Globalization and Employment Growth

- - Evidence from Japanese Establishment Data -

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Abstract

Japanese manufacturers began to relocate their production sites from Japan to low wage East Asian countries, such as China, Malaysia and Thailand in the 1980s and 1990s, and the import manufacturing goods to Japan from these countries increased substantially in the 1990s. Policymakers are concerned this rapid increase of import and globalization hurts employment growth in Japan and the effects can be very severe in some regions. This paper is the very first attempt to examine empirically regional variations of the employment response to the increased import penetration from low-wage countries using Japanese plant-level data in the manufacturing sector.

Our paper finds that the plant employment growth rate has been negatively related to the exposure to import from low-wage countries. However employment in a plant with high productivity is less affected by the import. With the advance of globalization, Japanese firms consider inter-industry and inner industry agglomeration less important, but they still prefer to have sites in the region where they can find more customers and many different industries.

Key Words: Import Competition from low-wage country, Manufacturing plant, Economic Geography

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1. Introduction

Japanese manufacturers began to relocate their production sites from Japan to low wage East Asian countries, such as China, Malaysia and Thailand in the 1980s and 1990s. This relocation brought a new form of international division of labor between Japan and countries in East Asia. The share of import manufacturing goods to Japan from low-wage countries in total has increased especially in the 1990s, from 16.0% in 1990 to 41.6% in 2004 (see Figure 1). Policymakers are concerned that this rapid increase of import and globalization hurts employment growth in Japan and the effects can be very severe in some regions in Japan, especially regions where manufacturers are producing more labor-intensive products.

Table 1 shows the employment growth rates in Japanese manufacturing industries by region (Hokkaido, Tohoku, North Kanto, South Kanto, Hokuriku, Tokai, Kinki, Chugoku, Shikoku and Kyusyu)[1] and by industry in the 1980s and 1990s. For this comparison, we employed the data from the "Census of Manufactures" conducted every year by the Ministry of Economy, Trade and Industry in Japan and this data covers all manufacturing establishments with more than 5 employees.[2] There is sharp contrast in the employment growth between the 1980s and 1990s. All regions show negative employment growth in the 1980s. On the other hand, only 1 region shows small positive employment growth in the 1990s. There is also a sharp contrast in employment growth between the 1980s and the 1990s in each region. For example, the average employment growth rate in the Tohoku area was 3.0% per annum increase in the 1980s, but the rate became 1.3% per annum decline in the 1990s. There is a substantial heterogeneity in the

[1] We aggregated Japanese 47 prefectures into 10 regions and the definition of each region is shown in the Appendix.
[2] More detailed explanation of the data appears in the latter section.

employment growth rate within the same industry by region. The employment growth rate in the Household Electronic Appliances industry showed a large decline in Tokai, Hokkaido and Chugoku, but in contrast it was positive in Kyusyu and Shikoku. These findings suggest that if there is a negative impact on employment growth from the increased import penetration from the low wage country in the 1990s, this impact can be quite different between regions depending upon their industrial structure and characteristics, such as industrial agglomeration.

There are some previous studies shedding light on this heterogeneity in employment response to the increase international competition between industries. Revenga (1992) and Branson and Love (1998) examined the effect of increased import penetration on US manufacturing employment based on industry-level data. Tomiura (2003a) and Rebick (1999) investigated this effect in Japanese manufacturing industries. More recent studies such as Bernard, Jensen and Schott (2006) and Ito (2005) use plant or firm-level data and examined the effect. However, to our knowledge there have been no previous studies examining the heterogeneity of manufacturing plant response to import competition at the regional level. In fact, the estimation results of Bernard, Jensen and Scott (2006) suggest that significant variation in the regional response to low-wage country competition. This paper is the very first attempt to empirically examine this variation using Japanese plant-level data in the manufacturing sector.

The reminder of the paper is organized as follows. The next section outlines our empirical model and variables used for regressions. Sections 2 and 3 describe low-wage country penetration and regional characteristics in Japan by using several indices constructed in this paper. Section 4 reports estimation results and Section 5 concludes the paper.

2. An empirical model and variables used for regressions

We essentially follow the specification employed in Bernard, Jensen and Schott (2006). Their empirical model based on the Heckscher-Ohlin model and employment in countries like the US and Japan is reallocated away from production of labor-intensive goods to capital-intensive or skill-intensive goods, as imports from labor-abundant low-wage country import increases. In the case of Japan, the rapid appreciation of the yen in the late 1980s indeed caused a substantial increase of imports from low-wage countries to Japan in the 1990s.

We are not only interested in variations of the employment response to import competition at the plant and industry level, but also in those at the regional level. Hence we also include regional specific factors, such as input-output linkage among regional industries. The New Economic Geography model constructed by Fujita et al. (1999) predicts that employment growth must be lower after trade liberalization in regions where input-output linkages among regional industries were previously stronger. Hanson (1998) examined the effect of trade reform on regional employment in Mexico and Tomiura (2003b) examined the effect of import competition on regional employment in Japan.

We also include plant characteristics such as size, capital-labor ratios and productivities as in Bernard, Jensen and Schott (2006) as explanatory variables in our estimation. In addition, we matched plant data with firm data and then we examined whether the firm’s international exposure, represented by its overseas investment situation, effects the employment growth. Our empirical specification is as follows.

$$LGrowth_{pt} = V'_{pt-1}\alpha + \beta MNE_{it-1} + IMPEN'_{jt-1}\gamma + REGION'_{rjt-1}\delta + X'_{prjt-1}\theta + \lambda_t + \lambda_j + \lambda_p + \varepsilon_{pt} \quad (1)$$

We define *LGrowth* as the difference of logged employment. Besides, in order to include the exiting plants in our regression sample, following from Davis, Haltiwanger, and Scott (1996), we estimated the model with the following employment growth rate;

$$LGrowth_{pt} = \frac{\Delta L_{pt-1}}{1/2\,(L_{pt} + L_{pt-1})} \quad (2)$$

In this setting, while the employment growth ratio for exiting plants is -2, the maximum growth rate must be less than 2. We call this employment growth rate the Haltiwanger type growth rate.

V_{pt-1} is the set of plant characteristics and it includes 4 size dummies (the plant size is measured by the number of employee), log TFP (tfp_{pt-1})[3] and log capital intensities ($lnKL_{pt-1}$) at time t-1.

