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Implications for the Spatial Assimilation Theory**

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International and Interprefectural Migration in Japan: Implications for the Spatial Assimilation Theory

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Abstract

We study the spatial assimilation of foreign residents in Japan by analyzing the concentration tendency among foreigners who arrive from overseas and relocate within Japan. Using spatial models, we find that immigrants from overseas tend to move to ethnically concentrated prefectures in Japan; this finding aligns with the spatial assimilation theory. In contrast, this trend weakens substantially with their subsequent domestic relocation in Japan, and it differs by national group. Slow assimilation is found among nationals from countries characterized as being low-income or culturally dissimilar from Japan.

Keywords: spatial assimilation; social integration; spatial interaction model; migration; Japan

JEL classification:

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1 Introduction

In 2018 the Japanese government announced the Basic Policy on Economic and Fiscal Management and Reform, which sets out a new immigration policy.¹ This policy recognizes that Japan’s labor shortage is becoming very serious, and that foreign workers are needed to fill job vacancies. Unlike immigration policies in other advanced countries, Japan’s new policy is not limited to foreign personnel in traditional specialized and technical fields: it also includes those who have more basic expertise and skill levels. As a result, the number of foreigners immigrating to Japan has rapidly increased in recent years, and the majority of them are from China or Korea.

According to the Ministry of Health, Labor and Welfare (MHLW), foreign workers in Japan can be categorized as per the following employment status typology: those who (1) are eligible to work, (2) stay based on their status, (3) participate in technical intern-training programs, (4) conduct designated activities, and (5) conduct nonqualified activities.² In October 2017, the distribution of foreign workers among the five categories was approximately 19%, 36%, 20%, 2%, and 23%, respectively. Many foreigners from the United States, the United Kingdom, and South Korea—most of whom are relatively wealthy—are employed in professional and technical fields. Filipino, Brazilian, and Peruvian individuals tend to be permanent or long-term residents. Many Japanese descendants in Brazil and Peru come to work in Japan and hold permanent resident status, and many Filipinos have obtained permanent residency through intermarriage with Japanese.

It is generally believed that foreigners do not assimilate well into Japanese society, and that friction between Japanese and foreigners will be conspicuous in the near future (Iguchi, 2011). The excessive concentration of foreigners in certain areas has been considered a failure of integration policy and has prevented foreigners’ integration and participation in the destination countries (Andersson, 1998; Bolt and van Kempen, 2003; Wright and Ellis, 2000). For immigrants’ children, growing up in an ethnically concentrated environment can have adverse economic effects; those effects can persist across generations, resulting in slow integration and difficulty in obtaining employment (Asselin

¹While the government claims that this is not an immigration policy, the Basic Policy does relax entry requirements for foreigners who wish to work in Japan, and so here it is considered an immigration policy.

²Under the status of “designated” activities, foreign nationals are permitted to work only in activities designated by the Ministry of Justice.

et al., 2006). Therefore, the spatial distribution of immigrants (i.e., spatial assimilation) is considered a key integration indicator (Alba and Foner, 2015). Japan’s current situation is similar to Europe’s past immigration experiences, in that it lacks a social integration policy that would eliminate discord between foreigners and local individuals and prevent foreigners from feeling isolated from society.

Against this background, we study the adaptability of foreigners in Japan by analyzing the relationship between foreign residents’ backgrounds and their residential location. In particular, based on the spatial assimilation theory (SAT)—which we describe in the next section—we compare the concentration tendency of international migrants (i.e., immigrants from other countries to Japan) with that of foreign migrants relocating within Japan (i.e., migrants moving from one Japanese prefecture to another). To the best of our knowledge, the current study is the first comprehensive attempt to apply the SAT in this way to the Japanese context.

2 Spatial assimilation theory

The geographic concentration of immigrants has been used to evaluate the SAT, which was first put forward in the early 20th century to study the integration of European immigrants with Americans in the United States (Park and Burgess, 1921). According to the SAT, immigrants will concentrate in the same ethnic city, not only to overcome disadvantages associated with language barriers, information uncertainty, and low socioeconomic status, but also to make the best use of employment and welfare conditions attributable to being in a community of immigrants. However, they can improve their local language skills, cultural fitness, and socioeconomic status over time, and eventually move about the country freely—even to suburban areas where few immigrants reside (Massey and Denton, 1985). In this way, immigrants eventually make more contact with local people and become assimilated into society.

Such assimilation is said to continue and progress across generations (Alba and Nee, 2003); however, the time required for spatial assimilation will be comparatively shorter if there are similarities (rather than dissimilarities) between immigrants and the local people of the target destination. Similarities among people can be measured in terms of their

level of human capital, language proficiency, and religion. Immigrants who have cultural and linguistic characteristics similar to those of the local people are, from the very start, less likely to settle in ethnically concentrated areas (Zorlu and Mulder, 2010). It follows that assimilation patterns may differ according to the immigrants' backgrounds.

