Impacts of International Migration on the Labor Market in Japan

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This paper introduces an empirical analysis on three key points: (i) whether the introduction of foreign workers into the labor market will serve to lower wages for Japanese workers, (ii) whether the introduction of foreign workers will affect the supply behavior of Japanese workers in a region, and (iii) whether the introduction of foreign workers will affect companies' technology choices. Since statistical data about foreign workers are limited in Japan, it is difficult to make a strict analysis on the relationship between Japanese and foreign workers. This paper analyzes this relationship, focusing on the above three key points and matching individual data by using existing statistical data including the Population Census, the Establishment and Enterprise Census, the Basic Survey on Wage Structure, and the Employment Status Survey. Analytical findings indicate that the introduction of foreign workers has positive effects on wages for domestic workers in Japan—as seen in other countries that accept foreign workers—and that the inflow of foreign workers into a region could cause an outflow of Japanese workers from that region through its effect on the labor supply behavior of Japanese workers.

I. Introduction

In discussions on whether Japan should accept the full-fledged introduction of foreign workers, the importance of empirical analysis on how this would affect the Japanese labor market is hardly worth stating. Since Japan has never experienced a full-scale introduction of foreign workers, however, it is extremely difficult to strictly assess the effects of this level of participation by foreign workers in the Japanese labor market.[1]

In fact, relevant empirical analyses are extremely limited in Japan. Be this as it may, Japan is not the only country where data on foreign workers are limited, and other countries with limited data have devised various efforts to produce empirical analyses. As labor market data are abundant in Japan, it is not impossible to combine relevant databases to empirically assess the effects of the introduction of foreign workers. One reason why empirical analyses using existing data have been limited in Japan is that procedures for using existing individual data have been very complicated. A greater reason may be that the limited range of data on foreign workers has made it difficult to directly assess their substitution for or complementary relationship with domestic workers—the most basic factor for considering the effects of foreign workers on the labor market.

Nakamura et al. (2009) attempted to consistently assess the impact of introducing

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[1] No accurate number of foreign workers in Japan has been published. The Ministry of Health, Labour and Welfare has estimated the number at around 800,000 (as of 2003) including illegal workers. See Ogawa (2004) for details.

foreign workers into the labor market by combining micro data from existing statistics to analyze its effects from various viewpoints, though not directly. As indicated in the next section, Japan has yet to utilize foreign workers on a full-scale basis, and the number of foreign workers in Japan is extremely limited. Although this makes it difficult to empirically assess the effects of introducing foreign workers into the labor market, the analysis achieved by Nakamura et al. (2009) was designed to do so as consistently as possible within the limited framework.

Hypotheses taken up for examination in the paper were roughly integrated into the following three issues:

(i)   Whether the introduction of foreign workers into the labor market would serve to lower wages for Japanese workers

(ii)   Whether the introduction of foreign workers would affect Japanese workers' entry into and exit from the labor market

(iii)   Whether the introduction of foreign workers would serve to delay upgrades to the industrial structure

These issues, as noted by even the Ministry of Health, Labour and Welfare (2002), represent major reasons for Japan to refrain from accepting unskilled foreign workers. This paper uses the Nakamura et al. (2009) analysis on these three points to outline the present influence of foreign workers. Due to physical restraints on this paper, details of the analysis cannot be introduced. The analysis is thus outlined below. See Nakamura et al. (2009) for details.[2]

II. Hypotheses and Data

As shown by Figure 1 (A), a simple framework of the effects of introducing foreign workers into the labor market indicates that wages, including those for domestic workers, may decline on a rightward shift of the supply curve. However, empirical analyses from Western countries as seen in such papers as Bauer and Zimmermann (1999) and Borjas (1994) has indicated that the introduction of foreign workers does not necessarily lead to wage drops for domestic workers. In this regard, such papers as Card and DiNardo (2000) have noted that the supply curve would shift leftward as indicated by Figure 1 (B), and would have no effect on wages for domestic workers as the introduction of foreign workers in one region would prompt domestic workers to move from the region. When considering the influence of foreign workers on wages for domestic workers, therefore, we must give consideration not only to direct influence but also to the labor supply behavior of domestic workers.

