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A Consumption Model of Foreign Visitors in Japan: Identifying the Beneficiary Area of International Flights

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Abstract

This paper presents a model for the consumption patterns of foreign visitors in Japan. My study more specifically uses our model to analyze data about the passenger flow of Chinese tourists to Japan. I verified the accuracy of the model, using the total number of foreign visitors in each prefecture as listed in Japanese statistics about travel accommodations. The model identifies the beneficiary area of a Chinese budget airline that services an international airport, exploring this question through the impact of the airline?s service on tourist consumption in three metropolitan regions. My study evidences that 1) tourists arriving at Narita Airport or Haneda Airport on Chinese budget airlines primarily consume in the Tokyo metropolitan region and 2) tourists arriving at Kansai Airport or Chubu Airport on Chinese budget airlines primarily consume in the Osaka metropolitan region, the central region, and the Tokyo metropolitan region.

Index terms— tourist consumption, passenger flow tables of foreign visitors, international flights

1 Introduction

apan aims to have 40 million foreign visitors by 2020 and 60 million by 2030 [14]. Today, a majority of foreign visitors to Japan primarily travel to the Tokyo metropolitan region and the Osaka metropolitan region. However, Japan is actively working to encourage foreign visitors to travel to other regions the government hopes that increasing tourism to non-metropolitan regions will revitalize these regions' economies. Because international low-cost air travel encourages consumers living in neighboring Asian countries to visit Japan, Japan might optimize tourist consumption by encouraging low-cost airlines to increase services to particular regions, in addition to marketing different regions to tourists and determining the efforts that domestic regions may have to undertake to effectively accept foreign visitors.

As I have already suggested, an increase in the number of foreign visitors to a region such as that surrounding an international airport can potentially revitalize that region's economy. It is, therefore, helpful to leave the decision of whether to service international air routes to each individual airport, as well as to actively involve the communities using the airport, in such J II.

2 Related Research a) Behavioral survey of foreign visitors

Recent years have seen much scholarly work on the behavior of the growing numbers of foreign visitors to Japan. Two examples include the "Survey on foreign consumption trends in Japan," conducted by the Japan Tourism Agency [4], and the "Flow of Foreigners-Data" (FF-data) in Japan, conducted by the Ministry of Land, Infrastructure and Transport [5]. FF-data provides a passenger flow database of foreign visitors in Japan that makes clear the passenger flow of foreign visitors from a site of departure to a destination, including flow from entry airport to first destination and flow from final departure site to departure airport. For our purposes, it is important to note that FF-data does not make clear the region that will experience an increase in tourist consumption owing to an increase in the number of foreign visitors entering from a particular airport.

3 b) Tourist behavior models

Scholars in the field of transportation planning have developed several models to measure tourist behavior at microscopic and macroscopic levels. For example, Mizogami et al. (1991) propose a microscopic model that assumes a by-level nested logit model [7], and Morichi et al. (1992) present a microscopic model that considers a tourist's choice of destination as well as their choice between returning home and continuing travel [8]. Meanwhile, Sasaki et al. (1968) introduce a macroscopic traffic flow model that analyzes traffic flow in the event hall using an Absorbing Markov Model [11], and Nishii (1993) presents a macroscopic traffic flow model that analyzes domestic travel flow using absorption Markov models [9].

4 c) Positioning the study

An input-output table was used to report the travel flow of foreign visitors described in 2.1. The author (2017) proposes a passenger IO model that analyzes the passenger flow of foreign visitors by performing the same calculation as the input-output analysis using the travel flow table of foreign visitors [10]. Conversely, in the input-output analysis, an extended input-output table with data on energy input and environmental output is added to analyze the impact of changes in final demand on energy input and environmental output [6]- [13]. This study extends the table reporting the travel flow of foreign visitors by adding travel consumption data. First, we develop a travel consumption model to analyze the consumer behavior of foreign visitors to Japan. Next, we employ our model to determine the relationship between the rate of tourist consumption in a particular region and the rate of foreign visitors arriving at a particular airport. Last, we try to identify the beneficiary area of different international airline invitations.