While the SAT has a strong sociological aspect, economists recognize that multiple changes in the residential location of immigrants stem from information uncertainty (Bodvarsson et al., 2015). A moderate concentration of immigrants creates a positive externality through cooperation among themselves, but excessive concentration is known to create for immigrants an uncontrollable externality. There is a considerable body of research on the impact of the geographical concentration of immigrants on society and on immigrants themselves. Ethnic segregation—whereby foreigners are geographically isolated from the local people—leads to a failure to educate immigrants, and can increase immigrants' reliance on social welfare as well as higher unemployment rates and higher poverty and crime levels (Andersson, 1998; Bolt and van Kempen, 2003). In fact, violence among foreigners has emerged in several European cities, including London, Paris, and Amsterdam (Zorlu and Mulder, 2008). Moreover, higher geographical concentrations of foreigners are also known to increase tension and concerns among the local residents of those immigrants' target destinations (Wright and Ellis, 2000).

Many US studies that analyze immigration concentration support the SAT. For example, ethnic groups who have had a long history of living in the United States tend to be more spatially distributed (Jones, 2003). Moreover, residential location and socioeconomic status are found to strongly correlate. Higher-income African-Americans are more likely to move from the center of a large city to the suburbs (Clark, 2007). Similarly, Hispanic immigrants with a higher socioeconomic status and higher English proficiency are more likely to move from ethnically concentrated areas (South et al., 2006).³

Similarly, the experience of Europe frequently supports the SAT. Zorlu and Mulder (2008) show that asylum-seekers and non-Western immigrants are most likely to move to ethnically concentrated areas in the Netherlands. In contrast, many immigrants from Western countries—which is to say, countries associated with high levels of human capital and socioeconomic status, and proximate the Dutch in terms of language and religion—

³Many other studies have shown the sluggish rate at which African-Americans in the United States spatially integrate (Crowder, 1999; Denton and Massey, 1989).

enter the country mainly as workers and with their families, and do not reside in ethnically concentrated places. Similarly, Chinese immigrants reportedly relocate, on a repeated basis, to ethnically concentrated areas of the United Kingdom (Simpson and Finney, 2009). Tammaru and Kontuly (2011) show that in Estonia, Estonian-language proficiency among immigrants and the possession of Estonian citizenship promote the movement from ethnically concentrated areas to nonconcentrated regions. However, other studies show that immigrants remain undispersed, on account of discrimination and their preference for their own ethnic community (Bolt and van Kempen, 2010).

Traditionally, SAT-related studies have focused on demographic movements to the suburbs from a city, in the latter of which immigrants tend to concentrate. However, in recent years, geologists and sociologists have argued that the topic of spatial integration among immigrants should be expanded so as to focus on interregional movements (Goodwin-White, 2007). In Japan, prefecture-level relocation data are available, making it possible to focus on the movement of foreigners among prefectures (i.e., regional migration) in addition to that of immigration from overseas.⁴

3 Econometrics for relocation analysis

We use gravity models to study the residential relocation of international and interprefectural migrants; these models have been previously used to analyze international trade. However, unlike the gravity models of trade, the random utility maximization model serves as a theoretical basis for migration analysis (McFadden, 1974), where migrants will pay the cost for the move as an investment in their own human capital in order to maximize future utility. This premise is called the human capital investment theory of migration (Bodvarsson et al., 2015). Until the mid-1980s, there was the misconception that international and domestic migration are fundamentally distinct phenomena. Today, however, the idea that migration is a form of human capital investment is a fundamental unifying theme of migration theory in economics (Bodvarsson et al., 2015). Eq. (1) shows the standard gravity model.

⁴A prefecture is the most broadly defined subdivision of Japan.

$$Y_{od} = K \frac{X_o^{\beta_1} X_d^{\beta_2}}{dist_{od}^{\beta_3}} \quad (1)$$

The subscript o denotes origin, and d destination. Y_{od} is the amount of migration from o to d . K is a constant, and X_o and X_d represent the unique characteristics of the origin and destination, respectively. $dist_{od}$ is the geographical distance between o and d , and β_1 , β_2 , and β_3 are parameters. In empirical analysis, Eq. (1) is examined in the natural log form.

$$\ln Y_{od} = \ln K + \beta_1 \ln X_o + \beta_2 \ln X_d - \beta_3 \ln dist_{od} \quad (2)$$

Both international and regional migration models use X_o and X_d , which include unemployment rates, per-capita gross domestic product (GDP), and population. X_d also includes the concentration rate of foreigners, as per the SAT. Unemployment rates and income are economic factors that are thought to strongly relate to migration (Sjaastad, 1962). The population of a destination is used to proxy the size of the labor market, with a large destination population encouraging emigration from elsewhere (Bodvarsson et al., 2015). The distance is a proxy for the transaction costs of migration.