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[2] The paper represents a joint study that was conducted by Nakamura, Naito, Kambayashi, Kawaguchi, and Machikita and compiled by Nakamura. See Nakamura et al. (2009) for details including the theoretical framework and data used for the study.
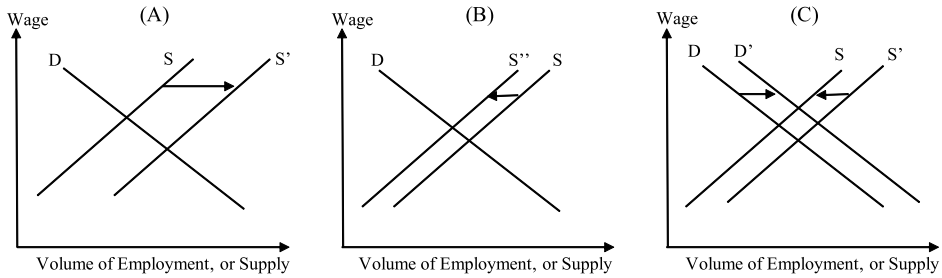
Figure 1. Introduction of Foreign Workers and Wages for Domestic
Workers in Japan

In order to understand foreign workers as a heterogeneous group and assess the effects of a change in the number of workers in the group, it is best to assess the substitution and complementary relationship between distinct heterogeneous groups. However, data restraints have worked to limit past empirical analyses as to which groups of workers would be affected by the inflow of foreign workers in terms of wages or labor transfer, as indicated above. If positive effects on wages for domestic workers are detected, therefore, we may have to consider various potential factors including the transfer of domestic workers.

Few analyses have directly examined the argument that the inflow of unskilled foreign workers would serve to preserve less-productive enterprises or industries with technologies that complement these workers. Lewis (2004) and some others have indicated that the inflow of unskilled foreign workers is linked to equipment with relatively lower technological levels. Detailed information on technologies used by businesses is required for these analyses, and great problems exist in regard to the availability of data.

If the introduction of foreign workers serves to preserve enterprises or industries where relatively less-productive technologies are linked to unskilled foreign workers, or if enterprises move to a region in search of relatively cheaper, less-skilled foreign workers, demand for less-skilled workers may increase to boost the wages for these workers, including domestic ones, as shown in Figure 1 (C).

Past studies have noted that the introduction of foreign workers can affect wages for a group of relatively less-skilled workers. As a matter of fact, this influence depends on whether or not the foreign workers are skilled. The acceptance of relatively-rare, skilled foreign workers may little affect unskilled workers; however, the acceptance of unskilled foreign workers can be expected to greatly affect domestic workers who could be replaced by such foreign workers. Many foreign nationals reportedly work as unskilled workers in Japan, which is contrary to the government's principle of not accepting unskilled foreign workers, but it is difficult to get relevant detailed data.[3]

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[3] Such data as the Population Census include educational levels of foreign workers as well. Nakamura et al. (2009) tested an analysis that gave consideration to educational level of foreign workers.

This paper examines the effects of Japan's introduction of foreign workers in relation to hypotheses on the three issues from various viewpoints, including a perspective similar to Borjas (1994). The following introduces the analytical findings of Nakamura et al. (2009) focusing on these three issues. Nakamura et al. (2009) empirically examined and assessed the effects of the introduction of foreign workers from various viewpoints by combining individual data from such statistics as the Population Census, the Establishment and Enterprise Census, the Basic Survey on Wage Structure, the Employment Status Survey and the Report of Employment Conditions of Foreign Workers.

1. Effects on Wages

First, we will take a look at the effects on wages. Here, we consider the effects on two categories of wages. The first is average regional wage by educational level and gender. The second is the wage at individual business establishments, with new university graduates' starting salaries by educational level and gender as the dependant variable. Effects on the former category of wage indicate how the inflow of foreign workers into a region's labor market would affect regional wages. Effects on the latter are somewhat different, indicating the relationship between starting salaries and the employment of foreign workers at individual business establishments. Usually, it would seem natural to assess how market wages are affected by the introduction of foreign workers. However, when the effects of the introduction of foreign workers are to be considered in a country that features such a strong internal labor market as Japan, it is important to consider wages encountered in the external labor market as much as possible.

For both categories of wages, different values are used for variables indicating the degree of introduction of foreign workers. As for the former category, foreign nationals' share of the population in each region is computed based on the Population Census to indicate the degree of the introduction of foreign workers. As for the latter category, the Basic Survey on Wage Structure and the Report of Employment Conditions of Foreign Workers are matched through the Establishment and Enterprise Census to create a variable of 1 for establishments employing foreign workers and a variable of 0 for those employing no foreign workers, indicating the degree of introduction of foreign workers. The former category is used to examine whether wages in a local labor market are affected by the degree to which foreign workers have been introduced. The latter is designed to detect any starting-salary gap between business establishments employing foreign workers and those employing no such workers.