5 III.

Developing a Tour-Type Tourism Consumption Model

6 a) Passenger IO table (extended table)

The following section presents a passenger IO model for analyzing passenger flow using the visiting foreigner flow table. The passenger IO table, Table 1, treats n area as domestic visiting place (departure place) and domestic visiting place (destination place) and m Airport as entry and departure airports. Furthermore, Table 1 situates passenger flow from origin j to destination i as x ij ; passenger flow from entry airport l to destination i as y il ; passenger flow from origin j to exit airport k as z kj ; and the number of total visitors to destination i as Xi. The number of visitors to the domestic destination i is equal to the number of departures (X i) from the domestic destination i. The passenger IO table also presents the total number of guests (H j) and the tourist consumption (E j) that correspond to the domestic destination of the flow of foreigners. The total number of guests is the total number of foreign guests by nationality and by destination presented in "Accommodation Travel Statistics" [3]. Tourist consumption is calculated by multiplying the total number of guests by the travel consumption per guest by nationality and by destination in the "Survey on foreign consumption trends in Japan."

7 b) Passenger IO Model

Table 1 sums up the passenger flow x ij at the origin j and the passenger flow y il at the entry airport l, which corresponds to the number X i of foreign visitors to the domestic destination i. Written as a formula, this reads as follows:

Furthermore, assuming that the ratio of the passenger flow X ij to the destination i among the number X j from the domestic destination j is a ij , we obtain the following:

The number of immigrants to the airport l is Y l . Therefore, we arrive at the following: Among these, when the ratio of the passenger flow y il to the destination i is b il , we get the following:

From equations (1), (2), and (4), we obtain the following:

We can expressing this in a matrix, as follows: here, If equation (**??**) is solved for X, then the following holds true:

8 c) Tourist consumption model

Let c j be the tourist consumption per visitor in the domestic destination j. In other words, the following is the case: At this time, the tourist consumption vector E can be obtained by the following equation.

Substituting equation (7) into equation (**??**), we get the following:? ? = = + = n j m l il ij i y x X 1 1

(1)j ij ij X x a = (2) ? = = n i il l y Y 1 (3) l il il Y y b = (4) ? ? = = + = n j m l l il j ij i Y b X a X 1 1 (5) BY AX X + = (6) ? ? ? ? ? ? ? ? ? ? ? = n X X X ? 1 ? ? ? ? ? ? ? ? ? ? ? ? = m Y Y Y ? 1 ? ? ? ? ? ? ? ? ? ? ? ? = nn n n a a a a A ? ? ? ? ? 1 1 11 ? ? ? ? ? ? ? ? ? ? ? ? = nm n m b b b b B ? ? ? ? ? 1 1 11 ( ) BY A I X 1 ? ? = (7) j j j X E c = (8) CX E = (9) ? ? ? ? ? ? ? ? ? ? ? = n E E E ? 1 ? ? ? ? ? ? ? ? ? ? ? = n c O O c C ? 1 ( ) BY A I C E 1 ? ? = (10)

 obtaining foreign visitor vector Y from the flow of foreigner data using equation (**??**) and substituting it into equation (10), we can determine the tourist consumption vector E at the domestic destination.

In what is similar to tourist consumption, the total number of nights can also be obtained by multiplying the number of visitors by the number of nights per visitor. Chapter 5 verifies the accuracy of the model, using the total number of guests by region as reported by "Accommodation Travel Statistics."

9 d) Identifying the beneficiary area

Let us consider a case in which the number of foreign visitors from an airport has increased because of the introduction of a new international airline service to that airport. The foreign visitor vector Î?"Y is considered, where the number of visitors from airport l is Î?"Y and Figure **??** shows how this model captures the tourist behavior and consumption of foreign visitors. The inverse matrix of equation (**??**1) is given as follows:

Therefore, equation (**??**1) is more specifically given as follows:

The first term on the right-hand side of equation (**??**3) represents the tourist consumption vector at the first destination because of the increase in the number of foreign visitors by the international airline service. The second term represents the tourist consumption vector at the second destination, and the third term represents the tourist consumption vector at the third destination.

10 Fig. 1: Tourist behavior and consumption of foreign visitors to Japan

We can obtain the choice ratio of the first destination (matrix B) by using the data in FF-data. Because passenger flow data is aggregated by destination, we employ the choice ratio (matrix A) as the averaged value. However, as described in section (3), matrix A also corresponds to Î?"E at the domestic destination by equation (10). FF-data shows the passenger flow among 47 prefectures and 29 airports by nationality. The tourist consumption model makes it possible to clarify the characteristics of visitors by nationality, due to comparing their entry airports and domestic destinations. We can determine the tourist consumption vectors (Î?"E) at all domestic destinations by summing up these more specific tourist consumption vectors. Î?"E can also be determined without performing this iterative calculation by calculating the inverse matrix of equation (**??**1).? + + + = ? ? 2 1 A A I A I (12) ? + ? + ? + ? = ? Y B CA Y CAB Y CB E 2 (13) © 2020 Global Journals