We extend the standard spatial model to capture spatial autocorrelation between migration flows; we do so by using a spatial weight matrix devised by LeSage and Pace (2008).⁵

$$Y_{od} = \rho_o W_o Y_{od} + \rho_d W_d Y_{od} + \iota \alpha + X_o \beta_o + X_d \beta_d + dist_{od} \gamma + \varepsilon \quad (3)$$

This is known as the spatial interaction model, and it has been used for example in interstate migration analysis (Beenstock and Felsenstein, 2016) and interregional traveler analysis (Marrocu and Paci, 2013). In (3), ι is a unitary term, ε is a residual, and ρ_o , ρ_d , α , β_o , β_d , and γ are parameters. W_o and W_d are origin and destination-based spatial weight matrices, respectively.

Figure 1 depicts the theoretical implications of spatial weights on migration flows (Y_{od}). The origin-based matrix (W_o) assigns greater weight to “flows to d from areas close

⁵LeSage and Pace (2008) introduced another spatial weight matrix called W_w . However, when origins and destinations are configured in different regions, W_w cannot be created with the Kronecker product. Therefore, W_w is omitted from analyses of international transfers (Beenstock and Felsenstein, 2016). For comparison purposes, we omit W_w from domestic migration analysis.

to o ” than to “flows to d from areas remote from o .” Therefore, $W_o Y_{od}$ is a variable that captures the stronger spatial correlation between flows that originate from nearby areas. Similarly, the destination-based matrix (W_d) assigns greater weight to “flows to areas near d ” than to “flows to areas distant from d .” Thus, $W_d Y_{od}$ is a variable that captures the stronger spatial correlation between flows to nearby destinations.

[Figure 1]

More precisely, in our international migration analysis featuring k origin countries ($k = 10$) and 47 destination prefectures, W_o can be constructed using the following specification of \widetilde{W}_o .

$$\widetilde{W}_o = \begin{pmatrix} \mathbf{0} & W_{12} & W_{13} & \cdots & W_{1k} \\ W_{21} & \mathbf{0} & W_{23} & \cdots & W_{2k} \\ W_{31} & W_{32} & \mathbf{0} & \cdots & W_{3k} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ W_{k1} & W_{k2} & W_{k3} & \cdots & \mathbf{0}, \end{pmatrix}$$

where $\mathbf{0}$ is a 47×47 nil matrix. The diagonal elements of W_{12} are an inverse of the squared distance between capitals of origin countries 1 and 2, and other elements are 0. W_o is a 470×470 matrix that can be obtained by dividing all elements of \widetilde{W}_o by the row sum of \widetilde{W}_o .

Similarly, W_d is a 470×470 matrix comprising W .

$$W_d = \begin{pmatrix} W & \mathbf{0} & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & W & \mathbf{0} & \cdots & \mathbf{0} \\ \mathbf{0} & \mathbf{0} & W & \cdots & \mathbf{0} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ \mathbf{0} & \mathbf{0} & \mathbf{0} & \cdots & W \end{pmatrix}$$

The elements of W are

$$w_{ij} = \begin{cases} \frac{dist_{ij}^{-2}}{\sum_{j=1}^{47} dist_{ij}^{-2}}, & \text{if } i \neq j \\ 0, & \text{otherwise.} \end{cases} \quad (4)$$

w_{ij} is a 47×47 that is constructed using the distance between prefectures i and j ($dist_{ij}$). Because it is normalized to the row, the row sum of W_d is 1. Since we have 10 origin countries and 47 destination prefectures for Y_{od} in (3), W_d is also a 470×470 matrix.

In our analysis of interprefectural migration, the origins and destinations involve 47 Japanese prefectures. Therefore, $W_o = W \otimes I$ and $W_d = I \otimes W$, where W is a 47×47 matrix with diagonal elements equal to w_{ij} in (4) and other elements 0, I is a 47×47 unitary matrix, and \otimes is the Kronecker product. There are 2209 combinations of o and d for Y_{od} in (3), and so W_o and W_d are both 2209×2209 matrices.

Finally, as the spatial lag variables ($W_o Y_{od}$, $W_d Y_{od}$) may be endogenous, to estimate Eq. (3), we use spatial two-stage least squares (S2SLS) to eliminate any endogeneity bias. We follow Badinger and Egger (2011), who set all exogenous explanatory variables to Z , and the instrumental variables for the endogenous variables $W_o Y_{od}$ and $W_d Y_{od}$ to $H = (Z, W_o Z, W_d Z, W_o^2 Z, W_d^2 Z, W_o W_d Z)$. Here, all explanatory variables, other than spatial lag variables, are used as Z .

4 Data

We obtained migration data from the Statistics Center of the Ministry of Internal Affairs and Communications. The National Census 2010 (*Kokuseichosa*) captured the number of foreign migrants (aged 15–64) who have settled in 47 Japanese prefectures, and that of foreign nationals in Japan who moved to other prefectures; all data are the October 2005–October 2010 period. The top 10 countries of origin (in descending order of number of immigrants) are China, (North and South) Korea, Vietnam, the Philippines, Brazil, Indonesia, the United States, Thailand, Peru, and the United Kingdom;⁶ their proportions by employment type are shown in Figure 2. As mentioned in the Introduction, there are significant differences in employment status by nationality.

