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The Rank-size Distribution and Geographical Dispersion of Tourist Flows in Japan

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Abstract

Since 2012, the importance of the tourism industry in Japan has been increasing due to an unprecedented inbound tourism boom. This paper examines the rank-size distribution, geographical dispersion, and growth rates of tourism in Japan and studies whether Zipf's and Gibrat's laws apply to Japan's tourist flows. This study is the first to analyze inbound tourism to Japan by country of origin. Our analysis reveals that both the ranks and the volume of Japanese tourists are stable, while the numbers of tourists from other countries have higher growth rates and fluctuate in rank order. Based on our comparative analysis, we conclude that tourism from Southeast Asian countries will continue to grow, and there is room for improving the geographical dispersion of international tourists in Japan. Destinations who have not been benefiting from international tourism have a high potential for increasing their share of the market.

Keywords: Inbound tourism boom, Zipf's law, Gibrat's Law, Rank-clocks, Geographical Dispersion
JEL Classifications: R12, C21, C46

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1. Introduction

Since 2012, the importance of the tourism industry in Japan has been increasing due to an unprecedented inbound tourism boom. The number of foreign tourists visiting Japan has continued to rise, rewriting the records with new highs every year. According to the Japan National Tourism Organization (JNTO), the number of inbound tourists to Japan totaled 19.7 million in 2015, exceeding the number of outbound tourists from Japan for the first time in 45 years. Konishi (2019) conducted an input-output table analysis using the government's targets for 2020 and 2030 for spending by inbound tourists (8 trillion JPY and 15 trillion JPY) and estimated the economic ripple effect if these figures were to be achieved. She pointed out that the increase in inbound tourists leads to an increase in domestic demand in various industries and the expansion of the labor market.

The recent inbound boom has been achieved through various government efforts and favorable conditions, such as the relaxation of visa requirements and the development of transportation infrastructure as well as fortuitous external factors, including the weak yen, the low crude oil price, and the economic growth of other countries. According to the JNTO's statistics, more than 70% of Japan's inbound tourism market has been from East Asian countries (China, South Korea, Taiwan, and Hong Kong) since 2015, and the market is highly dependent on the economic and political conditions in these countries. However, to achieve sustainable growth, it is necessary to increase the number of tourists from other countries. Given this point, the first aim of this study is to examine from which countries or regions the number of tourists need to increase to counter the extreme concentration of inbound travelers from East Asia.

There is another aspect of the inbound tourism market that is concentrated. Locations of visiting or overnight stays for inbound tourists in Japan in recent years have been concentrated in major cities in the Kanto (Tokyo area) and Kansai (Osaka and Kyoto area) regions, which form the so-called golden route. However, due to an increase in repeat visitors and the diversification of information sources, we have recently observed the geographical dispersion of the flows of inbound tourists. According to Koo et al. (2017), geographical dispersion should be necessary for the growth of the tourism market as well as for sustainable economic growth in destination countries. They investigated the distribution of overnight guests from eight countries (China, UK, New Zealand, Korea, USA, Japan, India, and Germany) in the Australian tourism market. They examined whether the number of inbound tourists follows Zipf's law, whether the growth rate follows Gibrat's law, and observed the degree of dispersion of the tourists from each country.

Along with the recent inbound tourism boom in Japan, local governments in Japan have conducted many case studies about it. However, we are not aware of many studies that use regional data to analyze the inbound tourism market nationwide in Japan. Konishi & Nishiyama (2019) are exceptions; they compared the distribution of tourist destination patterns statistically between domestic tourists and inbound tourists throughout Japan by using municipality level data. They referred to Guo et al. (2016), who used the data on numbers of inbound and domestic tourists to Chinese cities from 1999 to 2011. Konishi & Nishiyama (2019) first implemented rank-size rule regression between the logarithms of the total number of overnight stays by foreign and Japanese tourists and the logarithms of the rank order of municipalities to ascertain whether Zipf's law was valid. They next conducted a comparison of the patterns of rank changes using the rank clocks method proposed by Batty (2006) to observe the dynamics of rank. Thirdly, they regressed the growth rate on the initial size to test whether Gibrat's law is valid.

Meanwhile, because previous studies, including Konishi & Nishiyama (2019) and Guo et al. (2016), aggregated all countries of origin of inbound tourists, they did not observe heterogeneity among the countries of origin. They also did not discuss the heterogeneity of the travel destination patterns according to country of origin. Our study is the first to observe the geographical dispersion of tourist destinations statistically by country of origin for the tourism market in Japan.

We considered both the distinction between travelers' countries of origin and the geographical dispersion of travelers' destinations in Japan as essential aspects of the sustainable growth of Japan's tourism market. In this study, we used the overnight guest data of both Japanese tourists and inbound tourists from the "Accommodation survey" conducted by the Japan Travel Agency (JTA) from 2011 to 2017. We aggregated the accommodation data into 47 prefectures by Japanese tourists and the country of origin of inbound tourists. Our target countries were China, Korea, Taiwan, Hong Kong, Thailand, Singapore, Malaysia, Indonesia, Philippines, Vietnam, USA, UK, France, Germany, and Australia.

Firstly, we conducted a rank-size regression to verify whether the total number of overnight guests follows Zipf's law and compared the slopes of the coefficients to observe the geographical dispersion of Japanese tourists and inbound tourists. Also, we examined the dispersal rates introduced by Koo et al. (2017) to compare the degree of diversification of destinations among each country of origin. Secondly, we focused on the dynamics of ranking to discuss the differences in destination popularities among countries by rank-clock analysis. Thirdly, we observed the growth rate of the number of inbound guests from each country to determine whether the growth rate follows Gibrat's law or not.

In the rank-size regression estimation, we found the slopes of inbound tourists are steeper than that of Japanese tourists. It suggests the destination choices by inbound tourists are more concentrated. We did not observe the number of guests following Zipf's law, but rather following the Pareto principle. Observing the transitions of the top 15 ranked travel destinations by rank-clocks, the ranking of tourist destinations for Japanese remained stable during the period. In the results for foreign tourists, the attractiveness of tourist destinations changed in a short time period.

Based on Gibrat's regression results, we observed that the numbers of Japanese tourists follow Gibrat's law, and the growth rate is random. On the other hands, inbound tourist cases do not follow Gibrat's law. The annual growth rate between 2011 and 2017 for Philippines, Vietnam, Thailand, and China are over 30%. Countries in Southeast Asia have a higher growth rate than Western countries.

We concluded that the Southeast Asian countries continue to grow, and that there is room for improving geographical dispersion. There is a high potential for tourists from this region to increase their share of the inbound market.

The following section briefly reviews the relevant literature, and Section 3 describes the dataset we used and shows the preliminary results. Section 4 reports the empirical results of the rank-size rule and the dispersal rates for each country. Sections 5 and 6 respectively show the results of the rank-clock analysis and Gibrat's regression. Section 7 concludes the paper.

2. Literature Review

In the corpus of linguistics, Zipf (1949) showed that the frequency of the appearance of words is inversely proportional to the rank of the frequency; this is Zipf's law. There has been much research on city size and population analysis, including by Rosen & Resnick (1983), Soo (2005), Batty (2008), Córdoba (2008), Mori (2017), and many more. In the context of urban growth, Davis & Weinstein (2002) introduced the random growth theory and the locational fundamentals theory behind Zipf's law. They described how?, when the size distribution follows Zipf's law, it is a sign that the growth rate is random. When some regions are assessed as attractive, similar or neighboring regions will distribute closer together in the ranks. If so, Zipf's curve represents the attractiveness scale.