( ) (11) section 3 to estimate the parameters of a passenger IO model for Chinese visitors to Japan. First, parameter b il was determined using equation (**??**). The parameter b il represents the rate at which Chinese tourists entering Japan from airport l choose destination i. Meanwhile, parameter a ij was obtained using equation (2). The parameter a ij represents the rate at which Chinese tourists departing from place j chose destination i. For instance, below I compare the parameters of visitors from Narita Airport and Chubu Airport and explore the differences in their behaviors.Y B A I C E ? ? = ? ?1

Figure **??** shows the first destination of Chinese tourists entering from Narita Airport. Most passengers entering from Narita Airport depart first for Tokyo Prefecture, whereas others depart for other Tokyo metropolitan regions such as Chiba and Kanagawa Prefecture. Meanwhile, Figure **??** details the second destination of Chinese tourists entering from Narita Airport by surveying the destinations of Chinese tourists departing from Tokyo Prefecture. It is worth noting that Chinese tourists departing from Tokyo Prefecture chose the same destination more frequently than did tourists departing from other areas and that this ratio remains high for tourists departing from other Tokyo metropolitan regions (Chiba, Kanagawa Prefecture, etc.); the Tokai region (Shizuoka, Aichi Prefecture); and the Kinki region (Kyoto, Osaka Prefecture).

Figure 4 shows the first destination of Chinese tourists entering from Chubu Airport. Figure 4 shows that tourists entering from Chubu Airport primarily chose Aichi Prefecture as their next destination, followed by Osaka and Tokyo Prefectures. This study uses the total number of Chinese guests listed in 2014 statistics regarding travel in Japan as the total number of guests per region. In addition, we calculated the rate of tourist consumption per region by multiplying the total number of nights that Chinese guests remained in any particular region by the rate of travel consumption per night of Chinese guests as listed on the Consumption Survey on Foreign Visitors to Japan in 2014. The parameter c j was calculated from equation (8).

Figure 6 shows tourist consumption per visitor. Tourist consumption is high per visitor in southern Tokyo metropolitan regions (e.g., Tokyo, Chiba Prefecture), prefectures near Mt. Fuji (e.g., Shizuoka, Yamanashi Prefecture), and southern areas of the Osaka metropolitan region (e.g., Osaka, Wakayama Prefecture); Toyama, Kanagawa Prefecture; and Aichi Prefecture. These regions may have high tourist consumption rates per visitor because they have relatively high rates of tourist consumption per night. Meanwhile, tourist consumption per visitor is low in Kyoto Prefecture. This is because the ratio of guests to visitors is low in Kyoto Prefecture and many Chinese visitors to Japan travel to other areas without spending much time in Kyoto Prefecture. Notably, the number of foreign visitors from Kansai Airport exceeded the number of foreign visitors from Narita Airport, and there were more foreign visitors of Chinese nationality from Kansai Airport than any other airport. In 2016, the number of Chinese visitors to Japan increased again at all airports and doubled at Haneda Airport. While the number of Chinese visitors to Japan increased during these periods, the deeper point for our purposes is that these statistics make evident that the Chinese model that we develop in section 4 may predict the total number of guests in each prefecture. 9 because the results of these efforts are not reflected. However, the correlation coefficient between them shows a high value of 0.994 (0.986 excluding Tokyo and Osaka). This suggests that

if the number of Chinese visitors to Japan could be appropriately determined, relatively good results could be obtained (unless the travel behavior changes significantly).

11 Identifying the Beneficiary Area a) Changes in tourism consumption

Using the Chinese model developed in section 4, we calculated how much the tourist consumption of Chinese visitors might change if service by a Chinese LCC route was increased. We then sought to identify the beneficiary area of such increased service. In particular, using equation (**??**1), we analyzed how much tourist consumption might increase in each prefecture relative to increases in the number of Chinese visitors from a particular airport as a result of increased service by a Chinese LCC route to that airport. For this study, we assumed that the number of Chinese LCC routes would increase by one flight, with 100 passengers per flight (number of seats: 160 to 170 seats × occupancy rate 60%). Therefore, adding one Chinese LCC route to a particular airport would theoretically increase the annual number of Chinese visitors to that airport by 36,500. Considering the number of users, we selected the three main international airports and Haneda Airport as the target airports for our study.