The following equation has been assumed for the former category:

$$\text{Log}(Wc,t) = \beta_0 + \beta_1 D1996 + \beta_2 D2001 + \text{INDI}c,t \cdot \gamma_1 + \text{FIRM}c,t \cdot \gamma_2 \\ + \beta_3 \text{UUEMPLOYMENT}c,t + \beta_4 \text{FOREIGN}c,t \\ + \beta_5 D1996 \cdot \text{FOREIGN}c,t + \beta_6 D2001 \cdot \text{FOREIGN}c,t + u \quad (2\text{-}1)$$

Table 1. Estimation Results

	High school graduates					
	(1) Male			(2) Female		
	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value
FOREIGN	0.844	0.265	0.00	-0.147	0.411	0.72
D1996·FOREIGN	0.023	0.149	0.87	-0.284	0.229	0.21
D2001·FOREIGN	-0.377	0.152	0.01	0.087	0.236	0.71
Observations	8,750			8,561		

	University graduates					
	(3) Male			(4) Female		
	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value
FOREIGN	-0.357	0.375	0.34	-0.927	0.558	0.09
D1996·FOREIGN	0.285	0.190	0.13	-0.561	0.275	0.04
D2001·FOREIGN	0.453	0.191	0.01	-0.720	0.279	0.01
Observations	7,847			6,765		

In the equation, Wc,t indicates the local average wage rate in Region c in Year t. FOREIGNc,t represents the ratio of foreign workers to Japanese in the region. D1996 and D2001 are year dummies for 1996 and 2001. INDI shows the attributes of employees in the region (including the average age and education level of workers employed by enterprises in the region). FIRM indicates the attributes of enterprises located in the region (including the enterprise size and the gender ratio of employees).

The ratios of foreign workers to Japanese for three years (1990, 1995, and 2000) in each local community in the Popular Census are used. Other variables are based on data from the Basic Surveys on Wage Structure in 1991, 1996, and 2001. These data are used to regress each region's average wage by educational level and gender with the age, length of service, business establishment size, gender ratio at each business establishment, manufacturers' share of enterprises, the unemployment rate, the year dummy (for 1995 and 2001), and the ratio of foreign workers to Japanese (cross terms for year dummies are added to variables for some estimations). A regional dummy is also used for each local community to exclude any fixed effect. Since sample sizes for some 3,000 local communities are substantially different, the number of samples in each community is used as a weight with consideration given to heteroscedasticity upon estimation.

Estimation results are given in Table 1. Here, coefficient values other than the ratio of foreign workers to Japanese workers are omitted. The coefficient of the ratio of foreign workers to Japanese workers is significant and positive for male high school graduates, partially positive and significant for male university graduates, negative and significant for

female university graduates, and insignificant for female high school graduates. The effects of the ratio of foreign workers to Japanese workers differ from time to time for male high school and university graduates. For male high school graduates, the coefficient of the ratio of foreign workers to Japanese workers is positive with the cross term for the 2001 year dummy being negative, indicating that the effects of the introduction of foreign workers on wages have declined recently. For male university graduates, meanwhile, the cross term for the 2001 year dummy alone is estimated as positive and significant.

The above results indicate that the introduction of foreign workers can serve to boost wages for males more or less and to lower wages or have no effect for females.

How does the employment of foreign workers affect wages on a business establishment basis? The framework for estimation follows: first, starting salaries by educational level, job category, and gender (W_{ijt}) upon recruitment in April of Year t at Business Establishment i located in Prefecture j in Year t are computed as a dependent variable. Adopted as demand factors (X_{ijt}) for determining starting salaries were the number of regular employees, the overtime ratio (the ratio of the establishment's total overtime work hours to official working hours), the average age of employees, the ratio of regular employees, and the ratio of fulltime employees in the previous period. The prefecture-by-prefecture number of new university graduates is adopted as a labor market supply factor (Y_{jt}) facing the business establishment. In addition, a dummy (D_{ijt}) that stands at 1 for employment of foreigners in Year t is introduced to check the effects of foreigners' employment on starting salaries. The least square with 0 for the absence of new graduates is adopted as the estimation method. The estimated equation is as follows (2-2). The analysis focuses on the significance and positive or negative sign for β. Samples for the analysis are limited to establishments with 50 or more employees where accurate data are collected. Introduced as other control variables are prefecture, industry category, and year dummies considering differences in the labor market. Estimations have been made separately for high school graduates, junior college/vocational school graduates, and university graduates, production and nonproduction employees, and males and females.[4]

$$W_{ijt} = D_{ijt}\beta + X_{ijt}\gamma_1 + Y_{jt}\gamma_2 + Controls + \alpha \cdots\cdots(2\text{-}2)$$

As indicated by Figure 1, on the premise of the simplest competitive equilibrium, wage levels are determined in a competitive market and cannot be expected to depend on the attributes of business establishments that employ the relevant workers. Then, Equation (2-2) has no rationale. Only a few earlier studies have used this kind of data. Here, business establishments are assumed to exercise a monopolistic power in recruiting new graduates

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[4] Data used here (for the period between 1993 and 2003) are data from the Basic Survey on Wage Structure and the Survey on Employment Conditions of Foreign Workers that were matched for each business establishment through the Establishment and Enterprise Census. See Nakamura et al. (2009) for details of the matching method.