MNE_{it-1} is the firm *i*'s overseas activity dummy and it takes a value of one if the firm *i* has at least one foreign affiliate in time *t-1*. Castellani, Mariotti and Piscitello (2006) and Navaretti, Castellani and Disdier (2006) examined outward investment by Italian and French manufacturing firms on the domestic employment level. Their econometric analysis shows that the internationalization of activities by manufacturing firms does not reduce their domestic employment, independently of the host country. We include this variable and control the effect of outward investment on employment growth.

$IMPEN_{jt-1}$ is import penetration ratio in industry *j* at time *t-1*. We include both

[3] Details for the calculation of TFP of each plant are in Appendix.

import penetration ratio from low-wage country ($LWPEN_{jt-1}$) and that from other countries ($OTHPEN_{jt-1}$). REGION is the set of regional characteristics and it includes regional wage ($wage\_region_{rjt-1}$), inter-industry linkages (INP_{rjt-1} and OUT_{rjt-1}), intra-industry agglomeration (IIA_{rjt-1}) and industrial diversity (DIV_{rjt-1}). The definition of the import penetrations and regional characteristic variables in the above are explained in the next section.

X_{prjt-1} is interactions of plant and regional characteristics, and $LWPEN_{jt-1}$($LWPEN_{jt-1} \times tfp_{pt-1}$, $LWPEN_{jt-1} \times lnKL_{pt-1}$, $LWPEN_{jt-1} \times INP_{rj}$, $LWPEN_{jt-1} \times OUT_{rj}$, $LWPEN_{jt-1} \times IIA_{rj}$ and $LWPEN_{jt-1} \times DIV_{rj}$). We also include time fixed effect (λ_t), industry fixed effect (λ_j) and plant fixed effect (λ_p) in the estimation, respectively. The error term is expressed by ε.

By estimating equation (1), we test the following three hypotheses.

Hypothesis 1: Plant employment growth decreases when import from low-wage countries increases.

Hypothesis 2: Plant employment growth is lower in regions where input-output linkages among regional industries were previously stronger, when there is increase in import penetration. The imports from low-wage countries partly replace trade within region.

Hypothesis 3: The employment growth in capital intensive and high productivity plant is relatively less affected by import from low-wage countries. The employment growth in the plant located in the region which has higher industrial agglomeration is also less affected by import from low-wage countries.

Our estimation period is between 1981 and 2000. The employment growth in more than 100,000 plants all over Japan is estimated. We use more detailed classification of the region than that used in previous studies[4] and our detailed classification has 109 regions. This regional classification is based on the commuting sphere.

3. Low-wage country import penetration in Japan

In this section, we discuss the development of import penetration in Japan and the share of import from low-wage countries.

$LWPEN_{jt}$ and $OTHPEN_{jt}$ denote the import penetration of low-wage countries and other regions in industry *j* in year *t*, respectively,

$$LWPEN_{jt} = \frac{M_{jt}^{L}}{M_{jt} + Q_{jt} - X_{jt}} \qquad OTHPEN_{it} = \frac{M_{jt} - M_{jt}^{L}}{M_{jt} + Q_{jt} - X_{jt}} \tag{3}$$

where M_{jt}^{L} and M_{jt} is the nominal value of imports from low-wage countries and from all countries to Japan in industry *j* at time *t*, respectively. Q_{jt} is the nominal value of domestic production in industry *j* at time *t*. X_{jt} is the nominal value of exports in industry *j* at time *t*. In order to construct these indices, this paper derives country-specific industry trade data and nominal domestic production data from the JIP2006 database in RIETI. The definition of low-wage countries follows that in Ito (2005) and the list of countries is in the Appendix.

Table 2 shows the development of import penetration of manufacturing goods between 1981 and 2000 in Japan, and provides similar information for those in Table 2 in Bernard, Jensen and Scott (2006). Import penetration ratio of manufacturing sector increased in the 1990s. Especially, there is large import penetration increase in electrical machinery industry. For example, the import penetration in semiconductor devices and

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[4] Most of the previous studies use prefectural and city government as an unit of classification and there are 47 prefectural and city governments in Japan.

intergraded circuits industry increased from 16% in 1990 to 50% in 2000. There is also a large increase in import ratio from low-wage country in the 1990s. The ratio in household electric appliance industry increased from 3% in 1990 to 14% in 2000.

4. Regional characteristics in Japan

Since we are interested in the regional heterogeneity of the employment response to the import competition from low-wage countries, we include several variables indicating regional characteristics, such as inter-industry linkage, intra-industry agglomeration and industrial diversity in each region, into the estimation. Each of these variables is defined as follows. The whole manufacturing industry is disaggregated into 52 industries and it is also more detailed classified than previous ones.

The following from Dumains, Ellison and Glaeser (1997) and Tomiura (2003b), INP_{rjt} and OUT_{rjt} are indices that capture the inter-industry linkages of the industry *j* in the region r at time *t*.

$$INP_{rjt} = R\sum_{h \neq j}\left(\frac{X_{jt}^{h}}{X_{jt}}\right)\left(\frac{Q_{rht}}{Q_{ht}}\right) \qquad OUT_{rj} = R\sum_{h \neq j}\left(\frac{X_{ht}^{j}}{X_{t}^{j}}\right)\left(\frac{Q_{rht}}{Q_{ht}}\right) \tag{4}$$

where X_{jt}^{h}, X_{jt}, X_{t}^{J} denotes the intermediate transaction from industry *h* to industry *j*, the total input supplied to industry *j*, and total output from industry *j* at time *t*, respectively. We obtained information about input and output transactions from the Input-Output table in the JIP2006 database. Q_{rht}/Q_{rt} is the region *r*'s shipment share in industry *h* in total regional shipment at time *t*. To construct this index, this paper derived region-specific industry data from Japan's "Census of Manufacturers." The multiplication by *R* (total number of regions, namely 109) standardizes the average across regions as one.

IIA_{rjt} and DIV_{rjt} are indices for industry *j*'s intra-industry agglomeration, and industrial diversity based on the squared sum of shares of all other industries, respectively. We expect intra-industry agglomeration and industrial diversity of industries may generate positive externalities to the industry's activity in the region and the employment grows faster in there as discussed in Tomiura (2003b).

$$IIA_{rj} = \frac{L_{rjt} / L_{rt}}{L_{jt} / L_{t}} \qquad DIV_{rjt} = \left[\sum_{h \neq j} \left(\frac{L_{rht}}{L_{rt}}\right)^2 / \sum_{h \neq j} \left(\frac{L_{ht}}{L_{t}}\right)^2 \right]^{-1} \tag{5}$$

where L_{rjt}, L_{rt}, L_{jt} and L_t denotes the number of employment in industry *j*, the total number of manufacturing industry employment in region *r* at time *t*, the total number of employment in industry *j* and the total number of employment in the whole manufacturing sector at time *t*, respectively. While the former, what is called Hoover-type (1936) variables, is an index for Marshallian externalities, the latter is the index for knowledge spillover from regional diversity. To construct these indices, this paper derives region-specific industry data by aggregating the plant level data from Japan's "Census of Manufacturer."