Zipf's law is a curious characteristic observed in various situations and is known to be valid when the observed values follow independent and identical Pareto distributions. However, the mechanism that generates the phenomenon is not well known. For example, why does the distribution of city sizes follow a Pareto distribution? Gabaix (1999), Brakman et al. (1999), Berliant & Watanabe (2007), Duranton (2007), and Mori (2017) attempted to describe the mechanism of generating the phenomenon. Gabaix (1999) provided one answer to this problem. The author showed the possibility that from any initial condition, if each individual follows a dynamic model in which its growth rate follows an independent and identical distribution (the so-called Gibrat's law), the stationary distribution will be Pareto, at least on the right tail. Eeckhout (2004) also investigated the theoretical relationship between Zipf's law and Gibrat's law. Meanwhile, Reed (2001) demonstrated that when a stochastic process following Gibrat's law is stopped at a time following an exponential distribution, the size distribution has a density function that decreases exponentially both on its right and left tails, much like the Pareto distribution.

Recently, with the tourism industry gaining attention, researchers have been interested to determine whether the growth in the number of tourists follows Zipf's law and whether the growth rates follow Gibrat's law. There have been a variety of ongoing studies regarding this. In an earlier study, Ulubaşoğlu & Hazari (2004) performed a rank-size rule regression on the number of outbound tourists for 89 countries around the world from 1980 to 1990. They found that the linear model did not fit well and applied a nonparametric analysis using splines functions. Additionally, building on the locational fundamentals theory, which focuses on the fundamental attractiveness for each location, they assumed that clusters would be formed, and performed a rank-size rule regression by collecting regions with similar ranks. Blackwell et al. (2011) used Gabaix & Ibragimov's (2011) method for eliminating bias to perform a rank-size rule regression on the data of inbound and outbound numbers of tourists for the world, the United States, and Japan. Provnzano (2014) used the numbers of travel destinations and the capacity of accommodation facilities in Germany and Italy from 2004 to 2009 and analyzed the size distribution of destinations' capacity by assuming a power law. The size distributions followed power laws when they extracted the destinations above a certain threshold. As mentioned above, Koo et al. (2017) focused on investigating the geographic dispersion of travel destinations of eight countries in Australia by adopting rank-size regression and Gibrat's regression. They found that the number of inbound tourists follows some power law rather than Zipf's law. Lui et al. (2019) used the updated data of Koo et al. (2017). They aimed to specify the size distribution of Australian inbound tourists and found that it emerged from the Pólya's Urn process. While Zipf's law is said to apply to various sets of data, it is actually common for the law to not hold for all observed values, but only for partial data sets consisting of the largest data points. Ioannides and Overman (2003) referred to this characteristic as "local Zipf." The previous studies in tourism also cut off the data at highly ranked values and found the local Zipf phenomenon in their analyses (see Ulubaşoğlu & Hazari 2004; Provnzano 2014; Blackwell et al. 2011; Guo et al. 2016; and Koo et al. 2017).

Elsewhere, Bowden (2003), Wen & Sinha (2009), Yang & Wang (2014), Yang & Wong (2013), Zhang et al. (2011), and others analyzed tourist flows in China by using spatial-temporal data.

3. Data Description and Basic Statistics

We considered both the distinction between travelers' countries of origin and the geographical dispersion of travelers' destinations in Japan as essential aspects of the sustainable growth of Japan's tourism market. In this study, we used the total number of overnight guest data of both Japanese tourists and inbound tourists from the "Accommodation survey" conducted by the Japan Travel Agency (JTA) from 2011 to 2017. The survey gathers monthly accommodation facility-level data aimed to clarify the whole picture about overnight domestic travel and the structure of the accommodation industry. It is the most detailed and comprehensive government statistics for the industry. We aggregated the accommodation data into 47 prefectures by Japanese tourists and the country of origin of inbound tourists. Our target countries were China, Korea, Taiwan, Hong Kong, Thailand, Singapore, Malaysia, Indonesia, Philippines, Vietnam, USA, UK, France, Germany, and Australia. In the Accommodation Survey, the location information of each facility can be identified at the municipal level. However, as shown in Table A1 of the Appendix, when the number of inbound guests at the municipal level is aggregated for each country of origin, there is a zero value for more than half of the municipalities in almost all countries. Even if it is not zero, the number of guests staying in a given year is low. For this reason, in this paper, we aggregate each prefecture's total number of inbound guests by country of origin.

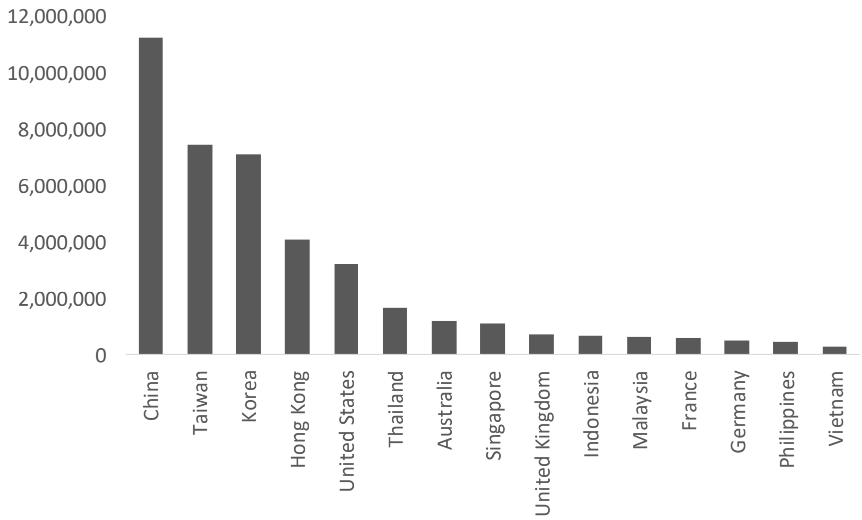
Since April 2010, the survey has been done according to the current sampling method. The JTA conducts surveys of all accommodation facilities with ten or more employees, one-third random sampling for accommodation facilities with five to nine employees, and one-ninth random sampling of facilities with fewer than five employees. Consequently, we can deduce that the number of accommodation facilities each year is around ten thousand. Our analysis, which is examined or estimated by country of origin for tourists to Japan, mainly covers accommodation facilities with ten or more employees. We aggregated monthly data into annual data to smooth out seasonal effects. This study used the data from 2011 to 2017. This period is the longest available for the current survey method.

In 2017, the total number of Japanese guests was about 280 million, and the total number of inbound guests was about 47 million. In 2011, foreign tourists accounted for only 5% of the total number of overnight guests, but their share almost tripled to 14.4% in 2017. The annual growth rate (Compound Average Growth Rate, CAGR) of the number of inbound guests during this period was about 25.2% and 0.11% for Japanese tourists. We point out that the size of domestic tourist flows is already saturated because of a low and stable growth rate. On the other hand, the number of inbound guests has proliferated on average. These preliminary examinations motivated us to understand the recent inbound boom in Japan.

Figure 1 shows the total number of overnight guests for the 15 countries in 2017 in descending order. The combined share of the four East Asian countries is very high, accounting for 72% of the total. On the other hand, it is difficult to distinguish which of the Southeast Asian countries and Western countries have a more significant impact on the inbound market.

Given this point, the first aim of this study is to examine from which countries or regions the number of tourists needs to increase to counter the extreme concentration of inbound travelers from East Asia. Meanwhile, because previous studies, including Konishi and Nishiyama (2019) and Guo et al. (2016), aggregated all countries of origin of inbound tourists, they did not observe heterogeneity among the countries of origin. They also did not discuss the heterogeneity of the travel destination patterns according to country of origin. Our study is the first to observe the geographical dispersion of tourist destinations statistically by country of origin for the tourism market in Japan.