and determine starting salaries and their respective numbers of workers for recruitment. A decision on whether to employ foreign workers may have some correlation with labor demand emerging at each business establishment, which analysts cannot perceive. This may cause some positive bias, though not so large, in the coefficient of the dummy for the employment of foreign workers. Therefore, three estimations were conducted to check the robustness of this estimation. They are the OLS (ordinary least squares) estimation, the random effect model estimation taking advantage of the data characterized as panel data by business establishments, and the Tobit model estimation taking into account the left-censored starting salary as a dependent variable. As a result, the coefficient values for the dummy for the employment of foreign workers were all significant and positive for male high school graduates in production jobs—67.23 in the OLS estimation, 61.597 in the random effect model estimation, and 240.79 in the Tobit model estimation. The coefficient value for the Tobit model estimation, though, being larger than those for other estimations, did not affect an overall conclusion. Therefore, only OLS estimation results are introduced below.

Table 2 shows the effects of the employment of foreign workers on starting salaries by educational level and gender. Estimated coefficients are positive and significant, indicating starting salaries for high school graduates are higher for business establishments that employ foreign workers. The estimation based on regions in Table 1 confirmed the tendency that the employment of foreign workers may exert a negative effect on wages for female university graduates. In this regard, Table 1 and 2 estimations are different. For all other wages, however, both estimations indicated that the employment of foreign workers would roughly exert positive effects on wages.

Tables 1 and 2 suggest that the employment of foreign workers has a positive relation to wages for not all but some employees. This tendency is remarkable particularly for male high school graduates. Why are such positive effects generated? Borjas and some others explain that this is mainly because the supply curve shifts leftward as indicated by Figure 1 (B) since the introduction of foreign workers in one region prompts domestic workers to move to other regions. Have such effects emerged in Japan as well? The following checks how the inflow of foreign workers may affect Japanese workers' entry into and exit from the labor market.

2. Effects on Domestic Workers' Entry into and Exit from the Labor Market

Foreign workers' inflow into a region is thought of as generating three effects: (a) domestic workers' moves to other regions, (b) domestic workers' exit from the labor market, and (c) an effect on career paths including higher education. The first effect may emerge mainly in relation to male workers, the second on married females, and the third on young people. The three effects of foreign workers' inflow into one region are outlined below.

The Population Census includes residence data from five years earlier. Such data are used for checking whether domestic workers moved from regions with more foreign workers

Table 2. Effects on Starting Salaries by Educational Level/Gender (At business establishments with 50 or more employees)

	Starting salaries for high school graduates (in hundreds of yen)											
	Production job						Nonproduction job					
Dependent variable	Male			Female			Male			Female		
	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value
Dummy for employment of foreign workers	63.230	8.003	0.00	60.676	5.724	0.00	39.128	7.929	0.00	41.242	8.101	0.00
Observations	116,789			116,789			116,789			116,789		

	Starting salaries for junior college graduates (in hundrends of yen)											
	Production job						Nonproduction job					
Dependent variable	Male			Female			Male			Female		
	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value
Dummy for employment of foreign workers	52.097	4.404	0.00	15.315	2.343	0.00	49.464	8.200	0.00	76.762	9.663	0.00
Observations	116,789			116,789			116,789			116,789		

	Starting salaries for university graduates (in hundrends of yen)											
	Production job						Nonproduction job					
Dependent variable	Male			Female			Male			Female		
	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value	Coef.	Std.Err	p-value
Dummy for employment of foreign workers	122.860	12.060	0.00	40.763	7.852	0.00	55.022	12.533	0.00	92.147	10.430	0.00
Observations	116,789			116,789			116,789			116,789		

to other regions with fewer foreign workers in those five years. The estimation is based on the following equation:

$$y_{ijt} = \alpha + \beta_1 x1_{jt} + \beta_2 x2_{ijt} + \beta_3 c_j + \beta_4 D_t + \varepsilon_{ijt}$$

The dependent variable is a dummy variable for moving that stands at 1 for domestic workers who within those five years had moved to regions where foreign residents' shares were slipping below prefectural averages and at 0 for others. Index *i* stands for the individual, *j* for the region, and *t* for the time (1990 or 2000). Here, $x1_{jt}$ is an independent variable of interest, representing Foreigner Share 1 from five years earlier (in the town of residence from five years earlier), Foreigner Share 2 from five years earlier (in the town of residence from five years earlier), present Foreigner Share 1 (in the town of residence from five years earlier) and present Foreign Share 2 (in the town of residence from five years earlier). Foreigner Share 1 includes *Zainichi* Koreans (North and South Korean residents in Japan) and Foreigner Share 2 encompasses only non-*Zainichi* Korean foreign nationals. $x2_i$ is a variable indicating the attributes of individuals or households. c_j is a dummy variable to control the regional characteristics. D_t is a dummy variable that stands at 1 if *t* is 2000.