Figures 2, 3 4 and 5 show Japanese manufacturing industry INP, OUT, IIA and DIV in 10 regions in 1981, 1990 and 2000. Both input and output inter-industry linkages are very high in South Kanto, Kinki and Tokai. These inter-industry linkages are decreasing in South Kanto and Kinki, but they are increasing in Tokai. On the other hand, intra-industry agglomeration is relatively low in South Kanto, Kinki and Tokai. DIV is high in South Kanto, Tokai and Kinki and it declined largely in South Kanto in 2000.

5. Empirical Results

The estimation results are presented in Table 3. The first column reports the coefficients of the model with firm, industry and regional characteristics. While both the capital-labor ratio (K/L) and TFP have a positive and significant effect on employment growth, the coefficient for the MNE dummy is negative and statistically significant. The result on the negative effect of MNE dummy suggests the employment decline more for plants owned by MNE. Considering the evidence on the positive effect of FDI on employment at the firm level in the previous literature, this result suggests that MNEs might reduce more unskilled workers at plants, and increased skilled workers at headquarters.

For the effect of import penetration, we found the negative and statistically significant coefficient on LWPEN, which is consistent with Bernard, Jensen and Schott (2006). The negative impact of LWPEN on employment growth suggests that the more the industry's exposure to imports from low-wage countries, the more the employment decreased. The impact of import penetration from other countries is also negative but insignificant.

Model 2 presents the effect of regional characteristics, such as wage and agglomeration variables. Consistent with our prediction, wage level has negative and statistically significant effect on employment growth. For the agglomeration variables, while the inter-industry agglomeration variables INP and OUT are both positive and statistically significant, the coefficient for the intra-industry agglomeration IIA is negative and statistically significant, implying the inter-industry linkages are more important than intra-industry linkages.

Model 3 includes interactions of LWPEN with productivity, MNE dummy and agglomeration variables. There are six noteworthy points. First, the interaction of LWPEN with TFP is positively and significantly related to employment growth as in

Barnard, Jensen and Scotto (2006). While increases in low-wage country imports reduce employment growth, the effect is smaller for those plants that have higher productivity.

Second, the interaction with MNE dummy is negative and significantly related to employment growth. One interpretation is that MNEs have more flexibility in reallocating their employment response to the exposure to low-wage countries; therefore employment declined more at the plant level for MNE.

Third, the interactions with INP are negative and statistically significant effects. This result may reflect that the increases in import from low-wage countries reduced inter-industry linkages, especially input linkage. For example, household electric appliance industry considers the input suppliers linkage less importantly after the increase import competition, and relocates their production sites to lower wage regions or countries.

Fourth, the interaction term with OUT has positively related to the employment growth. The customers' agglomeration may provide the opportunity for differentiating their products and gain new customers even when the import penetration increased.

Fifth, the negative impact of IIA, the intra-industry agglomeration on the employment growth suggests that intra-industry agglomeration has caused the congestion and as a result, employment declined in those areas.

The last point is that the coefficient on the interaction term of LWPEN and DIV is positive and significant and this implies the diversity of the industry in the region creates the positive externality and then the employment is less affected.

Models 4 to 6 present the results of regression analysis with Haltiwanger type growth rate of employment. Since these models include the exiting plants, the differences between Models 1 to 3 and Models 4 to 6 are attributed to the effect on plant death. In contrast to Models 1 to 3, the coefficients for MNE dummies and the interactions with MNE dummies are both positive and statistically significant. This implies that although there is substantial flexibility in reallocating the employment for MNEs at the plant level, the probability of plant death for MNEs is lower than that of non-MNEs.

6. Conclusion

This paper has examined the effects of import competition on the employment growth for the period 1981-2000. A unique feature of our analysis is the use of comprehensive plant-level panel data. In analyzing, we have focused on the impact of regional factors, such as inter and intra-industry agglomeration effect.

Our major finding is three fold. First, the plant employment growth rate has been negatively related to the exposure to import from low-wage countries. Import penetration from other countries also has negative impact on the employment growth, although it is not statistically significant.

Second, while the inter-industry agglomeration has positive effect on plant growth and mitigates the negative impact of the import penetration from low-wage countries, the intra-industry agglomeration does not. This result might suggest that in Japan each industry has already concentrated and the cost of congestion exceeds the agglomeration benefit.

Third, plants with high productivity are less affected by import from low-wage countries. In addition, we found the negative impact of import competition on MNE's plants is also smaller than other plants.

With the advance of globalization, Japanese firms consider inter-industry and inner industry agglomeration less important, but they still prefer to have sites in the region where they can find more customers and many different industries.

This paper suggests various avenues for future research. At first, we investigated the effect of import penetration on Haltiwanger type employment growth rate, which includes job loss caused by plant death. However, the effect on plant death might be different from that on employment growth. Therefore, it is worth separating those effects by probit model. Second, the exposure to low-wage countries might induce industry switching at the plant-level. Examination of the effect on industry switching will provide us with evidence on how firms change their product mix.

Appendix: Description of Data

Our primary data sources are the longitudinal data sets of the Census of Manufactures from 1981 to 2000. The Census of Manufacturing started in 1909, but the panel data is available since 1981[5]. It contains information on shipments, inventories, book value of equipment and structure, employment, cost of materials and energy usage. For firm characteristics, only the organization form and single or multiple statuses are available[6]. Our longitudinal data set covers all establishments with more than 4 employees. However, those establishments with less than 10 employees do not report the information on tangible assets, which is indispensable for estimating TFP index. Therefore, we restricted our sample to plants with more than 10 employees.