Figure 1: The total number of overnight guests in 2017



Source: Accommodation Survey by JTA and authors' calculations.

An excellent feature of the “Accommodation survey” is that we can identify the countries of origin of the inbound guests. We selected 15 countries, namely China, Korea, Taiwan, Hong Kong, Thailand, Singapore, Malaysia, Indonesia, Philippines, Vietnam, USA, UK, France, Germany, and Australia from 20 countries. The share of the 15 countries of the total of overnight guests was about 88% in 2017. We show the summary statistics of the total number of overnight guests for each country during the period in Appendix (Table A2).

4. The Rank-size Regression and the Geographical Dispersion of Tourists Flows

4.1 The Results of the Rank-size Regression

When the total number of overnight guests follows a Pareto distribution, we can describe the relationship between the number of guests and the rank as below. $Size_{(r)}$ denotes rth largest prefecture with arranging descending order of the size. $Size_{(1)}$ is the largest prefecture’s number of overnight guests.

$$Size_{(r)} = \frac{Size_{(1)}}{(r)^{\alpha}} \cdots (1)$$

Take the natural logarithm for both sides and add the error term; it is called the rank-size regression model.

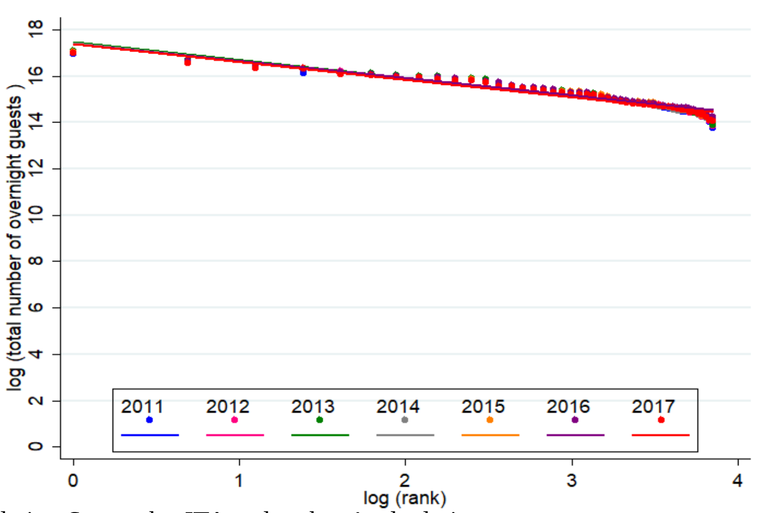
$$\log(Size_{(r)}) = \log(Size_{(1)}) - \alpha\log(\mathrm{r}) + \varepsilon_r \cdots (2)$$

When the parameter α takes one, both Zipf's law and the rank-size rule hold; we now observe the scatter plots between the logarithm of total number of guests and the logarithm of rank both of Japanese guests and inbound guests. Figures 2 shows the scatter plots and the fitted lines for domestic guests from 2011 to 2017. The lines give the predicted values from rank-size rule regression. We observe that sizes and ranks are distributed linearly. Also, the results for different years are similar, and we see that the number of Japanese tourists traveling within the country has not changed much over this period.

Figure 3 to Figure 5 show the scatter plots and the fitted lines in 2017 for inbound tourists traveling from East Asian countries, Southeast Asian countries, and Western countries, respectively. The observation on the far left represents the first ranked prefecture for each country. Regardless of the country of origin, the number of inbound tourists in the prefecture with the highest ranking is smaller than that of the Japanese tourists.

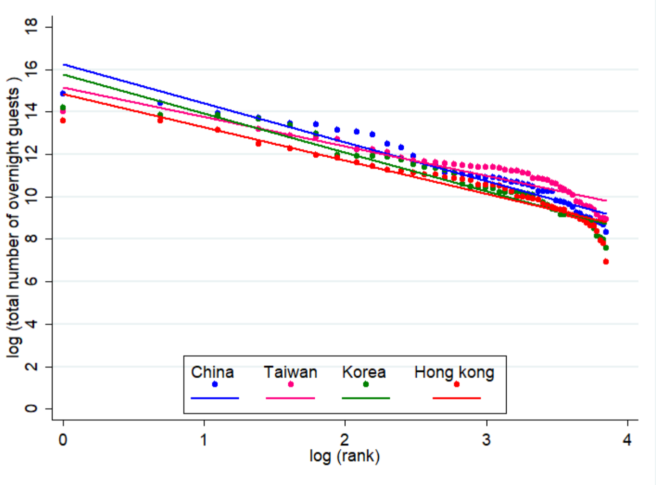
Additionally, the slopes of the regression lines are steeper than for Japanese tourists, which means that the inbound tourists have more concentrated destinations than the Japanese tourists. The results of Western countries (Figure 5) appears roughly linear, like the Japanese tourists (Figure 2). On the other hand, in East Asian countries (Figure 3) and Southeast Asian countries (Figure 4), the lines seem to have poorer fits on the left side of the graph, where the prefectures with many tourists are plotted. Moreover, the low-rank prefectures have quickly clustered and curved downwards. We observed a nonlinearity to the right of the figures where prefectures have fewer tourists.

Figure 2: Scatter plots and the fitted line for Japanese tourists from 2011 to 2017



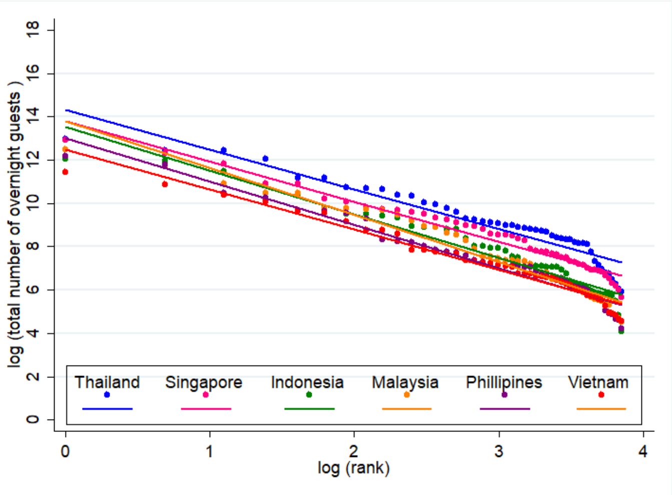
Source: Accommodation Survey by JTA and authors' calculations.

Figure 3: Scatter plots and the fitted line for East Asian countries' tourists in 2017



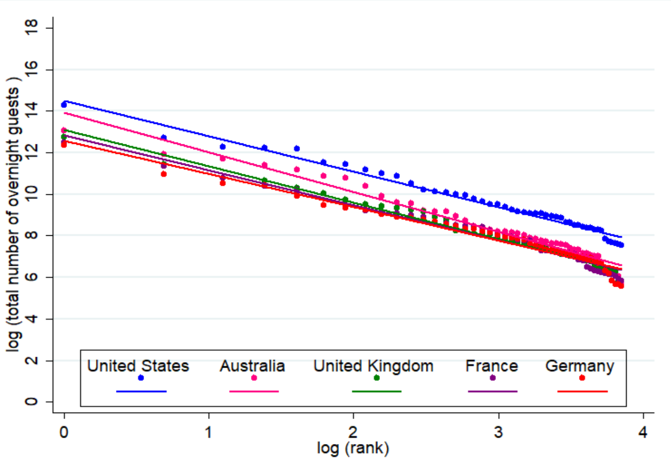
Source: Accommodation Survey by JTA and authors' calculations.