[Figure 2]

In terms of international migration analysis, X_o consists of unemployment rates, the natural log of population, and per-capita GDP in US dollars. (All data were drawn from the International Monetary Fund’s (IMF’s) World Economic Outlook.)⁷ Similarly, per-

⁶Information with respect to other popular origin countries of origin, such as India and Nepal, was not available on a national basis.

⁷For Korea, we use only information pertaining to South Korea, as there are no official diplomatic

capita GDP in X_d was converted to US dollars using the average yen-to-US dollar exchange rate published by the IMF. The distance is proxied by the natural log of geographical distance between the capital of each country and the government of each prefecture. The concentration rate equals the number of foreign nationals as a percentage of the total population in each prefecture. Data pertaining to these explanatory variables are from 2005.

In our interprefectural migration study, no single nationality on its own had enough people migrating to Japan's many prefectures to provide a sufficiently large sample. Therefore, we classify foreign nationals as being in the East Asian Group (Korea and China), the Southeast Asian Group (Vietnam, the Philippines, Indonesia, and Thailand), the South American Group (Brazil and Peru), and the Western Group (the United Kingdom and the United States). This immigrant typology is based on intragroup similarities in terms of culture, location, and economic conditions.⁸ Y_{od} is the flow of interprefectural migrants, and it equals 0 if $o = d$. X_o contains unemployment rates, the natural log of per-capita GDP (in Japanese yen), and the number of foreigners belonging to each of the aforementioned groups if $o \neq d$; it equals 0 if $o = d$. X_d contains the natural log of per-capita GDP of d , unemployment rates, the natural log of the total population, and the concentration rate of foreigners if $o \neq d$, and it equals 0 if $o = d$. The distance variable is the natural log of the interprefectural distance when $o \neq d$, and it equals 0 when $o = d$. Data pertaining to these explanatory variables are also from 2005 (Table 1). As one can see, in that year, foreign nationals accounted for a small percentage (0.85%) of Japan's population.

[Table 1]

Table 2 shows the results of Moran's I test from the spatial weight matrices. In all cases, the p-value of the test was less than 0.0001, and the null hypothesis of no spatial correlation was rejected. Therefore, there is evidence of spatial correlation in migration.

relations between Japan and North Korea.

⁸For example, in the East Asian Group, China and Korea are adjacent nations and their cultural spheres have historically used the same alphabet (*Kanji*); they also share the traditional practice of Mahayana Buddhism. Vietnamese, Filipinos, Indonesians, and Thais (who comprise the Southeast Asian Group) have different religions and languages, but their home countries are in close proximity and their income levels are relatively similar. Brazilians and Peruvians (the South American Group), despite speaking different languages, have similarities in terms of distance to home countries, and most of their citizens are Catholic. Americans and British nationals (the Western Group) have commonalities (e.g., speak English and are Christian) and their countries' per-capita GDP is higher than that of Japan.

Moreover, with respect to international immigration, W_d has a larger Moran I statistic and a smaller standard deviation than W_o . Therefore, a country has a strong spatial autocorrelation based on destination (Figure 1): immigrants tend to move from overseas to prefectures near certain destinations. Moran’s I statistic for interprefectural migration is at most 0.33, and less than the statistic associated with W_d for international immigrants. Moreover, there are variations in the spatial weights for interprefectural migration by group; the Moran I statistic of East Asians and of Southeast Asians is larger than that of Western countries and of Southeast Americans.

[Table 2]

5 Empirical results

5.1 International immigration

Table 3 shows the results of analyzing migration from overseas to 47 Japanese prefectures. Column (A) shows the ordinary least squares (OLS) results, which imply that economic motivations are driving forces of international migration. Low income and large population in o (origin countries) increase immigration to Japan, particularly to highly populated prefectures. Moreover, the concentration rate of foreigners is significantly positive; foreigners find particular prefectures containing many foreign nationals attractive. These results align with those of many previous studies (Backhaus et al., 2015; Belot and Ederveen, 2012; Clark et al., 2007; Pedersen et al., 2008). The unemployment rates in o are significantly negative; as such, unemployment does not serve as an adequate explanation for economic motivation pertaining to immigration. Nonetheless, this result is consistent with that of DeWaard et al. (2012) and suggests that many people cannot afford to migrate internationally from countries with a high unemployment rate: after all, in the context of the current study, the majority of foreigners are originally from China and South Korea, each of which has low-unemployment conditions.

[Table 3]

The results from the spatial model—which fits the data better than the OLS model according to the Akaike information criterion (AIC)—are similar to those from the OLS model (Column B). Interestingly, the spatial lag variable $W_d Y_{od}$ is significantly positive,

but W_oY_{od} is not found to be significant. The latter suggests that migration flows are not strongly affected by migration flows from various other countries: the decision to leave one's home country must in itself be a momentous decision for immigrants to Japan. On the other hand, the significantly positive parameter for W_dY_{od} implies that immigrants from the same home country tend to go to prefectures that are geographically close to each other.