The definition of productivity index[7]

We estimated the total factor productivity (TFP) index, following Caves, Christensen and Diewert (1982), Caves, Christensen and Tretheway (1983), and Good, Nadiri, Roeller and Sickles (1983). The TFP index is calculated as follows:

$$\ln TFP_{it} = \left(\ln Q_{it} - \ln \overline{Q}_t\right) - \sum_{j=1}^{J} \frac{1}{2}\left(s_{ijt} + \overline{s}_{jt}\right)\left(\ln X_{ijt} + \ln \overline{X}_{jt}\right)$$
$$+ \sum_{s=1}^{t}\left(\ln \overline{Q}_s - \ln \overline{Q}_{s-t}\right) - \sum_{s=1}^{t}\sum_{j=1}^{J} \frac{1}{2}\left(\overline{s}_{js} + \overline{s}_{js-1}\right)\left(\ln \overline{X}_{js} - \ln \overline{X}_{js-1}\right)$$

where Q_{it}, s_{ijt} and X_{ijt} denote the gross output of plant i in year t, the cost share of input j

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5 See Shimpo, Takahashi, and Omori (2005), Fukao, Kim and Kwon (2006) and Matsuura, Hayakawa and Suga (2007) for details of the longitudinal dataset of the Census of Manufacturing.

6 MNE dummy variable take one if the plants belong to MNE, zero otherwise. The information on firm characteristics is obtained by linking the Survey of Overseas Business and Activity (Ministry of Economy, Trade and Industry) with the Census of Manufacturing. As for the details of data linkage procedure, see Matsuura, Hayakawa and Suga (2007).

7 See Motohashi, Matsuura and Hayakawa (2008) for details of estimation procedure of the TFP index with the Census of Manufacturing.

for plats *i* in year *t* and plants *i*'s input of factor *j* in year *t*, respectively. Variables with an upper bar denote the industry average of that variable.

We define a hypothetical (representative) plant for each year by industry. Plant input and output are calculated as geometric means of those for all plants in a certain industry. The first two terms on the right hand side of the equation denote the cross-sectional TFP index based on the Theil=Tornqvist specification for each plant, for each year, relative to the hypothetical plants. Since this cross-sectional TFP index is not comparable between *t* and *t*-1, we adjust the cross sectional TFP index with the growth rate of TFP for hypothetical plants as in the third and forth term in the equation.

Output, intermediate input, labor input and deflator

The real value added is defined as real gross output minus real intermediate input. Real gross output is measured as the sum of shipments, revenues from repairing and fixing services, and revenues from performing subcontracted work, deflated by output deflator. Intermediate input is measured as the cost of materials deflated by input deflator. Labor input is measured by total number of employment multiplied by the spectral working hours form System of National Accounts (Cabinet Office in Japan). All output and input deflators used are from the JIP database 2006 (Fukao, et al. (2007)).

Capital stock

Following Fukao, Kim and Kwon (2006), we estimated capital stock with the nominal book values of tangible assets by multiplying the ratio of the net stock to the book value of industry-level capital[8]. Net capital stocks by industry are derived from the

[8] Fukao, Kim and Kwon (2006) propose to use the ratio of net stock to the book value of

JIP database 2006 and the book values of capital by industry are obtained by aggregating “Census of Manufacturing.”

Cost share

Cost share consists of labor costs, intermediates costs, and capital costs. Labor costs are defined as total salaries and intermediates costs are defined as the sum of raw materials, fuel, electricity and subcontracting expenses for consigned production.

Capital costs were calculated by multiplying the real net capital stock with the user cost of capital, P_K. The latter was estimated as follows:

$$P_K = P_I\left(r_t + \delta - \dot{P}_I / P_I\right),$$

where P_I, is the price of investment goods, r is the interstate and δ denotes the depreciation rate. Data on the price of investment goods and the depreciation rate are calculated with the investment and capital stock matrix in the JIP database 2006. Interest rates (10-year-bond yield) are from Bank of Japan.

List of Low-income Countries

We defined low income countries as in the table below following Ito (2005).

Korea, Dem. Rep.	China	Mongolia	Vietnam
Thailand	Philippines	Indonesia	Cambodia
Lao PDR	Myanmar	India	Pakistan
Sri Lanka	Maldives	Bangladesh	Timor-Leste
Afghanistan	Nepal	Bhutan	Iran, Islamic Rep.
Iraq	Jordan	Syrian Arab Republic	Yemen, Rep.

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capitals by type of assets. However, in the census, the book values of capital by type of assets are available only for those plants that have more than 30 employees. Therefore, in order to include small establishments in our sample, we did not calculate the ratio of net stock to the book value of capital by type of assets.

Azerbaijan	Armenia	Uzbekistan	Kazakhstan
Kyrgyz Republic	Tajikistan	Turkmenistan	Georgia
West Bank and Gaza	Russian Federation	Yugoslavia, Fed. Rep.	Albania
Romania	Bulgaria	Turkey	Ukraine
Belarus	Moldova	Bosnia and Herzegovina	Macedonia, FYR
Guatemala	Honduras	Belize	El Salvador
Nicaragua	Jamaica	Cuba	Haiti
Dominican Republic	St. Vincent and the Grenadines	Colombia	Guyana
Suriname	Ecuador	Peru	Bolivia
Paraguay	Morocco	Algeria	Tunisia
Egypt, Arab Rep.	Sudan	Mauritania	Senegal
Gambia, The	Guinea-Bissau	Guinea	Sierra Leone
Liberia	Cote d'Ivoire	Ghana	Togo
Benin	Mali	Burkina Faso	Cape Verde
Nigeria	Niger	Rwanda	Cameroon
Chad	Central African Republic	Equatorial Guinea	Congo, Rep.
Congo, Dem. Rep. (former Zaire)	Burundi	Angola	Sao Tomand Principe
Ethiopia	Djibouti	Somalia	Kenya
Uganda	Tanzania	Mozambique	Madagascar
Zimbabwe	Namibia	South Africa	Lesotho
Malawi	Zambia	Swaziland	Comoros
Eritrea	Papua New Guinea	Samoa	Vanuatu
Fiji	Solomon Islands	Tonga	Kiribati
Marshall Islands	Micronesia, Fed. Sts.		

Reginald Classification

We aggregated the 47 Japanese prefectures into 10 regions and use this regional classification in the table and figures in this paper.