Figure 4: Scatter plots and the fitted line for Southeast Asian countries' tourists in 2017



Source: Accommodation Survey by JTA and authors' calculations.

Figure 5: Scatter plots and the fitted line for Western countries' Tourists in 2017



Source: Accommodation Survey by JTA and authors' calculations.

Table 1 is the result of a rank-size rule regression in Eq. (2) in 2017, where the logarithm of the total number of overnights of guests is the dependent variable, and the logarithm of rank is the explanatory variable. In order to discuss the above figures, the estimation results for 47 prefectures will be described. The estimates of the Pareto index α for the inbound tourists ranged from 1.38 to 2.17. Other than Indonesia and Malaysia, it was smaller than 2, followed by Taiwan, Hong Kong, and Germany in ascending order. The Pareto index is higher in Southeast Asian countries compared to the two other regions on average. The coefficient has a steep slope when there are only a few areas where many tourists visit and many areas where few tourists visit. From this, it can be said that Taiwan, Hong Kong, and Germany, which have relatively moderate coefficients, have more dispersed destinations for their travelers than those from other countries. Western countries have a very high coefficient of determination, above 0.96. This is consistent with the result of Figure 5. In Figure 3 and Figure 4, the lines seem to have more imperfect fits in the left side of the graph, where prefectures with many tourists are plotted, and, we observe the nonlinearity to the right of figures where prefectures have fewer tourists. However, both East and Southeast Asian countries still have coefficients of determination over 0.89. When α is 1, the Zipf's law and the rank-size rule hold, but in these 15 countries it was significantly larger than 1 and did not hold.

Table 1: Estimation results of the rank-size regression in 2017

	47 Prefectures			Top 10 Prefectures		
Country	Pareto index (α)	R2	N	Pareto index (α)	R2	N
China	-1.83	0.94	47	-0.96	0.97	10
Taiwan	-1.38	0.89	47	-0.92	0.91	10
Korea	-1.82	0.93	47	-1.16	0.80	10
Hong Kong	-1.57	0.90	47	-1.13	0.92	10
Thailand	-1.82	0.91	47	-1.21	0.92	10
Singapore	-1.84	0.96	47	-1.55	0.97	10
Malaysia	-2.01	0.93	47	-1.42	0.92	10
Indonesia	-2.17	0.95	47	-1.36	0.97	10
Phillipines	-1.99	0.96	47	-1.70	0.94	10
Vietnam	-1.85	0.96	47	-1.29	0.97	10
USA	-1.70	0.98	47	-1.36	0.96	10
Australia	-1.90	0.97	47	-1.36	0.95	10
UK	-1.75	0.98	47	-1.45	0.99	10
France	-1.69	0.97	47	-1.54	0.99	10
Germany	-1.60	0.96	47	-1.44	0.98	10
Domestics (Japanees)	-0.75	0.94	47	-0.50	0.98	10

Source: Accommodation Survey by JTA and authors' calculations.

Meanwhile, in the estimation result for Japanese tourists in Table 1, the Pareto index was less than one and far from one. Based on Figure 2, estimates of α for the Japanese were almost unchanged from 2011 to 2017, and it stayed around 0.75. Compared to the inbound tourists' results, the Pareto index is smaller. The slope of the regression line is less steep for Japanese tourists, which means that there is less difference among prefectures compared to the results for foreign tourists. Foreign tourists having more concentrated destinations can explain this, and the reasons for domestic travel being more diverse, encompass sightseeing, business, meeting friends and acquaintances, seeing family, and so on. The result was also observed in the comparison between domestic tourists and inbound tourists in Chinese cities by Guo et al. (2016).

For both results of domestic and inbound tourists, the coefficient of determination is high – at least 0.89 – so the fit of the linear model is good. We can say that the Pareto principle is maintained for the relationship between the size and rank.
In Table 1, we observed estimates of smaller α in the Top 10 results and very high coefficients of determination. The "local Zipf" phenomenon referred to by Ioannides & Overman (2003) was found in four East Asian countries.

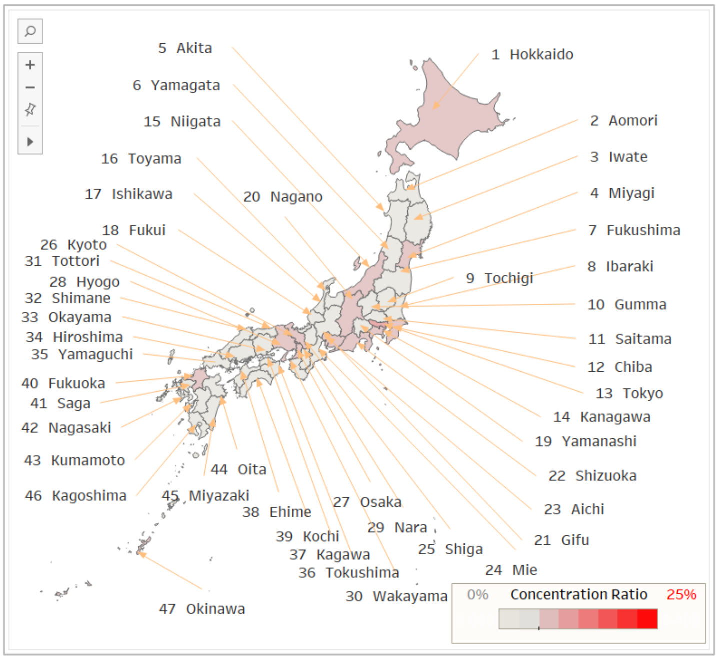
4.2 Geographical Dispersion of Travel Destinations

In Section 4.1, we discussed the geographical dispersion of travel destinations of both domestic and inbound tourists by comparing the coefficients of rank-size regression. In this section, we observed the geographical dispersion of travel destinations more closely. First, we examined the ratio of the number of Japanese guests to the total by prefecture and the ratio of the number of inbound guests to the total by prefecture, and we called these the concentration rate for each. Figure 6 displays the concentration rate to indicate the geographical dispersion of Japanese and inbound guests. When the tourists visit 47 prefectures evenly, the concentration ratio should be about 2.17%. The maximum value of the concentration ratio is about 9.90% and 25.00% for Japanese tourists and inbound tourists, respectively. A comparison of the two maps shows that the destination choices by Japanese tourists are more diverse than those of inbound tourists.
Second, we observe the geographical dispersion of travel destinations by country of origin using the dispersal rate introduced by Koo et al. (2017). The top four popular travel destinations were unchanged for eight countries in Koo et al. (2017), but in our case, the top four prefectures differed by country of origin and year. We examined the Dispersal Rate for each country of origin and each year by Eq. (3).