Given heterogeneity among the 10 types of foreign nationals studied, Column (C) speaks to their preferences in terms of the concentration of certain groups of immigrants who share many similarities. For this analysis, we create concentration rates for the four groups (i.e., East Asian, Southeast Asian, South American, and Western). Then, we confirm different preferences among the groups in terms of residential location in Japan. The concentration rates of the East Asian and Southeast Asian Groups are found to be significantly positive; the other groups do not show such strong preferences that manifest as concentrations in particular Japanese prefectures. These findings are in line with those of Simpson and Finney (2009), who report that Chinese immigrants prefer to stay in particular regions in the United Kingdom. Interestingly, the groups with positive and significant concentration rate estimates share some common features. For example, the per-capita GDP of their home country is lower than that of Japan, and this phenomenon is consistent with the results of Zorlu and Mulder (2008) and predictions derived from the SAT. The SAT also explains the Southeast Asia Group's high concentration rate: it differs from Japanese society in terms of culture, language, and religion. Koreans and Chinese (i.e., the East Asian Group), on the other hand, have a stronger affinity with Japanese society in these respects, but the per-capita GDP of their home country is lower than that of Japan, and many Chinese technical interns live in Japan. It seems that these interns attempt to compensate for their relatively low human capital and weak socioeconomic positions by cooperating with their ethnic community.

Immigrants within the South American and Western Groups appear to be spatially dispersed. The concentration rate of the South American Group is insignificant at the 5% level ($p = 0.072$). Although they do not possess strong socioeconomic status, many Brazilians and Peruvians living in Japan are descendants of Japanese immigrants. Therefore, their affinity with Japanese society at the time of entry is higher than that of foreigners

belonging to either the East Asian or Southeast Asian Group, and their need to concentrate upon entry is relatively small. Both Americans and British (i.e., the Western Group) come from countries with higher per-capita GDP values, and in many cases work in specialized fields. It is thought that the concentration rate of the Western Group is insignificant because its members feel no need to concentrate upon entering the country, given their high socioeconomic status.

Finally, the impact of distance (*dist*) between origin country and Japanese prefecture on immigration is, on many occasions, uncertain. This finding runs counter to the results of previous studies on international immigration, where the expected sign significantly negative. According to Ramos and Surinach (2017), adjoining borders have the effect of significantly increasing immigrant inflows, and because Japan is an island country with tight immigration control, it is presumed that short distance does not act among immigrants as a pull factor.

5.2 Interprefectural movements

Tables 4 and 5 show the results of analyzing foreigners' interprefectural migration. Table 4 presents the OLS results, while Table 5 summarizes the S2SLS results with the addition of the spatial lag variable. These tables provide evidence that spatial assimilation has occurred in Japan, but that the speed of assimilation differs significantly by nationality.

In both tables, the concentration rate of foreigners is insignificant in analyzing all foreign nationals (i.e., overall) and the East Asian Group, but it remains significant and positive for the other foreigner groups. The insignificant concentration rate for members of the East Asian Group derives from their proximity to Japanese culture, and the overall result is affected by the results of East Asian Group, since the majority of immigrants in Japan are Chinese or Korean. Like Japanese, Chinese and Koreans (the East Asian Group) have a long history of Mahayana Buddhism and have linguistic, cultural, and religious characteristics relatively similar to Japan's. Moreover, they belong to a cultural area that has since ancient times used Chinese letters (*kanji*) and had a history of immigrating to Japan before World War II. The insignificant concentration rate of foreigners for interprefectural migration is consistent with the findings of previous studies (Jones, 2003; White and Glick, 1999; Zorlu and Mulder, 2008) and the predictions

deriving from the SAT. Given our finding of a high concentration tendency in their international movements, a low concentration tendency in interprefectural analysis for the East Asian Group suggests that Chinese and Koreans have improved their socioeconomic status in Japan, and that their social integration is progressing successfully. Their assimilation into Japanese culture sharply contrasts with their behavior in the United Kingdom, where Chinese tend to congregate over a protracted period (Simpson and Finney, 2009). We hereby confirm the conventional implication of the SAT, that immigrants find it easier to assimilate themselves into societies that resemble their own.

[Tables 4 and 5]

While the spatial assimilation of foreign nationals in Japan is generally in progress, the concentration rates of the Southeast Asian, South American, and Western Groups are significantly positive. Immigrants in the first two groups earn relatively low incomes in their home countries, are distant linguistically and religiously from Japanese, and have a weak socioeconomic position in Japan. This result is consistent with the behavior of non-Western immigrants in the Netherlands (Zorlu and Muder, 2008). These immigrants—who are both linguistically and religiously distant from the Dutch—choose ethnically concentrated areas, regardless of whether their migration is international or domestic. Moreover, our results indicate that foreigners from the Southeast Asian Group, whose concentration rate was also significant during international migration (Table 3), fail to improve their socioeconomic status and carry out cultural transformation within Japan; consequently, they have experienced significant difficulties in integrating themselves into Japanese society. The South American Group seems to start residing close to each other upon arriving in Japan, since their concentration rate was insignificant for international migration (Table 3) but significant for interprefectural migration. Finally, it appears that members of the Western Group change their preference of residential location upon arriving in Japan: at the time of entry, the spatial location is not an important factor for immigration, but they prefer to stay together when making relocation decisions in Japan.