Region	Prefectures						
Hokkaido	Hokkaido						
Tohoku	Aomori	Iwate	Miyagi	Akita	Yamagata	Fukushima	Nigata
Hokuriku	Toyama	Ishikawa	Fukui				
North Kanto	Ibaragi	Tochigi	Gunma	Yamanashi	Nagano		

South Kanto	Saitama	Chiba	Tokyo	Kanagawa				
Tokai	Gifu	Shizuoka	Aichi	Mie				
Kinki	Shiga	Kyoto	Osaka	Hyogo	Nara	Wakayama		
Chugoku	Tottori	Shimane	Okayama	Hiroshima	Yamaguchi			
Shikoku	Tokushima	Kagawa	Aichi	Kochi				
Kyusyu	Fukuoka	Saga	Nagasaki	Kumamoto	Oita	Miyazaki	Kagoshima	Okinawa

References

Bernard. A. B, Jensen. J. B and Schott. P. K, (2006), “Survival of the best fit: Exposure to low-wage countries and the (uneven) growth of U.S. manufacturing plants”, *Journal of International Economics*, Volume 68, Issue 1, pp. 219-237

Branson W.H. and Love J.P., (1988) “US manufacturing and real exchange rate,” in Marston, R.C.(Ed.), *Misalignment of Exchange Rates: Effects on Trade and Industry*, *University of Chicago Press, Chicago*,p.p.241-275

Castellani D., Mariotti I. and Piscitello L., (2006), “The impact of outward FDI on the parent’s company’s skill upgrading. Evidence from the Italian case”, University of Urbino, manuscript.

Caves, D., L. Christensen, and M. Tretheway (1983) “Productivity Performance of U.S. Trunk and Local Service Airline in the Era of Deregulation.” *Economic Inquire*. Vol. 21, pp.312-324

Caves, D., L. Christensen, and W. Diewert (1982) “Output, Input and Productivity Using Superlative Index Numbers.” *Economic Journal*, Vol. 92, pp73-96

Davis, S., Haltiwanger, J. C. and Schuh, S. (1996) *Job creation and destruction*, Cambridge, Mass., MIT Press

Dumais, G., Ellison, G., and Glaeser, E., (1997) “Geographic concentration as a dynamics process,” *NBER Working Paper* No. 9020.

Fukao K., Kim, Y. and Kwon, H. (2006), “Plant Turnover and TFP Dynamics in Japanese Manufacturing.” *Hi-Stat Discussion Paper Series*, No. 180

Fukao, K. et al. (2007) “Estimation Procedure and TFP analysis of the JIP Database 2006” *RIETI Discussion Paper,* 07-E-003

Fujita, M, Krugman, P. and Venables, A. (1999), *The Spatial Economy: Cities, Regions, and International Trade.* MIT press, Cambridge, MA.

Good, D., I. Nadri, L. Roeller and R. Sickles (1983). “Efficiency and Productivity Growth comparisons of European and U.S/ Air Carriers: A First Look at the Data.” *Journal of Productivity analysis*, Vol. 4, pp.115-125

Hanson G.H., (1998), “Regional adjustment to trade liberalization”, *Regional Science and Urban Economics,* Volume 28, pp.416-444

Hoover, E. (1936). “The Measurement of Industrial Localization,” *Review of Economics and Statistics,* Vol.18, pp.162-171

Ito, K (2005), “Import competition from low and middle-income countries: Empirical analysis using firm-level micro data from “Basic Survey of Business Activities of Enterprises,” (Japanese) RIETI Discussion Paper Series 05-J-028

Matsuura, T., Hayakawa, K. and Suga, S. (2007) “The linkage procedure of the Census of Manufacturing with firm-level survey data –Toward the comprehensive analysis on location choice of Japanese companies-” (Kogyo tokei jigyosho data to kigyo jouho no rinkeji ni tsuite –nihon kigyo no gurobaru na ricchi sentaku ni mukete-) *Keizai Tokei Kenkyu* (in Japanese)

Motohashi, K., Matsuura, T. and Hayakawa, K.. (2008) “How does FDI in East Asia affect performance at home?: Evidence from Japanese Multinational firms,” mimeo

Navaretti G.B., Castellani D., and Disdier A.C. (2006), “How does investing in cheap labour countries affect performance at home? France and Italy”, CEPR Discussion Paper 5765.

Rebick M.E., (1999),”Trade and the wage structure in the presence of price differentials in the product market: The Japanese labor market 1965-1990” *Journal of the Japanese and International Economics,* Volume 13, pp.22-43

Revenga A.L., (1992),”Exporting jobs? The impact of competition on employment and wages in U.S. manufacturing”, *Quarterly Journal of Economics,* Volume 107(1), pp. 255-284

Shimpo, K., Takahashi, M. and Omori, T. (2005) “Creation of Panel Data from the Census of Manufacturers: A Component of the Industrial Structure Database,” *RIETI Policy Discussion Paper* 05-P-001

Tomiura E., (2003a), “The impact of import competition on Japanese manufacturing employment”, *Journal of the Japanese and International Economies*, Volume 17, pp. 118-133

Tomiura E., (2003b), “Changing economic geography and vertical linkages in Japan”, *Journal of the Japanese and International Economies*, Volume 17, pp. 561-581