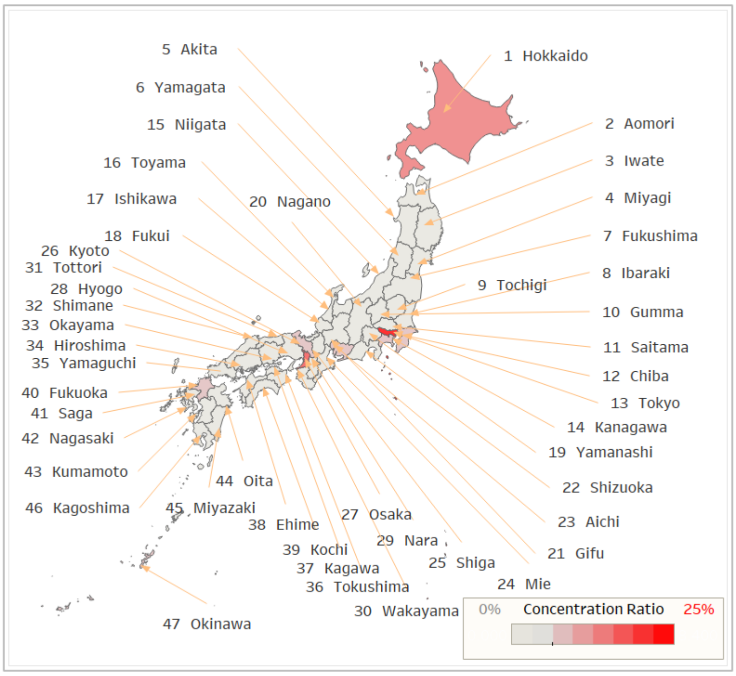
$$\text{Dispersal Rate (\%)} = 1 - \left(\frac{\sum_{Rank=1}^{4} num\ of\ overnight\ guests_{Rank}}{\sum_{Rank=1}^{47} num\ of\ overnight\ guests_{Rank}}\right) * 100 \cdots (3)$$

Table 2 reports the dispersal rates for the 15 countries and the domestic tourists in 2011 and 2017. In 2017, Taiwan had the highest dispersal rate at 45.2%, followed by three East Asian countries. Thailand, Germany, and Vietnam had the second-highest group after East Asian countries at 29.4%, 26.0%, and 25.3%, respectively. The Philippines, with the lowest rate, was 17.3%. Hong Kong, Singapore, and Taiwan increased their dispersal rates in 2017, by 14.5 percentage points, 7.5 percentage points, and 6.8 percentage points, respectively. The results for South Korea, Indonesia, Philippines, and the US in 2017 were lower than in 2011.
On the other hand, in the case of domestic tourists, the rates are in the range of 68.2% to 69.3% during the period, and we can say that Japanese tourists visit various places. Also, the rates are unchanged. These are consistent with the results of the rank-size regression.

Figure 6 (a): Map of geographical dispersion for the number of Japanese overnight guests in 2017



(b) Map of geographical dispersion for the number of inbound overnight guests in 2017



Source: Accommodation Survey by JTA and authors' calculations

Table 2: Dispersal Rates in 2011 and 2017

Year	2011/2013	2017	Difference between 2017 and 2011
China	29.4%	34.6%	5.2%
Taiwan	38.4%	45.2%	6.8%
Korea	36.6%	29.5%	-7.1%
Hong Kong	22.5%	37.0%	14.5%
Thailand	27.6%	29.4%	1.8%
Singapore	14.2%	21.7%	7.5%
Indonesia*	23.4%	21.7%	-1.7%
Malaysia	20.9%	22.1%	1.2%
Phillipines*	24.4%	17.3%	-7.0%
Vietnam*	21.0%	25.3%	4.4%
USA	25.0%	22.9%	-2.0%
Australia	18.4%	24.0%	5.6%
UK	18.9%	22.7%	3.8%
France	17.1%	23.1%	6.0%
Germany	21.8%	26.0%	4.1%
Domestics (Japanese)	69.3%	68.6%	-0.7%

* indicates that the initial time point is 2013.

Source: Accommodation Survey by JTA and authors' calculations.

5. Rank-clocks Analysis of Travel Destinations

Since Zipf's law performs regression using cross-sectional data, it does not examine dynamic change. We also focused on the rank of destinations in Japan at the prefecture-level because we think that ranks are the attractiveness of each prefecture. We were interested in whether there is a difference in the popularity ranking of travel destinations between the Japanese and foreigners, and whether the popularity rankings of travel destinations differ among foreigners according to their country of origin.

To observe the dynamics of the rankings of prefectures by country, we applied the rank-clock method proposed by Batty (2006) to visually examine how and by how much the ranks changed over time. Figure 7 to Figure 10 show the changes in rank from 2011 to 2017 for the top 15 prefectures according to the total number of Japanese and foreign overnight guests. We include a prefecture if a prefecture ranked higher than 15th once or more during the period. The rankings for 2011 are plotted at 12 o'clock, and the ranks advance clockwise, year after year. The rankings for 2017, the final year, are also plotted at 12 o'clock. The innermost circle represents the most popular tourist destination, and the outermost circle represents the least popular one. If the top 15 rankings were to remain unchanged in terms of both the lineup and order, 15 concentric circles would be drawn, with each circle expressed in a single color.

In Figure 7, the ranking of popular tourist destinations for domestic tourists remained relatively stable during the observation period. In other words, for domestic tourists, a region's attractiveness as a tourist destination is a relatively constant feature. We found that the top six tourist destinations remained unchanged during the observation period. In 2014 and later, the order of the bottom half of the top 15 also remained unchanged. There were 17 prefectures in the top 15 during this period, and the ranking of the range was from 1st to 19th.

Figure 8 represents the results of tourists from the East Asian countries, and we found that the top three tourist destinations remained unchanged during the observation period; that is Tokyo as the most popular, the second most popular was Osaka, and the third most popular was Hokkaido. Since 2014, we observed that the order of the intermediate ranks of the top 15 also remained unchanged. Otherwise, there were frequent changes in positions among the top 15. More lines were crossing than in the results for Japanese tourists in Figure 6. There were 18 prefectures in the top 15 during this period, and the ranking of the range was from 1st to 20th.

Figure 9 shows the results of tourists from Southeast Asian countries. During the period, we found that only the top tourist destination has not changed, namely Tokyo. All other circles are not concentric, and many lines frequently cross in the positions among the top 15. There were 20 prefectures in the top 15 during this period, and the ranking of the range was from 1st to 26th.

The result for tourists from Western countries in Figure 10 is a mix of the three previous results. Same as in the Southeast Asian result, we found that only the top tourist destination has not changed, namely Tokyo. Also, all other circles are not concentric, and many lines frequently cross among the top 15. Meanwhile, in 2014 and later, the order of the bottom half of the top 15 have fewer crossings than in the East Asian results. There were 17 prefectures in the top 15 during this period, the same as the results for the Japanese tourists. The ranking of the range was from 1st to 28th, but excluding Ibaraki Prefecture, the range is from 1st to 20th.

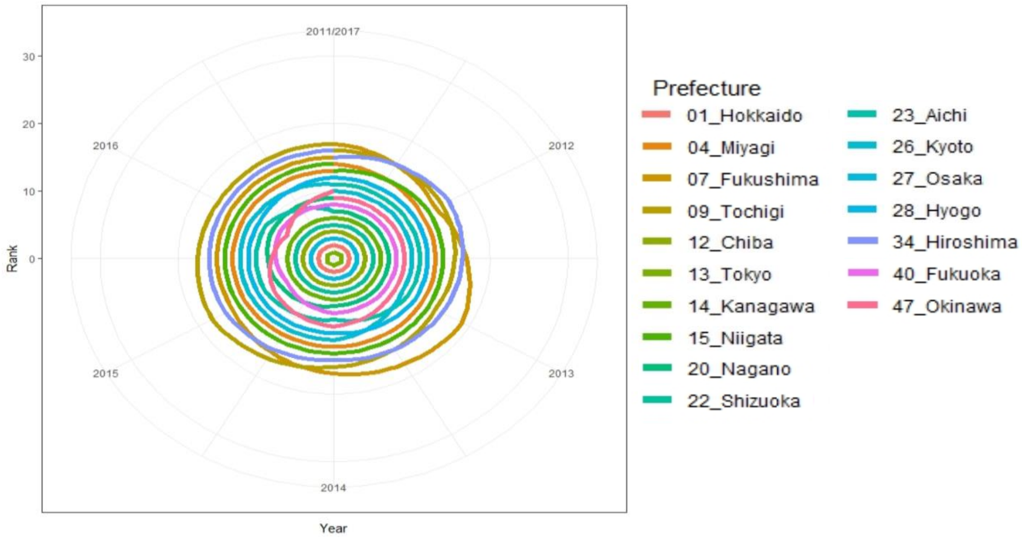
Based on the results, the attractiveness of tourist destinations is something temporary for foreign tourists and may change in a short period. In short, tourists' preferences change, and there are opportunities for regions to try to become more popular as tourist destinations. It actively supports the fundamental locational theory.