Besides a tendency for immigrants to concentrate, there are some differences between the empirical results of international and interprefectural migration analyses.⁹ For example, while there was a strong tendency for workers to relocate to highly populated

⁹Based on the AIC, the spatial model is more appropriate for all foreigners and the East Asian Group (Table 5), while the OLS model is better for the other groups (Table 4).

prefectures during domestic migration, such a tendency was very weak in the spatial analysis of international migration. Moreover, while economic motivations remain important with respect to domestic migration, job opportunities (rather than higher income) tend to be the motivation behind relocation. In the case of international immigration, increases in unemployment rates in origin countries reduce workers' economic gains and emigration, but in the case of interprefectural migration, unemployment rates (o) are often significantly positive. Foreigners living in Japan already have the economic power to move between nations, and domestic travel costs are significantly lower than international travel costs; these facts facilitate foreign nationals' movement to other prefectures that offer better employment opportunities.

Additionally, the distance functions more consistently with theoretical predictions of interprefectural movement than with those of international immigration. Unlike the case of migrating from outside the country, in the interprefectural analysis, the distance variable is correctly signed and both significant and negative. Compared to cases of international movement where there is no adjacent foreign country, prefectural borders (which are more likely to be adjacent to each other in domestic movement) are associated with a cost of movement (i.e., between neighboring prefectures) that is significantly lower and more affordable. Therefore, we obtain the predicted result that the distance between prefectures negatively correlates with the number of migrants.

6 Conclusion

Based on the spatial assimilation theory (SAT), we analyzed the concentration tendency of immigrants to Japan and that of foreigners relocating within Japan. According to the SAT, when first entering a country, immigrants tend to flow into areas where their own ethnic group concentrates, but subsequently relocate to areas with low ethnic intensity. Therefore, spatial assimilation—the theme of this study—acts as an indicator of social integration, and we show that spatial assimilation among foreigners in Japan is in progress.

Analysis of international migration data showed that the effect of the prefecture-level concentration of foreigners on immigration was significantly positive for the East Asian and Southeast Asian Groups, both of which come from regions whose per-capita GDP

is lower than that of Japan. In contrast, interprefectural migration analysis showed that the East Asian Group (Chinese and Korean)—which is characterized by similarities with Japan in terms of language, culture, and religion—had a weaker tendency to concentrate during domestic migration; this finding aligns with SAT predictions. However, for each of the Southeast Asian, Western, and South American Groups—which are relatively different from Japan in terms of culture, language, and religion—the concentration rate significantly and positively correlated with migration. This finding suggests that the integration of Chinese and Korean immigrants into Japanese society is progressing at a faster rate than that of other immigrant groups.

In Japan—a country that aims to increase its volume of foreign labor—it is urgently necessary to prepare a social integration policy for foreigners. European countries—which have had a comparatively longer history of hosting foreign workers and refugees—have invested considerably in social integration policies so as to prevent isolation among foreigners and stabilize society. Given that many immigrants' children do not attend school in Japan, investment in education on Japanese culture and history is needed to establish an immigration policy that will have positive impacts on Japanese society.

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Table 1: Descriptive statistics

	Mean	SD	Min	Max
Immigration of foreigners to prefectures (100people)	6.34	16.7	0	180
Unemployment rates of foreign countries	6.86	3.45	1.86	11.4
Real GDP per capita of foreign countries	9.22	0.85	8.04	10.7
No. of population of foreign countries	4.78	1.06	3.33	7.18
Inter-prefectural migration of foreigners (100 people)	0.37	1.88	0	42.2
Unemployment rates of prefectures	5.94	1.34	4.24	11.9
Real GDP per capita of prefectures	10.1	0.16	9.83	10.8
No. of population of prefectures	14.5	0.74	13.32	16.3
Foreigners' rates of prefectures	0.85	0.50	0.26	1.83
Distance between foreign countries and prefectures	8.52	0.933	6.29	9.84
Distance between prefectures	5.98	0.80	2.35	7.72

Note: Standard deviation (SD). All variables are in natural log except number of migrants that includes 0, and unemployment rates and foreigners' rates that are expressed in terms of percentage.