Figure 1: Imports from low-wage countries and other countries

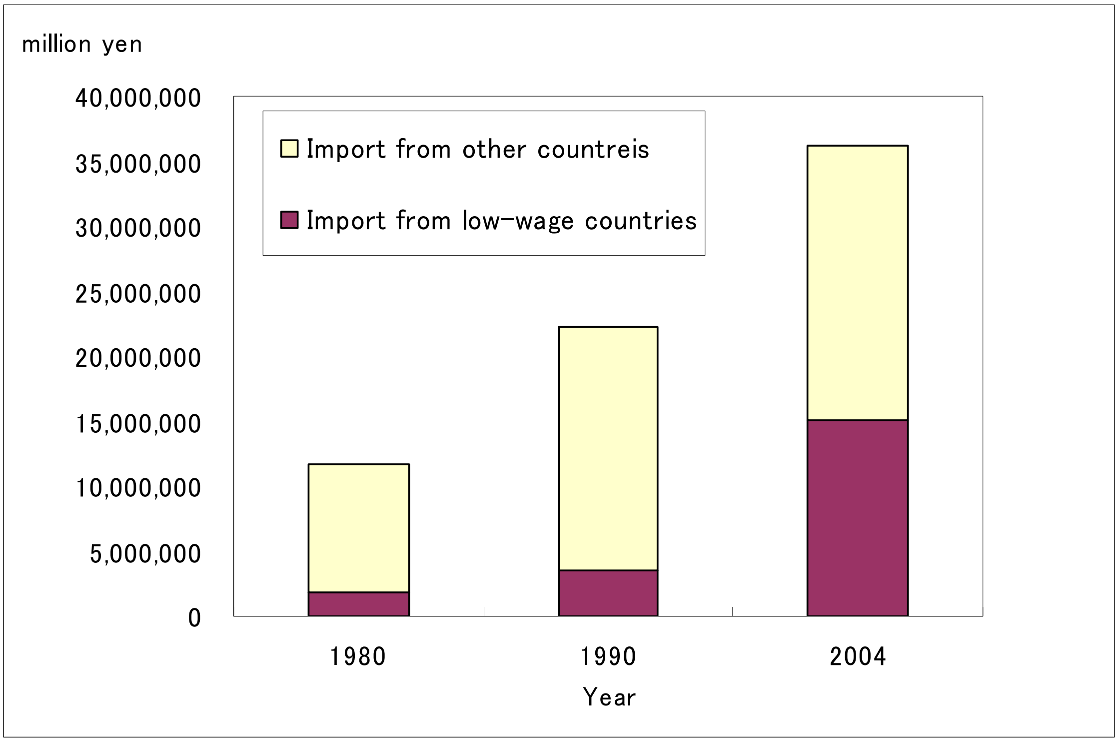

Table 1 Employment growth rates in the manufacturing sector by region between 1981 and 2000

[redacted]

Table 2: Share of import from low-wage countries by industry in Japan

industry	JIP 2006 Classification	Share of imports from low-wage countries(%)			Overall import penetration(%)			Employment change(%)
		1981	1990	2000	1981	1990	2000	1981-2000
8	Livestock products	9	8	15	13	17	20	5
9	Seafood products	16	40	64	10	21	25	3
10	Flour and grain mill products	35	33	28	0	0	1	-44
11	Miscellaneous foods and related products	35	28	38	6	5	6	16
12	Prepared animal foods and organic fertilizers	42	29	28	1	3	10	-37
13	Beverages	12	8	13	2	4	3	4
14	Tobacco	11	1	0	4	6	8	-47
15	Textile products	26	35	79	7	12	27	-49
16	Lumber and wood products	14	30	37	10	15	22	-48
17	Furniture and fixtures	17	24	45	2	4	11	-36
18	Pulp, paper, and coated and glazed paper	2	3	10	7	7	8	-23
19	Paper products	2	6	41	1	1	2	-2
20	Printing, plate making for printing and	1	1	6	0	0	0	14
21	Leather and leather products	21	14	47	9	22	41	-38
22	Rubber products	5	14	65	4	7	12	-14
23	Chemical fertilizers	2	9	30	2	7	13	-60
24	Basic inorganic chemicals	17	15	28	10	10	11	-14
25	Basic organic chemicals	7	5	2	1	1	1	-42
26	Organic chemicals	5	5	10	9	12	16	-1
27	Chemical fibers	2	1	14	4	6	7	-37
28	Miscellaneous chemical products	6	5	10	8	7	10	11
29	Pharmaceutical products	2	2	3	7	7	7	13
30	Petroleum products	24	18	13	11	16	11	-43
31	Coal products	38	58	97	0	1	1	-53
32	Glass and its products	1	9	21	3	6	8	13
33	Cement and its products	3	10	16	0	1	0	-29
34	Pottery	8	9	33	2	5	8	-24
35	Miscellaneous ceramic, stone and clay	37	14	65	5	7	9	-29
36	Pig iron and crude steel	30	52	78	2	3	3	-66
37	Miscellaneous iron and steel	5	15	20	1	2	3	-34
38	Smelting and refining of non-ferrous metals	30	22	61	38	52	53	-31
39	Non-ferrous metal products	24	22	53	4	4	9	4
40	Fabricated constructional and architectural metal products	2	41	47	0	1	1	-4
41	Miscellaneous fabricated metal products	2	8	34	2	2	4	-10
42	General industry machinery	0	4	19	3	4	6	10
43	Special industry machinery	1	1	9	5	6	8	-8
44	Miscellaneous machinery	2	15	22	7	4	6	17
45	Office and service industry machines	0	11	43	3	2	7	33
46	Electrical generating, transmission, distribution and industrial apparatus	0	15	56	3	5	15	11
47	Household electric appliances	1	14	48	2	3	14	-44
48	Electronic data processing machines, digital and analog computer equipment and	0	5	22	13	13	35	137
49	Communication equipment	1	6	15	9	5	6	36
50	Electronic equipment and electric measuring instruments	0	1	4	26	8	17	39
51	Semiconductor devices and integrated circuits	6	2	14	12	16	50	112
52	Electronic parts	0	4	33	1	3	7	31
53	Miscellaneous electrical machinery equipment	1	4	22	3	4	14	17
54	Motor vehicles	0	0	2	2	9	10	0
55	Motor vehicle parts and accessories	4	3	21	1	1	2	21
56	Other transportation equipment	6	0	7	10	14	14	-34
57	Precision machinery & equipment	2	3	18	11	15	29	-33
58	Plastic products	1	7	33	1	1	3	29
59	Miscellaneous manufacturing industries	16	19	42	10	15	17	-13