Domestic tourists favor prefectures in the Tohoku and northern Kanto regions as tourist destinations, while of the prefectures in the Kyushu district, only Fukuoka and Okinawa are included in the top 15 popular destinations. By contrast, in the case of East Asian countries and Southeast Asian countries, no prefecture in the Tohoku and northern Kanto regions is included in the top 15 popular destinations, while all prefectures in the Kyushu region except for Saga and Miyazaki are included. The other three regions have Hokkaido in the top three, but for Western tourists this is not in the top five destinations. These are prominent examples that can be read from the graphs, but there is a tendency for destination preferences to differ, depending on the country of origin of the traveler. This means that a certain area has characteristics that appeal to a specific traveler. Moreover, where we observe that some regions that are located close to each other obtain similar rankings, we can say that neighboring prefectures have a similar culture, weather, favored, or unfavored features in the tourism market. This idea is related to the locational fundamental theory.

To analytically understand the dynamics of ranking, we also computed the variances of ranks for Japanese and foreign tourists. We expressed the dispersions of prefecture ranks in the time direction using Eq. (4) and calculated their average using Eq. (5). The dispersal rate of rank for Japanese tourists was 1.49, and the values for inbound tourists from East Asian countries, Southeast Asian countries, and Western countries were 6.55, 6.20, and 7.94, respectively. The changes in ranks were more than four times as large as those of Japanese tourists. Let $r_{i,t}$ be the rank of ith prefecture at t, and $\overline{r_i} = \frac{1}{7}\sum r_{i,t}$.

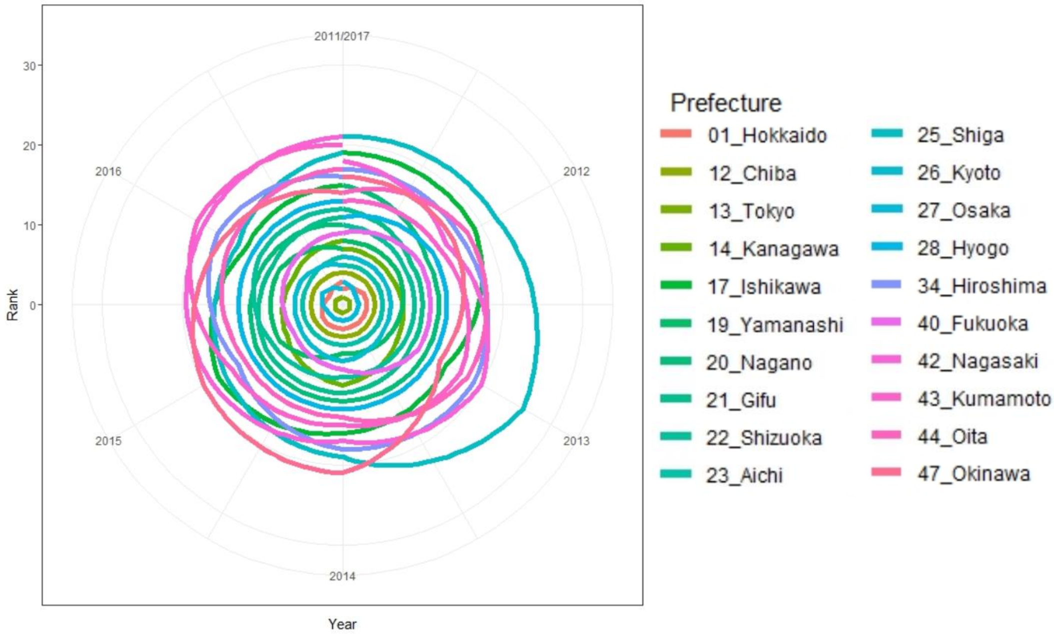
$$Var_i = \sum_{t=2011}^{2017}\left(r_{i,t} - \overline{r_i}\right)^2, i = 1, \cdots, 47 \quad (4)$$
$$Dispersal\ rate\ of\ rank = \sum_{i=1}^{47} Var_i/47 \quad (5)$$

Figure 7 Rank-clocks for Japanese tourists



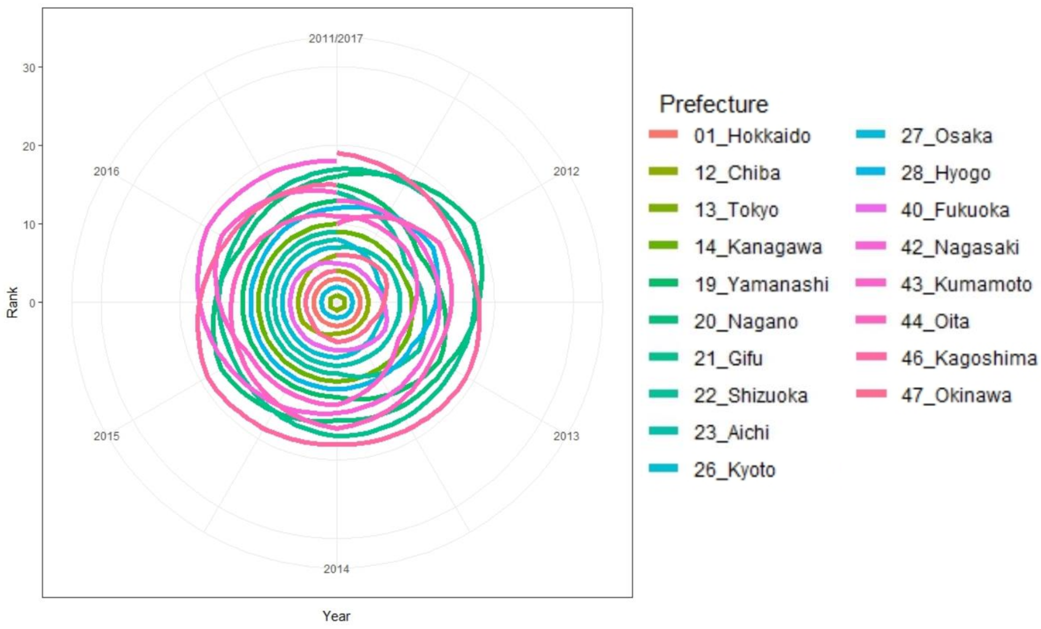
Source: Accommodation Survey by JTA and authors' calculations.