Table 2: Moran's I tests for migration flows

Spatial weight matrix	Moran's I statistic	Expectation	SD	p-value
W_o (Immigration to Japanese prefectures)	0.203	-0.002	0.036	0.000
W_d (Immigration to Japanese prefectures)	0.738	-0.002	0.025	0.000
W_o (Inter-prefectural migration_all foreigners)	0.334	-0.000	0.011	0.000
W_d (Inter-prefectural migration_all foreigners)	0.294	-0.000	0.011	0.000
W_o (Inter-prefectural migration_East Asians)	0.306	-0.000	0.011	0.000
W_d (Inter-prefectural migration_East Asians)	0.259	-0.000	0.011	0.000
W_o (Inter-prefectural migration_Southeast Asians)	0.317	-0.000	0.012	0.000
W_d (Inter-prefectural migration_Southeast Asians)	0.321	-0.000	0.012	0.000
W_o (Inter-prefectural migration_Americans and British)	0.193	-0.000	0.011	0.000
W_d (Inter-prefectural migration_Americans and British)	0.171	-0.000	0.011	0.000
W_o (Inter-prefectural migration_South Americans)	0.183	-0.000	0.012	0.000
W_d (Inter-prefectural migration_South Americans)	0.225	-0.000	0.012	0.000

Note: Expectation and SD express the expectation value and standard deviation of the null distribution in Moran's I test. W_o and W_d are origin- and destination-based spatial matrices, respectively.

Table 3: Results of immigration models

Dependent variable:	Immigration to prefectures from abroad		
	(A)	(B)	(C)
Intercept	-169.789 (93.595)	-118.835* (51.818)	-113.013* (54.819)
Unemployment rate _o	-0.936*** (0.187)	-0.474** (0.159)	-0.585*** (0.172)
Real GDP per capita _o	-4.370*** (0.732)	-2.888** (0.921)	-2.933** (0.886)
No. of population _o	6.397*** (0.874)	2.781*** (0.723)	3.066*** (0.833)
Unemployment rate _d	-0.004 (0.635)	0.446 (0.535)	0.502 (0.548)
Real GDP per capita _d	11.568 (9.565)	8.468 (5.666)	7.454 (5.805)
No. of population _d	5.048*** (1.040)	1.925 (1.485)	1.580 (1.415)
Foreigners' rate _d	36.197*** (9.441)	15.999** (5.399)	
East Asians _d			19.261* (9.628)
Southeast Asians _d			42.820** (16.223)
Americans and British _d			-12.875 (31.529)
South Americans _d			10.886 (6.039)
Distance _{od}	-0.106 (0.581)	2.127 (1.294)	3.110* (1.465)
$W_o Y_{od}$		0.233 (0.173)	0.275 (0.172)
$W_d Y_{od}$		0.570*** (0.076)	0.563*** (0.079)
Sample size	470	470	470
AIC	3654.615	3448.405	3455.068

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. Subscripts 'o' and 'd' represent origin and destination regions, respectively.

Table 4: OLS results for inter-prefectural migration models

	All foreigners	East Asians	Southeast Asians	Americans and British	South Americans
Intercept	-0.079** (0.028)	-0.066** (0.021)	-0.002 (0.002)	-0.001 (0.001)	0.006** (0.002)
Unemployment rate _o	0.068 (0.035)	0.063* (0.025)	0.006* (0.002)	-0.001 (0.002)	0.007** (0.002)
Real GDP per capita _o	-0.945 (0.898)	-0.435 (0.562)	-0.111 (0.065)	-0.013 (0.031)	-0.023 (0.024)
No. of foreigners (same group) _o	0.440*** (0.098)	0.281*** (0.063)	0.060*** (0.010)	0.020*** (0.005)	0.030*** (0.003)
Unemployment rate _d	0.055 (0.043)	0.050 (0.034)	0.007 (0.004)	-0.002 (0.002)	0.000 (0.003)
Real GDP per capita _d	-0.057 (0.889)	-0.213 (0.577)	0.015 (0.065)	-0.008 (0.037)	-0.053 (0.030)
No. of population _d	0.533*** (0.097)	0.333*** (0.074)	0.050*** (0.008)	0.016** (0.005)	0.057*** (0.010)
Foreigners' rate (same group) _d	0.053 (0.122)	0.179 (0.121)	0.253*** (0.055)	0.591** (0.215)	0.232*** (0.045)
Distance _{od}	-0.720*** (0.153)	-0.445*** (0.112)	-0.079*** (0.014)	-0.026*** (0.007)	-0.075*** (0.010)
Sample size	2209	2209	2209	2209	2209
AIC	8584.404	7160.988	-1295.597	-4448.364	35.530

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. Subscripts 'o' and 'd' represent origin and destination regions, respectively.