Figure 2: Japanese manufacturing sector INP by region in 1981, 1990 and 2000

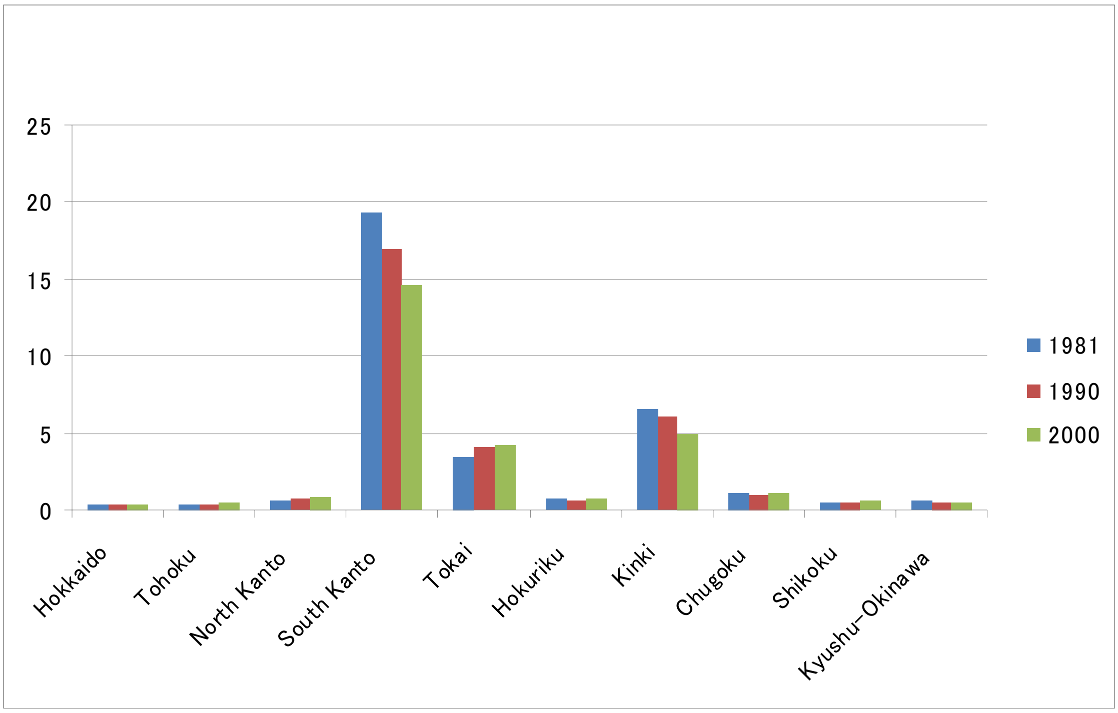

Figure 3: Japanese manufacturing sector OUT by region in 1981, 1990 and 2000

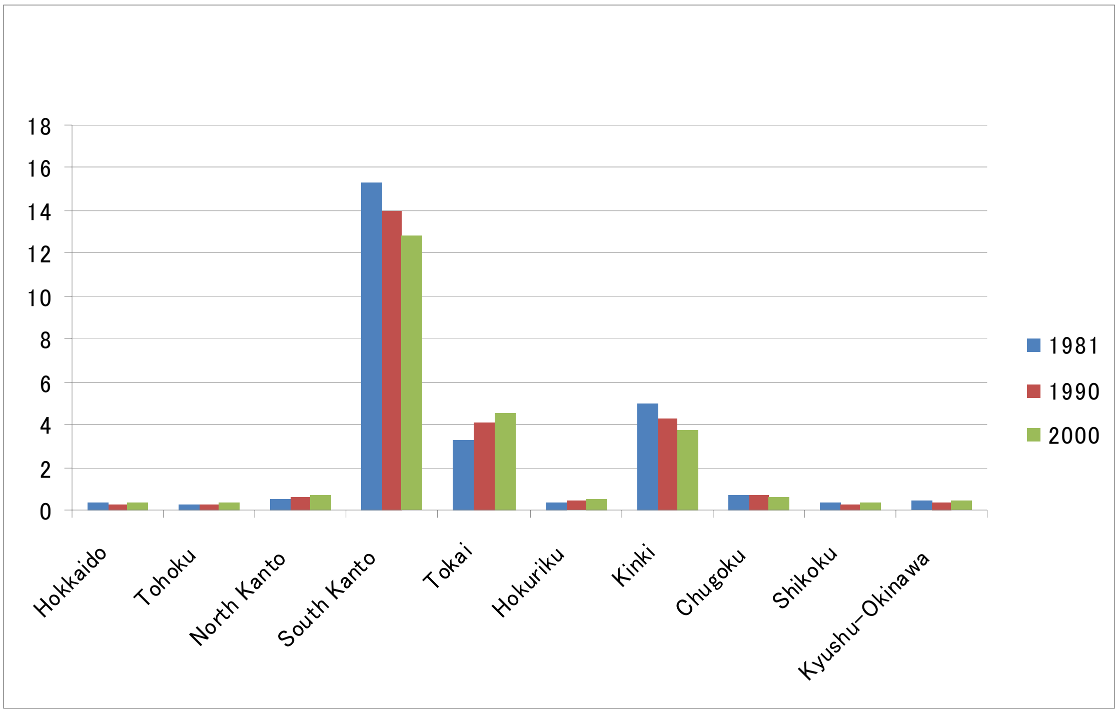

Figure 4: Japanese manufacturing sector IIA by region in 1981, 1990 and 2000

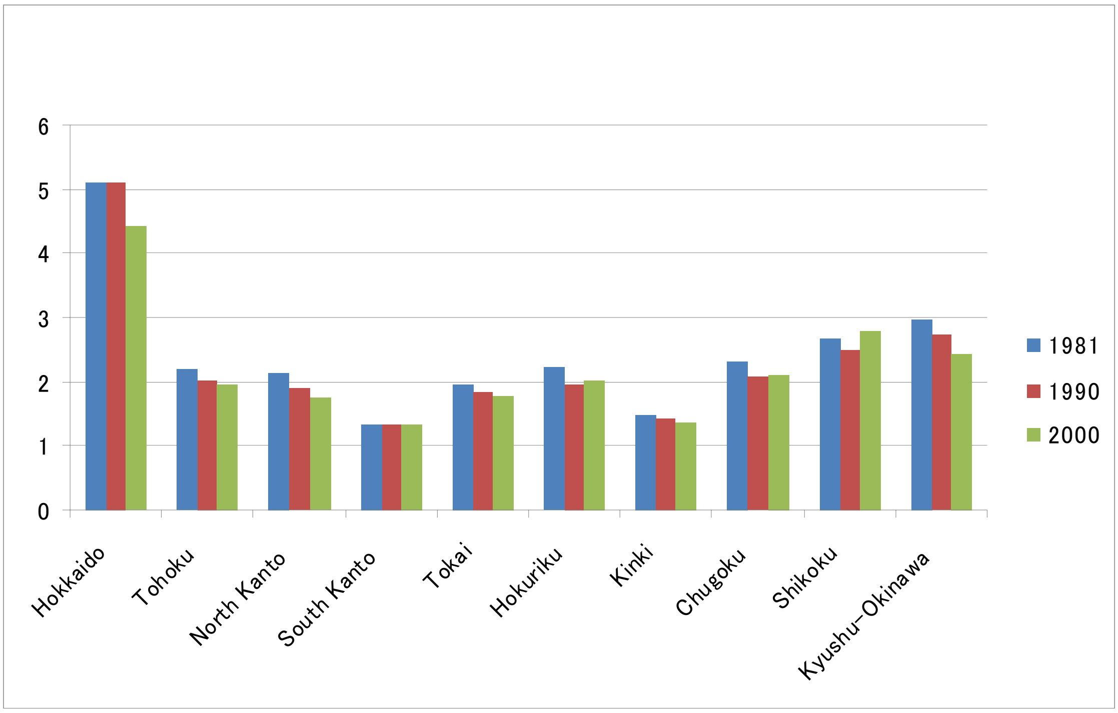

Figure 5: Japanese manufacturing sector DIV by region in 1981, 1990 and 2000

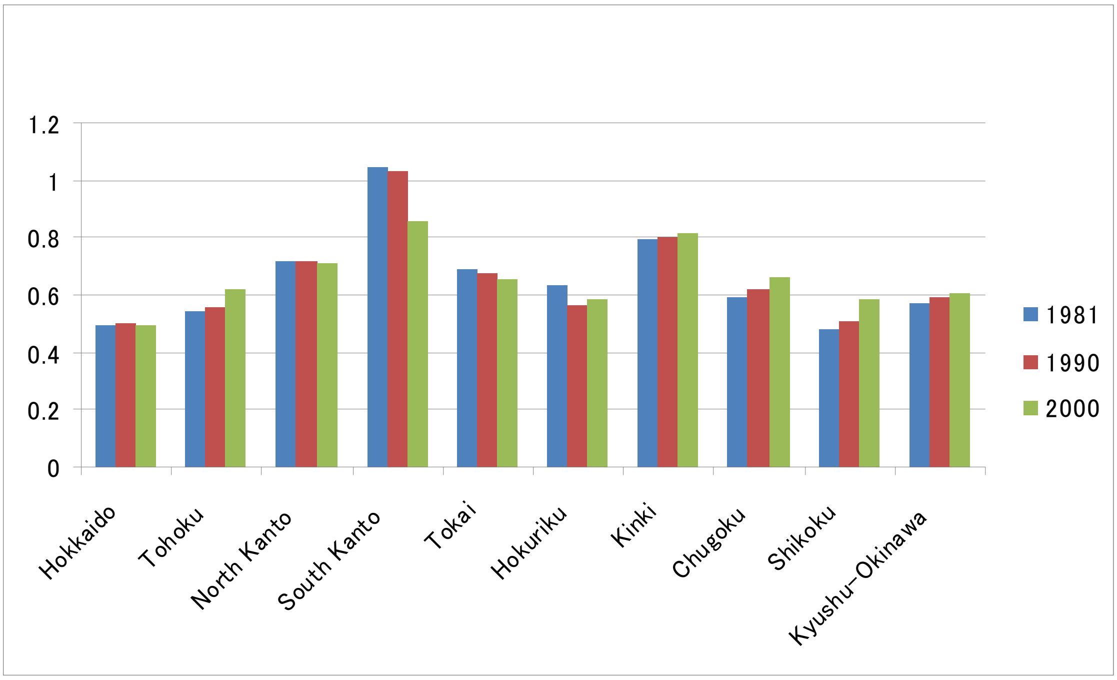

Table 3 Estimation Results

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Estimation Method	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect	Fixed Effect
Dependant Variable	Difference of log of employment			Haltiwanger type employment growth rate		
N	2355614	2310631	2310631	2629657	2577461	2577461
r2_a	−0.06	−0.06	−0.06	0.46	0.45	0.45
p	0	0	0	0	0	0
lnKL	0.03	0.03	0.03	0.03	0.03	0.03
	[136.41]***	[135.79]***	[136.03]***	[59.97]***	[59.55]***	[59.42]***
tfp	0.05	0.05	0.05	0.08	0.08	0.06
	[105.26]***	[105.06]***	[90.11]***	[67.38]***	[66.57]***	[48.22]***
MNE	−0.01	−0.01	−0.01	0.08	0.08	0.06
	[−7.00]***	[−6.77]***	[−3.69]***	[19.03]***	[18.90]***	[13.55]***
lwpen	−0.18	−0.18	−0.33	−0.75	−0.77	−1.41
	[−29.02]***	[−28.64]***	[−15.75]***	[−52.12]***	[−53.10]***	[−28.57]***
othpen	−0.01	−0.01	−0.01	−0.04	−0.04	−0.04
	[−1.55]	[−1.55]	[−1.20]	[−2.81]***	[−3.10]***	[−3.23]***