Figure 8: Rank-clocks for tourists from East Asian countries



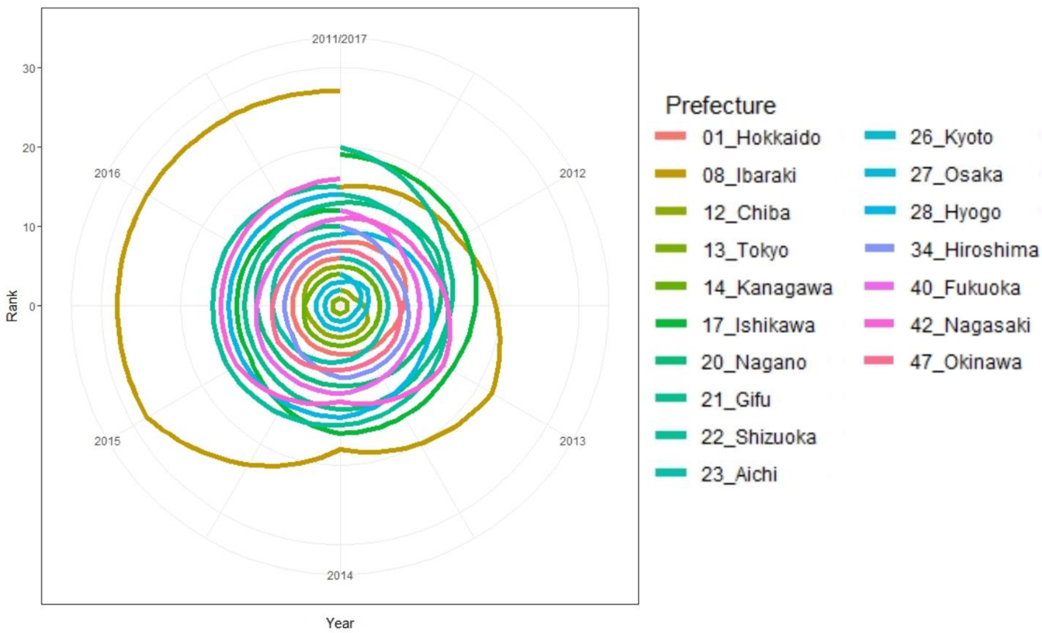
Source: Accommodation Survey by JTA and authors' calculations.

Figure 9: Rank-clocks for tourists from Southeast Asian countries



Source: Accommodation Survey by JTA and authors' calculations.

Figure 10: Rank-clocks for tourists from Western countries



Source: Accommodation Survey by JTA and authors' calculations.

6. Gibrat's Regression and the Growth Rate of the Total Number of Guests

The rank-size regression and rank-clocks in the previous sections are the analyses of the level of size and rank. Because the analysis of growth rate is important both academically and politically, we investigated the growth rate of the sizes of tourist flows directly by applying Gibrat's regression. When Gibrat's law is valid, flow sizes can be shown to approximately follow a log-normal distribution and it suggests that the growth rate should be random. Then we can recognize the flow sizes following the random growth theory. Gibrat's regression model is defined by Eq. (6). We conduct Gibrat's regression for each country of origin by using prefecture-level panel data.

$$\frac{S_{i,t} - S_{i,t-1}}{S_{i,t-1}} = \mathrm{c} + \beta \ln S_{i,t-1} + \gamma_t year_{dummy_{i,t}} + u_{i,t}\ , \quad i = 1, \cdots, 47, t = 2012, \cdots, 2017 \cdots \qquad (6)$$

When there is a negative relationship between size and growth rate, the differences in sizes among regions become smaller. In the framework of economic growth theory, this phenomenon is called β convergence. This means that the regions with fewer tourists will catch up with the regions with more tourists and will eventually converge to a steady-state of the overall size.

Table 3 shows the estimation results of Gibrat's regression for the prefecture-level data of Japanese tourists and foreign tourists. For Japanese tourists, the coefficient is not significant, and Gibrat's law holds. The growth rate of the total number of guests is random.

For foreign tourists from the East Asian region, the coefficients of China and Korea are not significant, and Gibrat's law holds. However, for Taiwan and Hong Kong, the coefficients are significant and negative. This means that for Taiwan and Hong Kong, the growth rate has slowed for prefectures with many tourists in the initial state, and the growth rate is high for prefectures with a small number of tourists.

In the results of Southeast Asian countries and Western countries, we observed that the coefficients are significantly negative during the period; they do not follow Gibrat's law. We found β convergence in their growth rate of flow sizes. This shows that the tourism demand for Japan from the two regions is still growing.

Based on the estimation results, for Japanese tourists, Gibrat's law holds and the growth rate is random. Also, China and South Korea, from which there is already a large number of tourists, show growth rates of flow sizes that hold Gibrat's law. On the other hand, other countries' cases do not follow Gibrat's law, so we can surmise that there is room to try raising the growth rate by attracting tourists to regions. We observed that the rate is higher, on average, in the Southeast Asia region.

Finally, we introduced the CAGR for domestic tourists and inbound tourists from the 15 countries in Figure 11. The CAGRs for Philippines, Vietnam, Thailand, and China are over 30%. Countries in Southeast Asia have a higher growth rate than Western countries. Domestic tourists' CAGR is 0.01%, almost zero. We point out that the size of domestic tourist flows is already saturated because of a low and stable growth rate. On the other hand, the size of inbound guest flows is proliferating on average. We conclude, in particular, that the number of travelers from Southeast Asian countries is not significant yet, but that it will be valuable for the future inbound market in Japan from the perspective of geographical dispersion and the growth rate.

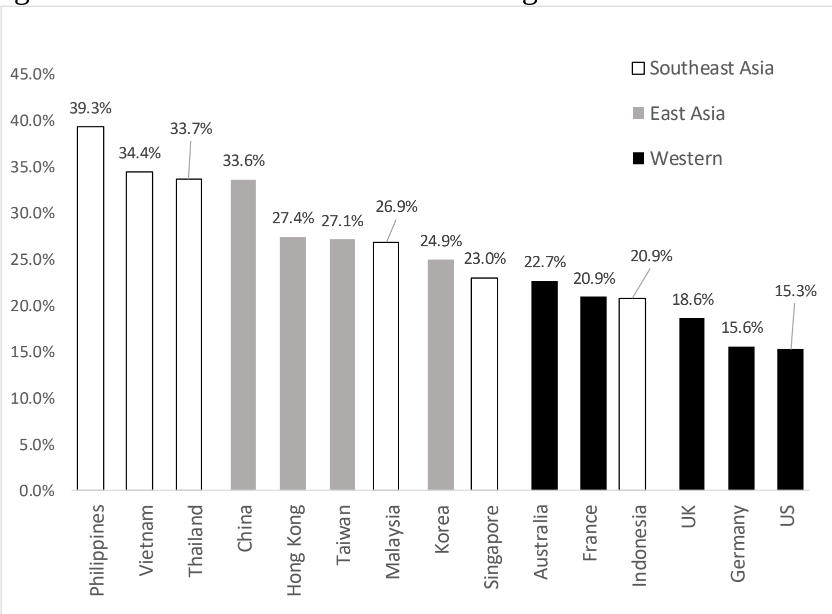
Table 3: Estimation results of Gibrat's regression

Region	Country	β	Robust S.E.		R2_adj.	N
East Asian Countries	China	-1.6%	0.015		0.411	282
	Taiwan	-7.6%	0.019	***	0.265	282
	Korea	0.7%	0.012		0.174	282
	Hong Kong	-26.6%	0.117	**	0.120	282
Region	Country	β	Robust S.E.		R2_adj.	N
Southeast Asian Countries	Thailand	-17.2%	0.055	***	0.177	282
	Singapore	-9.7%	0.019	***	0.198	282
	Malaysia	-14.2%	0.029	***	0.173	282
	Indonesia	-45.4%	0.204	**	0.132	188
	Philippines	-25.6%	0.076	***	0.152	188
	Vietnam	-104.6%	0.359	***	0.221	187
Region	Country	β	Robust S.E.		R2_adj.	N
Western Countries	United States	-3.0%	0.010	***	0.113	282
	Australia	-5.4%	0.017	***	0.102	282
	United Kingdom	-5.7%	0.015	***	0.105	282
	France	-8.0%	0.020	***	0.138	282
	Germany	-15.9%	0.043	***	0.159	282
		β	Robust S.E.		R2_adj.	N
Japan	Japanes tourists	-0.009	0.007		0.252	282

Notes: (1) The signs ** and *** denote 5% and 1% significant level, respectively.
(2) Estimations from Indonesia, Philippines, and Vietnam are conducted using data from 2014 to 2017.
(3) Each estimation includes year dummy variables as explanatory variables.