The estimation model using foreigner shares from five years earlier indicates that past foreigner shares would cause a crowding out. The model, which uses the foreigner share that a domestic worker would face if he/she were to remain in his/her town of residence from five years earlier, takes into account a reasonable prediction that an expected foreigner share would affect human behavior.

Moves between regions must be prudently considered with aspects such as the effects of regional characteristics taken into account. Table 3 indicates panel estimation results. These results confirm that male workers who are high school graduates moved from regions with higher foreigner shares to those with lower foreigner shares. This means that the inflow of foreign workers to Japan has caused moves of domestic workers who are likely to be replaced with foreign nationals, as indicated by Figure 1 (B). Indications are that such effect is stronger on junior high or high school graduates than on university graduates.

The estimation results for the second and third effects are outlined below. As for the effect of foreign workers on domestic females' entry into and exit from the labor market, female junior high or high school graduates who are relatively expected to take unskilled jobs are likelier to exit from the labor market in regions into which more foreign workers have flowed. In this case even without moves to other regions, as is the case with males, the labor supply curve in relevant regions shifts leftward. As for the effect on young people's career paths, the presence of many foreign workers in a region may be expected to affect high school students' decisions on whether to continue on to higher education. The presence of many foreign workers who are relatively expected to take up unskilled jobs can serve to reduce the relative scarcity of workers who are high school graduates. In fact, the coefficient value of the foreigner share affecting high school graduates' probability of taking jobs

Table 3. Males' Moves to Regions with Lower Foreigner Shares: Fixed Effect on a Municipality-by-Municipality Basis

Dependent variable = a dummy for moves to regions with lower foreigner shares

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreigner Share 1 from five years earlier (in the town of residence from five years earlier)	-1.043 (1.61)				-0.622 (2.34)*			
Foreigner Share 2 from five years earlier (in the town of residence from five years earlier)		-2.501 (3.34)**				-0.774 (3.31)**		
Present Foreigner Share 1 (in the town of residence from five years earlier)			0.325 (0.97)				-0.136 (1.24)	
Present Foreigner Share 2 (in the town of residence from five years earlier)				-0.481 (1.73)				-0.267 (3.52)**
Educational level of samples	University and junior college graduates				Junior high and high school graduates			
Number of observations	1,351,762 for each category				2,958,538 for each category			
R-squared	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.04

Note: Clustering robust t statistics in parentheses. * significant at 5%; ** significant at 1%. In addition to the above independent variables, each regression equation includes the age, the square of the age, the number of household members, the year dummy, the constant, and the fixed effect.

after graduation is positive and significant. In regions where there are more foreign workers, high school graduates' probability of taking jobs right out of high school is lower and the percentage for those going to high education is higher.

The estimation results for the three cases above indicate that the inflow of foreign workers to a region leads to a decline in labor supply of domestic workers to the labor market in the region. This means that the effect on their labor supply behavior could have prompted the labor supply curve to shift leftward, as indicated by Figure 1 (B).

Are there any effects other than the labor supply curve's leftward shift? The following considers the effects on the reorganization of enterprises.

3. Reorganization of Enterprises

Employing foreign workers is reportedly expected to serve to preserve enterprises that are relatively less productive. In fact, Lewis (2004) confirmed that U.S. enterprises that employed foreign workers had adopted technologies for which relatively higher skills were not required. Enterprises' adoption of less productive technologies is expected to lower their survival probability, but could this also be the case in Japan? It is difficult to find data that directly indicate the relationship between the employment of foreign workers and the levels

of adopted technologies. Here, let us look at the relationship between foreign workers and the development of the industrial structure from two viewpoints. One viewpoint is to look at this as a short-term issue of whether enterprises employing foreign workers have adopted technologies for relatively less skilled workers. Specifically, we will estimate a wage function to examine a hypothesis that if enterprises have equipment that can be operated by workers of relatively lower quality, demand for higher-quality workers may decline to reduce wage disparities based on worker quality gaps.

Another viewpoint represents a more direct problem—whether such enterprises have a higher probability of going bankrupt or going out of business in the medium to long term. Specifically, the following hypotheses are examined:

(i)   Reduced scarcity of labor and improvement of returns on capital through the introduction of foreign workers to a region increases the survival probability of enterprises located in the region.

(ii) The introduction of foreign workers in one region encourages more enterprises to expand into the region.

On the first hypothesis, the effect of the unskilled/skilled and the labor/capital ratios at relevant business establishments is also considered.

First, we will look at estimation results on the wage function. Here, the cross term for the number of years of education and the foreign worker share are added as independent variables in the Mincer wage function, similar to Equation (2-1), to examine the hypothesis. If the cross term coefficient is negative, it will indicate that wage disparities among workers with different education levels are narrower with the introduction of more foreign workers. This means wages for relatively less skilled workers are higher. It is assumed that under the technology structure in which demand is relatively higher for less skilled workers, demand for relatively less skilled workers may increase to relatively boost their wages.