wage_region		−0.07	−0.07		−0.04	−0.04
		[−15.98]***	[−15.58]***		[−3.44]***	[−3.30]***
INP1		0	0		0	0
		[9.79]***	[10.86]***		[15.04]***	[16.21]***
OUT1		0	0		0	0
		[4.72]***	[3.55]***		[0.64]	[−0.78]
IIA		0	0		0	0
		[−6.80]***	[−6.41]***		[−0.34]	[0.29]
DIV		0	0		0.07	0.06
		[−1.22]	[−1.63]		[11.75]***	[10.69]***
lwpenXtfp			0.13			0.66
			[12.11]***			[27.21]***
lwpenXINP1			−0.02			−0.07
			[−9.20]***			[−11.17]***
lwpenXOUT1			0.03			0.07
			[9.28]***			[10.13]***
lwpenXmne			−0.24			0.81
			[−7.89]***			[11.39]***
lwpenXDIV			0.06			0.08
			[2.39]**			[1.35]
scale (30<=emp<100)	−0.1	−0.1	−0.1	−0.03	−0.03	−0.03
	[−177.20]***	[−175.20]***	[−175.35]***	[−23.48]***	[−23.48]***	[−24.07]***
scale (100=<emp<500)	−0.19	−0.19	−0.19	−0.08	−0.09	−0.09
	[−191.09]***	[−188.80]***	[−189.01]***	[−32.22]***	[−32.13]***	[−32.50]***
scale(500<=emp<1000)	−0.28	−0.28	−0.28	−0.15	−0.15	−0.15
	[−108.97]***	[−107.26]***	[−107.64]***	[−22.27]***	[−22.19]***	[−21.90]***
scale(emp>1000)	−0.36	−0.36	−0.36	−0.22	−0.22	−0.21
	[−81.86]***	[−80.25]***	[−80.54]***	[−18.74]***	[−18.59]***	[−18.24]***
_cons	−0.14	0.2	0.19	−0.1	0	0.01
	[−96.40]***	[3.99]***	[3.91]***	[−26.82]***	[−0.00]	[0.06]
Time dummy	Yes	Yes	Yes	Yes	Yes	Yes

Number in parenthesis is t value

***, **, * indicates the level of significance at 1%, 5%, and 10%, respectively