Table 5: S2SLS results for inter-prefectural migration models

	All foreigners	East Asians	Southeast Asians	Americans and British	South Americans
Intercept	-0.042 (0.308)	-0.023 (0.215)	-0.000 (0.034)	0.033 (0.022)	0.050 (0.044)
Unemployment rate _o	0.100** (0.035)	0.090*** (0.026)	0.005 (0.004)	-0.002 (0.002)	0.007** (0.002)
Real GDP per capita _o	-0.499 (0.570)	-0.176 (0.320)	-0.121** (0.047)	-0.025 (0.015)	-0.010 (0.030)
No. of foreigners _o	0.466*** (0.128)	0.320** (0.102)	0.060*** (0.013)	0.025** (0.010)	0.027*** (0.004)
Unemployment rate _d	0.032 (0.029)	0.025 (0.019)	0.008* (0.003)	-0.003 (0.002)	-0.002 (0.003)
Real GDP per capita _d	-0.430 (0.602)	-0.456 (0.380)	0.022 (0.036)	-0.009 (0.016)	-0.106 (0.055)
No. of population _d	0.470** (0.163)	0.305** (0.118)	0.051*** (0.014)	0.022* (0.009)	0.085*** (0.021)
Foreigners' rate (same group) _d	0.068 (0.109)	0.052 (0.223)	0.243*** (0.058)	0.742* (0.334)	0.335*** (0.101)
Distance _{od}	-0.720*** (0.181)	-0.458** (0.140)	-0.080*** (0.018)	-0.033** (0.012)	-0.083*** (0.017)
$W_o Y_{od}$	0.238 (0.316)	0.269 (0.334)	-0.006 (0.040)	-0.264 (0.514)	-0.496 (0.351)
$W_d Y_{od}$	-0.239 (0.288)	-0.284 (0.315)	0.005 (0.037)	-0.104 (0.496)	0.291 (0.184)
Sample size	2209	2209	2209	2209	2209
AIC	8577.211	7156.315	-1277.948	-4153.134	169.017

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$. Subscripts 'o' and 'd' represent origin and destination regions, respectively.

Figure 1
Origin-based dependence (left) and Destination-based dependence (right) of migration

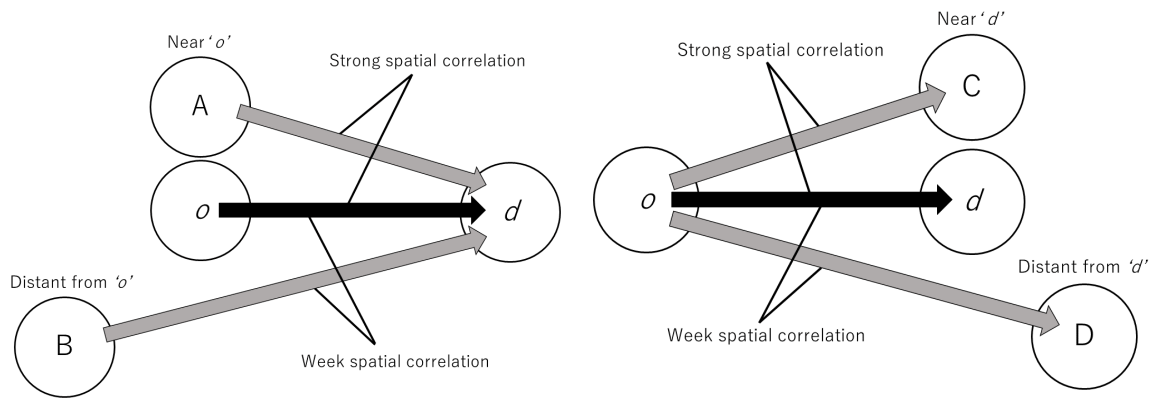
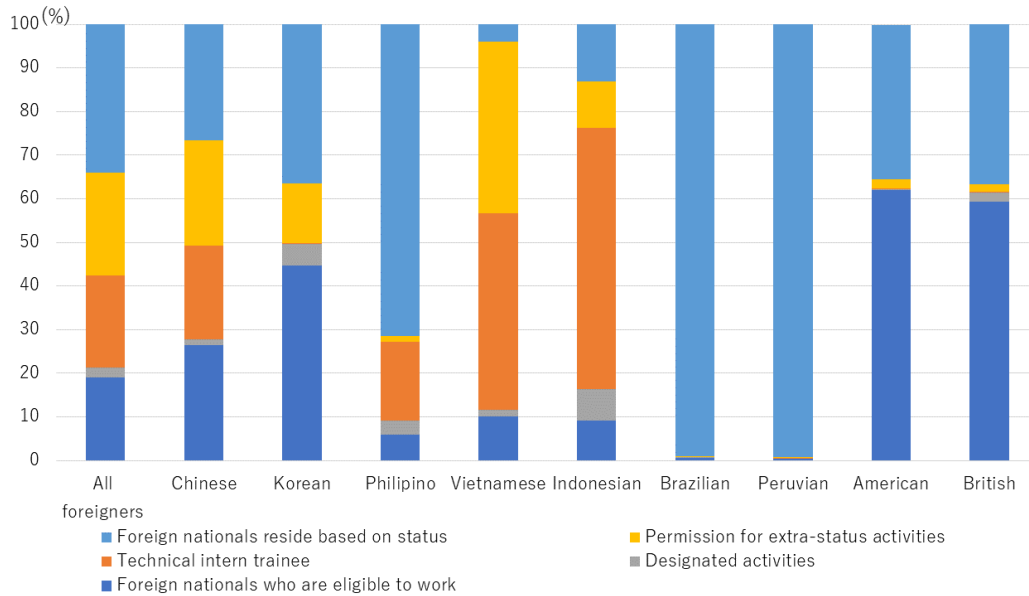


Figure 2
The percentage of foreign residents in Japan by residential type (October, 2018)



Note: The data source is the report on employment status of foreigners produced by Ministry of Health, Labor and Welfare