Basic estimation results are compiled in Table 4.[5] The coefficients for variables other than the cross term for the number of years of education and the foreign worker share are very significant, meeting the sign conditions almost completely. All estimates of the cross term for the number of years of education and the foreign worker share in 2000 are significant and negative. This indicates that the number of years of education has less effect on wages in regions with more foreign workers than in those with fewer foreign workers. If observable variables are used to identify estimated samples, estimation results, though with estimated coefficients becoming smaller, strongly indicate a relationship in which the number

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[5] Since the foreign worker share is a municipality-based variable that fails to indicate differences between individuals, estimates' standard deviations must be adjusted in the estimation to get a consistent estimator that explains the differences among municipality-based foreign worker shares in relation to those among individual wages. Here, the clustering-robust regression is used for adjusting the standard deviation. Data used here include the foreign worker share, the region-by-region unemployment rate and the population size from the 2000 Population Census, and some data from the 2002 Basic Survey on Wage Structure. As for wages, a median level is used for each category.

Table 4. Basic Estimation Results (Foreign Labor Share Computed for Each Municipality)

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Foreign worker share in 2000	8.039 (1.493)***	9.12 (1.589)***	6.355 (1.416)***	2.255 (0.891)**	1.995 (0.934)**	2.535 (0.794)***	2.444 (0.807)***	2.352 (0.809)***
Years of education*Foreign worker share in 2000	-0.451 (0.088)***	-0.536 (0.094)***	-0.535 (0.103)***	-0.193 (0.061)***	-0.175 (0.064)***	-0.198 (0.058)***	-0.19 (0.058)***	-0.183 (0.058)***
Unemployment rate, population size, years of education	yes	yes	yes	yes	yes	yes	yes	yes
Females, years of working, square of years of working		yes	yes	yes	yes	yes	yes	yes
Independent variable: University graduates' share of employment in 2002							yes	yes
Years of residence								yes
Prefecture			yes	yes	yes	yes	yes	yes
Industry				yes	yes	yes	yes	yes
Occupation					yes	yes	yes	yes
Enterprise size						yes	yes	yes
Observations	431,746	431,746	431,746	428,789	428,693	427,147	427,147	425,721

Note: Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

of years of education has less effect on the wage rate for (individuals located in) municipalities with more foreign workers.

Various other estimations were conducted in addition to those indicated here. In every estimation, the estimated cross term for the number of years of education and the foreign worker share was negative and significant, suggesting that wage disparities among workers of different educational levels are narrower for regions with higher foreign worker shares. Therefore, indications are that the introduction of foreign workers can serve to preserve older technologies over the short term.

How about the medium to long-term effects on the consolidation of business establishments? The following equation is estimated to examine Hypothesis (1).

$$y_{ic} = \alpha_0 + \alpha_1 g_c + \alpha_2 [x_{1i} - \overline{x_1}] + \beta_1 g_c \times [x_{1i} - \overline{x_1}] + \beta_2 x_{2i} + \beta_3 x_{3c} + \varepsilon_{ic}$$

In the equation, y_{ic} is a dummy variable indicating whether Enterprise i existed in Region c in both 1991 and 2001. The variable is 0 for the case in which the enterprise exited from the region during the 10 years and 1 for the case in which it remained there for the 10 years. g_c is an index indicating the regional foreign worker share. x_{1i} represents variables indicating characteristics of Enterprise i. These are the variables we are interested in (the labor-capital ratio and the unskilled- skilled ratio). x_{2i} represents variables indicating other characteristics of enterprises that are expected to have effects on their exits (including the enterprise size and the founding year). x_{3c} is a variable indicating municipalities' characteristics other than the foreigner share. α_1 is a coefficient indicating the survival probability of Enterprise i with Characteristics x_{1i} at $\overline{x_1}$ if foreign workers increase in a municipality where the enterprise is located. α_2 is the survival probability of enterprises in a municipality with a foreigner ratio of 0 if Enterprise Characteristics x_{1i} (enterprise age, enterprise size, etc.) increase by one unit. β_1 is a coefficient indicating how much longer an enterprise that has one unit more of beneficial characteristics (the unskilled-skilled ratio and the labor-capital ratio) can survive than an enterprise that has one unit less of such characteristics in a region when the regional foreigner share increases by one unit.[6]

The coefficients for Foreigner Shares 1 and 2 in 2000 are of our primary interest. They are the foreigner shares in municipalities where enterprises were located in 2000. The coefficients indicate how the survival probability for enterprises would change with the labor-capital and unskilled- skilled ratios controlled if the foreigner share rises by one unit.

