	215	189	243	275	245	278	268	2,913	57.4	7
Special industry machinery	115	134	119	112	165	174	162	188	209	157	269	253	258	237	253	2,805	60.1	8
Electrical generating, transmission, distribution and industrial apparatus	108	113	126	118	145	161	126	190	191	128	255	279	231	260	242	2,673	62.7	9
Communication equipment	180	186	183	145	189	194	135	173	159	109	164	150	139	125	142	2,373	65.0	10
Electronic data processing machines, digital and analog computer equipment and accessories	106	114	118	124	134	133	136	166	183	157	270	243	144	108	179	2,315	67.2	11
Miscellaneous manufacturing industries	66	105	115	151	151	150	166	166	180	146	192	189	170	166	150	2,263	69.4	12
Non-ferrous metal products	106	121	101	120	144	165	130	161	161	118	185	163	157	174	172	2,178	71.5	13
Plastic products	67	89	109	90	86	93	84	104	126	71	190	176	171	237	258	1,951	73.4	14
Retail	67	94	107	116	121	131	115	129	147	104	151	164	126	117	170	1,859	75.2	15
Miscellaneous fabricated metal products	55	83	77	71	87	98	79	106	97	88	164	174	196	206	205	1,786	77.0	16
Office and service industry machines	116	123	129	129	131	136	144	156	111	71	116	110	79	111	111	1,773	78.7	17
Miscellaneous electrical machinery equipment	59	71	82	69	92	96	117	104	109	115	146	152	141	148	154	1,655	80.3	18
Textile products	43	59	89	85	92	89	75	108	105	96	119	91	101	114	110	1,376	81.6	19
General industry machinery	44	52	62	49	63	74	69	67	76	66	101	107	121	166	194	1,311	82.9	20
Others	718	867	880	906	978	1,118	1,040	1,228	1,375	867	1,442	1,489	1,404	1,651	1,712	17,675	100.0	
Total	4,269	5,175	5,441	5,369	6,106	6,668	6,113	7,127	7,700	5,753	8,655	8,878	7,844	8,783	9,374	103,255	100.0	

Note: Top 20 industries are reported. Rank is based on total (from 1995 to 2009).
Source: METI Database.

Table A6. Estimation Results of Capital Demand: All Industry and Munufacturing

Dependent variable: lnK	All observations				Excludes observations if imports = 0			
	All industry		Manufacturing		All industry		Manufacturing	
Domestic wage (log)	-0.026	-0.007	0.110***	0.123***	0.107***	0.107***	0.094***	0.095***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.014)	(0.014)	(0.014)	(0.014)
Foreign wage (log)	-0.000	-0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Domestic investment goods price (log)	-0.373***	0.035	-0.711***	-0.485***	-1.103***	-1.117***	-1.101***	-1.102***
	(0.057)	(0.058)	(0.064)	(0.068)	(0.045)	(0.052)	(0.046)	(0.053)
Foreign investment goods price (log)	-0.216***	-0.202***	-0.127***	-0.128***	-0.084***	-0.084***	-0.089***	-0.089***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)
Relative final goods price (log)	-0.268***	-0.248***	-0.157***	-0.156***	-0.103***	-0.102***	-0.108***	-0.108***
	(0.010)	(0.009)	(0.010)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)
Parent R&D-sales ratio		0.698***		0.126**		-0.085*		-0.093*
		(0.067)		(0.059)		(0.051)		(0.052)
Affiliate R&D-sales ratio		-3.776*		-1.165**		-1.057**		-1.125**
		(2.100)		(0.504)		(0.449)		(0.457)
Imports (share)		1.049***		0.482***		-0.013		0.017
		(0.042)		(0.029)		(0.032)		(0.033)
Constant	10.435***	10.313***	10.552***	10.477***	10.559***	10.565***	10.594***	10.595***
	(0.030)	(0.029)	(0.029)	(0.029)	(0.025)	(0.026)	(0.025)	(0.026)
Fixed effect								
Parent firm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	103,228	103,228	69,700	69,700	70,762	70,762	67,570	67,570
R-squared	0.00001	0.03	0.0003	0.0004	0.001	0.001	0.001	0.002

Note: Robust standard errors in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10% levels, respectively. R-squared excludes firm fixed effect.
Source: METI Database.

Table A7. Estimation Results of Labor Demand: User Cost of Capital

	All industry		Manufacturing	
	(1)	(2)	(3)	(4)
	lnLh	lnLh	lnLh	lnLh
Domestic wage (log)	-0.125***	-0.128***	-0.140***	-0.139***
	(0.011)	(0.011)	(0.015)	(0.014)
Foreign wage (log)	-0.000	-0.000	-0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Domestic user cost of capital (log)	-0.005	-0.002	0.031***	0.033***
	(0.009)	(0.009)	(0.011)	(0.011)
Foreign user cost of capital (log)	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Relative final goods price (log)	-0.014***	-0.019***	-0.016***	-0.021***
	(0.004)	(0.004)	(0.004)	(0.004)
Parent R&D-sales ratio		-0.300***		-0.530***
		(0.076)		(0.078)
Affiliate R&D-sales ratio		-2.441**		-0.766*
		(1.215)		(0.421)
Imports (share)		-0.148***		-0.156***
		(0.016)		(0.018)
Constant	7.625***	7.662***	7.787***	7.838***
	(0.028)	(0.028)	(0.030)	(0.031)
Fixed effect				
Parent firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	83,576	83,576	56,251	56,251
R-squared	0.0012	0.0004	0.0023	0.002

Note: Robust standard errors in parentheses. ***, **, and * are statistically significant at 1%, 5%, and 10% levels, respectively. R-squared excludes firm fixed effect.

Sources: The METI Database, the JIP2012 Database, IMF-IFS, and Penn World Table (ver 7.1).

Table A8. Calculating the Impact of Different Aspects of Globalization on Parent Labor Demand: User Cost of Capital

Baseline (Column (3) in Table A7)	Impact of 1 % increase in factor	Actual change in sample	Percentage change in labor demand	Keeping only significant coefficient
	(1)	(2)	(3) = (1) * (2) * 100	(4)
Domestic wage (log)	-0.140	-0.214	3.001	3.001
Foreign wage (log)	0.000	-0.220	0.000	
Domestic user cost of capital (log)	0.031	-0.102	-0.315	-0.315
Foreign user cost of capital (log)	0.001	-0.1176	-0.012	
Relative final goods price (log)	-0.016	-0.067	0.107	0.107
Net impact of above all variables			2.781	2.793

Alternative specification (Column (4) in Table A7)	Impact of 1 % increase in factor	Actual change in sample	Percentage change in labor demand	Keeping only significant coefficient
	(1)	(2)	(3) = (1) * (2) * 100	(4)
Domestic wage (log)	-0.139	-0.214	2.980	2.980
Foreign wage (log)	0.000	-0.220	0.000	
Domestic user cost of capital (log)	0.033	-0.102	-0.336	-0.336
Foreign user cost of capital (log)	0.001	-0.1176	-0.012	
Relative final goods price (log)	-0.021	-0.067	0.140	0.140
Parent R&D-sales ratio	-0.530	0.00384	-0.203	-0.203
Affiliate R&D-sales ratio	-0.766	0.00018	-0.013	-0.013
Imports (share)	-0.156	0.057	-0.883	-0.883
Net impact of above all variables			1.673	1.685

Sources: Table A7 and the authors' calculation from the sample.