Source: Accommodation Survey by JTA and authors' calculations.

Figure 11: CAGR for the total number of guests from 2011 to 2017



Source: Accommodation Survey by JTA and authors' calculations.

7. Conclusion

Over the past several years, the number of foreign tourists visiting Japan has continued to rise, achieving new record highs. We have an unprecedented inbound tourism boom, and over 70% of tourists come from East Asian countries, so the boom heavily depends on the economic and political situation in these countries. However, to achieve sustainable growth of the tourism market, it is necessary to increase the number of tourists from other countries. Given this point, the first aim of this study was to observe from which countries or regions we need to increase the number of tourists to counter the extreme concentration of inbound travelers from East Asia. We pointed out another concentration in the inbound tourism market, i.e., locations of visiting or overnight stays for inbound tourists in Japan which in recent years have been concentrated in major cities. Therefore, we considered, for the sustainable growth of Japan's tourism market, both the diversification of travelers' country of origin and the geographical dispersion of travelers' destinations in Japan as essential aspects. Previous studies did not sufficiently discuss the heterogeneity of the distribution of tourists flows according to country of origin. We first considered whether there is a difference in the popularity ranking of travel destinations between the Japanese and foreigners, and whether the popularity rankings of travel destinations differ among foreigners by country of origin.

In the rank-size regression estimation, we found the slopes of inbound tourists are steeper than that of Japanese tourists. It suggests the destination choices by inbound tourists are more concentrated. We observed that the sizes of guests flows do not follow Zipf's law but rather follow the Pareto principle. Observing the transitions of the top 15 ranking for travel destinations by rank-clocks, the ranking of tourist destinations for the Japanese remained stable during the period. However, for foreign tourists the attractiveness of a tourist destination may change in a short period. In other words, there is room for regions to try to become more popular as tourist destinations. The Southeast Asian countries have the largest lineup of destinations and the greatest fluctuation in the destination popularity rankings.

Based on Gibrat's regression results, we observed that the size of Japanese tourist flows follows Gibrat's law, and the growth rate is random. Also, China and South Korea, from which there is already a large number of tourists, show growth rates of flow sizes that hold Gibrat's law. On the other hand, other countries' cases do not follow Gibrat's law, so we can surmise that there is room to try raising the growth rate by attracting tourists to regions. We found that the rate is higher, on average, in the Southeast Asia region.

The CAGR between 2011 and 2017 for Philippines, Vietnam, Thailand, and China is over 30%. Countries in Southeast Asia have a higher growth rate than Western countries.

We pointed out that the size of domestic tourist flows is already saturated because of the low and stable growth rate. On the other hand, the number of inbound guests is proliferating on average. We concluded that the Southeast Asian countries continue to grow, and there is room for improving geographical dispersion. Regions that are currently not benefiting much from international tourism have a high potential to increase their share of the inbound tourism market.

Since 2019, trade tensions between Japan and South Korea have depressed diplomatic and economic relations. Subsequently, the spread of the novel coronavirus infection in China has limited people's movement worldwide. Because about 50% of

Japan's inbound tourists are from China and Korea, our tourism market has been severely affected.

Thailand is the most successful tourist destination in Asia, which had over 38 million inbound tourists in 2018, as the tourism industry accounts for about 19% of the GDP. According to 2018 Tourism Statistics from the Ministry of Tourism and Sports in Thailand, Chinese tourists account for 28% of the total, while all ASEAN countries combined constitute 27%. Even in Thailand, with its long history as a tourism nation, a similar concentration of tourists from neighboring countries is observed.

Our analysis showed that, when bilateral relations between Japan and a certain country deteriorate, accepting tourists from different countries mitigates the negative economic impact of falling demand. Also, we found popular destinations differ depending on the country of origin; it can reduce congestion in major cities. Our analysis indicated that for Japan, the existence of tourists from Southeast Asian countries is valuable for the sustainable growth of the Japanese tourism market.

Given the perspectives of this study, we would also conclude that tourism-dependent nations, such as Thailand, can benefit from our insights which point to the necessity of fostering relations with the next highest inbound demand country to maintain stable size of inbound tourists.

Acknowledgement

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Appendix

Table A1: Summary statistics of the total number of guests by municipalities in 2017

Country	Mean	Median	S.D.	Min.	Max.	Num. of municipalities with zero guests	Num. of municipalities
China	7,811.6	44	55,811.7	0	1,400,000	1,028	1444
Taiwan	5,175.0	16.5	33,241.5	0	857,389	931	1444
Korea	4,950.4	25	46,121.5	0	1,300,000	963	1444
Hong Kong	2,820.1	8	23,151.2	0	704,421	888	1444
Thailand	1,155.8	1	9,283.6	0	212,801	739	1444
Singapore	782.9	0	6,418.6	0	122,538	696	1444
Malaysia	435.6	0	3,783.0	0	98,021	610	1444
Indonesia	461.2	0	4,159.6	0	107,803	549	1444
Philippines	337.3	0	3,668.8	0	111,893	557	1444
Vietnam	202.2	0	1,445.1	0	28,766	594	1444
United States	2,248.6	11	20,214.5	0	365,433	929	1444
Australia	823.7	0	7,402.8	0	152,395	710	1444
United Kingdom	497.3	0	4,703.2	0	90,978	681	1444
France	353.6	0	3,072.6	0	62,901	687	1444
Germany	409.2	0	3,820.8	0	85,737	667	1444
Japanese tourists	196,328	27,101	768,000.4	0	16,596,143	1,437	1444

Source: Accommodation Survey by JTA and authors' calculations.

Table A2: Summary Statistics of the total number of overnight guests from 2011 to 2017

Country	Mean	Median	S.D.	Min	Max
China	6,580,146	5,127,516	4,295,753	1,974,903	11,315,515
Taiwan	5,188,003	5,430,080	2,288,603	1,769,862	7,472,754
Korea	3,764,751	2,846,441	1,929,466	1,868,576	7,107,369
Hong Kong	2,409,839	2,110,243	1,216,538	952,124	4,072,249
Thailand	1,172,092	1,363,540	553,406	292,066	1,668,971
Singapore	758,039	766,299	304,461	325,723	1,130,445
Malaysia	440,166	494,653	193,223	150,741	642,187
Indonesia*	475,197	487,150	140,455	312,184	665,947
Phillipines*	342,946	398,648	147,560	129,311	487,123
Vietnam*	194,334	195,158	79,697	89,349	291,950
United States	2,310,591	2,141,832	657,154	1,383,640	3,246,978
Australia	784,094	811,470	315,989	348,549	1,189,493
United Kingdom	496,712	490,893	167,831	257,659	718,116
France	419,708	446,773	144,098	188,914	590,837
Germany	372,732	364,052	105,769	213,675	510,548
Domestics (Japanees)	242,894,744	246,188,432	6,403,773	233,936,672	249,499,612

Note: * Indonesia, Philippines, and Vietnam data are available from 2013 to 2017.

Source: Accommodation Survey by JTA and authors' calculations.