The following variable was created to examine the effect of the unskilled-skilled and labor-capital ratios. The "dev_unskill_skill_ratio" is a deviation of an enterprise's unskilled-skilled ratio from an average unskilled-skilled ratio of all enterprises. When the

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[6] The average, the median, and 90% of x_{1i} are used for $\overline{x_1}$ here. In the equation, $\overline{x_1}$ is changed to indicate how the effect of the foreigner share would change on the survival of enterprises with different characteristics.

"unskill_skill_ratio" stands for the ratio for an enterprise and the "average (un-skill_skill_ratio)" for an average of all enterprises, the deviation (dev_unskill_skill_ratio) is defined as "dev_unskill_skill_ratio=unskill_skill_ratio-average (unskill_skill_ratio)." The unskilled-skilled ratio for each enterprise was computed by obtaining the ratio of newly recruited junior high and high school graduate workers to junior college and university graduate workers, and the average ratio of all enterprises, based on the 1991 Basic Survey on Wage Structure. How would an increase in the foreigner share affect un-skilled-labor-intensive enterprises compared with other enterprises? Analyzing the question is the following cross term for the foreigner share and the unskilled-skilled ratio's deviation from the average:

Foreigner Share 1 in 2000 × dev_unskill_skill_ratio

or

Foreigner Share 2 in 2000 × dev_unskill_skill_ratio

The cross term indicates how the marginal foreigner share effect would change when the unskilled-skilled ratio rises by one unit.

Meanwhile, the labor-capital ratio was computed as the ratio of the total number of employees to the capital size for each enterprise in 1991. As was the case with the un-skilled-skilled ratio, the "dev_labor_capital_ratio" was computed in the following way:

dev_labor_capital_ratio = labor_capital_ratio – average (labor_capital_ratio)

Data used here are from the 2000 Population Census, the 1991 and 2001 Establish-ment and Enterprise Censuses, and the 1991 Basic Survey on Wage Structure.

Estimation results are put in order in Table 5. The results, though including a small number of significant coefficients, indicate a certain amount of tendency. The coefficient of Foreigner Share 2 in 2000 is positive and significant. This indicates that an increase in the foreigner share that includes *Zainichi* Koreans does not lead to a rise in the survival proba-bility of enterprises, while an increase in the share that excludes *Zainichi* Koreans brings about such a rise in the relevant region.

What about the effects of the unskilled-skilled and labor-capital ratios? Column (3) indicates that when Foreigner Share 1 rises by 1 percentage point in a municipality, the sur-vival probability may increase by 0.025 percentage point for an enterprise with an un-skilled-skilled ratio that is one unit higher in the municipality, compared with an enterprise with a ratio that is one unit lower. Similarly, this indicates that when the foreigner share rises by 1 percentage point in a municipality, the survival probability may increase by 0.31 percentage point for an enterprise with a labor-capital ratio that is one unit higher in the municipality, compared with an enterprise with a ratio that is one unit lower. These effects cannot be observed when Foreigner Share 2 is used (Column [4]). The results in Table 5, though failing to produce any strict conclusion, indicate that the introduction of foreign workers tends to increase the survival probability of enterprises. Particularly, such tendency is more remarkable for enterprises with higher unskilled-skilled and labor-capital ratios.

Lastly, let us consider capital flow to regions with more foreign workers (Hypothesis

Table 5. Foreigner Share's Effects on Survival of Enterprises: Assessment Based on
Average Unskilled-Skilled and Labor-Capital Ratios

Dependent variable = a 2001 survival dummy

	(1)	(2)	(3)	(4)
Foreign share 1 in 2000	0.027 (1.39)		0.028 (1.43)	
Foreign share 2 in 2000		0.047 (2.98) **		0.047 (2.94) **
Foreign share 1 in 2000 × dev_unskill_skill_ratio			0.025 (2.09) *	
Foreign share 2 in 2000 × dev_unskill_skill_ratio				0.024 (1.33)
Foreign share 1 in 2000 × dev_labor_capital_ratio			0.312 (3.09) **	
Foreign share 2 in 2000 × dev_labor_capital_ratio				0.130 (0.75)
Observations	1,208,368	1,208,368	1,208,368	1,208,368

Note: Clustering robust t statistics in parentheses. * significant at 5%; ** significant at 1%. In addition to the above independent variables, the regression equation includes the enterprise age, the square of the enterprise age, the number of employees, the square of the number of employees, Japanese population in the relevant municipality in 1990, the square of the 1990 Japanese population, the share for employees in each industry on a workplace basis in the relevant municipality in 1990, the share for university and junior college graduates on a workplace basis in the relevant municipality in 1990, the share for junior high and high school graduates, the unemployment rate on a residence location basis, and the elderly share.

[2]). If an increase in the number of foreign workers engaged in unskilled jobs leads to a rise in the supply of unskilled workers in a region, complementary capital for such workers may flow into the region.

The following model is considered for examining the above hypothesis:

$$y_c = \beta_1 x_{1c} + \gamma_1 x_{2c} + \varepsilon_c$$

Index c indicates a municipality. y_c represents the number or the total capital of new enterprises founded in each municipality in seven years to 2001. x_{1c} is the foreigner share. x_{2c} represents the other variables (regional industrial structure) that affect the number or the total capital of new enterprises. A problem with the OLS (ordinary least squares) estimation using this equation is the possible correlation between x_{1c} and ε_i. Instrumental variables are used for the estimation to resolve the endogeneity problem.

The estimation results are put in order in Table 6. Dependent variables are the number

Table 6. Foreigner Share's Effects on the Number and Total Capital of New Enterprises in Each Municipality

Dependent variable	(1) ln (number of new enteprises)	(2) ln (number of new enteprises)	(3) ln (total capital of new enterprises)	(4) ln (total capital of new enterprises)
Foreign share 1 in 2000	0.908 (3.36) **		0.876 (2.05) *	
Foreign share 2 in 2000		0.908 (3.40) **		0.880 (2.08) *
Observations	3,226	3,226	3,226	3,226

Note: Clustering robust t statistics in parentheses. * significant at 5%; ** significant at 1%. In addition to the above independent variables, Japanese population in the relevant municipality in 1990, the square of the population, the share for employees in each industry on a workplace basis in the relevant municipality in 1990, the share for university and junior college graduates on a workplace basis in the relevant municipality in 1990, the share for junior high and high school graduates, the unemployment rate on a residence location basis, the elderly share and the total number of enterprises in the relevant municipality in 1990 are included as independent variables.

of new enterprises logged by Columns (1) and (2), and the total capital of new enterprises logged by Columns (3) and (4). Used as instrumental variables here are the Chinese share, the foreigner share excluding North Americans, Asians, and Europeans, and the foreigner share excluding *Zainichi* Koreans in 1990.[7]

First, let us look at the estimation results for the number of new enterprises. Coefficients of Foreigner Shares 1 and 2 are positive and significant, indicating that a rise of 1 percentage point in the foreigner share may lead to an increase of about 0.9% in the number of new enterprises.

Next, let us look at the relationship between a rise in the foreigner share and capital brought about by new enterprises in the same region. In order to control differences in new capital amounts among large and small cities, total capital amounts and numbers of enterprises in the same cities in 1991 are added to control variables. The same instrumental variables as used for the number of new enterprises were adopted here. As a result, as seen in Columns (1) and (2), coefficients of Foreigner Shares 1 and 2 were positive and significant. Coefficient values are almost the same. The results in Table 6 confirm that both the number and the total capital of new enterprises indicate that more new enterprises have been founded in regions with more foreign workers, as suggested by Figure 1(c).

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[7] Phase-1 F values of the instrumental variables were very high. Correlations between instrumental and endogenous variables were also very high. The Hansen J statistics were very low when the instrumental variables were used for the estimation. As a result, the P value indicating the absence of correlations between error terms and endogenous variables was sufficiently high. This indicates that the instrumental variable estimation was successful.

The above results indicate a significant relationship between enterprises' entry into and exit from a region, and the introduction of foreign workers to the region, endorsing a general fear that the introduction of foreign workers could serve to impede the development of the industrial structure. However, foreign workers might be functioning as a lubricant to facilitate adjustments in the industrial structure as Japanese workers shift to more productive enterprises or industries in the development process of the industrial structure. This point must be subjected to more detailed consideration.

III. Conclusion

The number of foreign workers in Japan is extremely small as the nation has yet to introduce such workers on a full-fledged basis. As young workers decline in Japan over the long term, however, pressures are expected to grow on Japan to accept more foreign workers. So far, various arguments have been made about accepting foreign workers into the labor force, but none of these has been based on any empirical analysis.

Under the physical restraints of this paper, the findings introduced here are limited to a part of the findings of Nakamura et al. (2009). They do, however, give some answers to past arguments. They deny the past argument that "the acceptance of foreign workers, particularly unskilled workers, would serve to lower wages for Japanese workers." As seen in other industrial countries, however, the findings also indicate that accepting foreign workers into a region's labor force may prompt Japanese workers to move away from that region, and that it may serve to preserve less productive sectors.

As a matter of course, it is necessary to retain some reservations about these findings. If foreigner workers serve to prevent less productive sectors from declining rapidly amid Japanese workers' shift from less productive sectors to more productive ones, foreign workers can be seen to function as a cushion in the course of the development of Japan's industrial structure. Less productive sectors might increase their survival probability by taking advantage of an efficient combination of foreign and Japanese workers, rather than cheap foreign labor, to make production operations more efficient. There are many problems left to be solved, and these findings must be subjected to a more detailed analysis.

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