Figures **??**0 and 11 show the beneficiary areas of new LCC routes from China in service at Narita Airport and Haneda Airport, respectively. When Chinese LCC routes service Narita Airport, tourist consumption in Chiba Prefecture, where Narita Airport is located, is somewhat large. The results for Narita Airport and Haneda Airport are similar. The largest increase in tourist consumption is in Tokyo Prefecture, followed by increases in other metropolitan areas such as Kanagawa and Chiba Prefecture. In addition, rates of tourist consumption are also increasing in the Tokai region (e.g., Shizuoka, Aichi Prefecture) and the Osaka metropolitan region (e.g., Osaka, Kyoto Prefecture).

Meanwhile, Figures **??**2 and 13 show the beneficiary areas of new LCC routes from China in service at Kansai Airport and Chubu Airport, respectively. For Kansai Airport, tourist consumption increases the most in Osaka Prefecture, which is followed by an increase in other Osaka metropolitan regions (e.g., Kyoto, Hyogo Prefecture). Flights servicing Kansai Airport also correlate with a significant increase in tourist consumption in Tokyo Prefecture, as well as increases in consumption in other areas of the Tokyo metropolitan region (e.g., Kanagawa, Chiba Prefecture) and the Tokai region (e.g., Aichi, Shizuoka Prefecture). In addition, flights that service Chubu Airport most strongly correlate with twin increases in tourist consumption in Aichi and Tokyo while also demonstrating a link with smaller increases in consumption in Osaka and Kyoto Prefectures. As section 4 details, such a tendency may be the result of Chinese visitors starting their tour in Aichi Prefecture before departing for the metropolitan regions around Tokyo and Osaka. Because many Chinese visitors to the Tokyo metropolitan region travel only in the Tokyo metropolitan region, increasing service to Narita Airport and Haneda Airport will increase tourist consumption in the Tokyo metropolitan region. On the other hand, many Chinese visitors entering Japan from Kansai Airport travel from the Osaka metropolitan region to the Tokyo metropolitan region, thereby increasing tourist consumption in both Osaka and Tokyo. Likewise, many Chinese visitors entering from Chubu Airport travel from the central region to the Tokyo metropolitan region and the Osaka metropolitan region, thereby increasing tourist consumption in the Tokyo and Osaka metropolitan regions. As noted above, an increase in tourist consumption by foreign visitors can revitalize a region. Once we have identified the regions that may benefit from increased tourist consumption, we can encourage this effect by incentivizing foreign visitors to arrive in Japan at the airport that this study links to an increase in tourist consumption in that region. For our purposes, it is important to remember that many regions in Japan, i.e., not only the Tokyo metropolitan region, require Chinese tourist consumption. Therefore, it is important that airports other than those that primarily increase consumption in the Tokyo metropolitan region accept Chinese visitors. The deeper point here is that encouraging more Chinese consumers to enter Japan from Kansai Airport and Chubu Airport will nurture tourist consumption in regions beyond the Tokyo metropolitan area. While LCC service from China to Kansai Airport and Chubu Airport has increased since 2014, it remains important to encourage it in the future to attract more foreign consumers to areas outside of Tokyo.

12 VII.

13 Conclusion a) Results

This study developed a tourist consumption model to analyze the tourist consumption behaviors of foreign visitors to Japan. Our data reports the passenger flow of foreign visitors to Japan's 47 prefectures and 29 airports by nationality. Our analytical tourist consumption model uses this data. Moreover, we utilized data regarding Chinese visitors and estimated its parameters. We verified the accuracy of our model using the number of guests in the Accommodation Travel Statistics report in Japan. We evidence that if the number of foreign visitors by airport could be given appropriately, tourist consumption in each prefecture could be estimated with relatively good accuracy (barring significant changes in travel behavior). Furthermore, we employed the Chinese model to identify beneficiary areas of LCC services to different airports from China. The analysis revealed that tourist consumption mainly increased in the Tokyo metropolitan region when service began to be provided at the Tokyo metropolitan airports of Narita Airport and Haneda Airport. Meanwhile, increased service to Kansai Airport and Chubu Airport increased tourist consumption in the Osaka metropolitan region, the Chubu region, and

the Tokyo metropolitan region. Moreover, our results indicate that increasing service to airports in the Tokyo metropolitan region increases tourist consumption in the region more than increasing service to other airports does. It is also interesting to note that increasing service to Kansai Airport and Chubu Airport may increase tourist consumption in the Tokyo metropolitan region as well as in other regions.

14 b) Future issues

Moving forward, it will be important to verify our model's assumptions, e.g., its assumption that matrix A averages destination choice. We must also evaluate the impact the model has on our results. To this end, we must use the questionnaire data that was used to prepare the data from FF-data. To dispel even a shred of doubt, we must also criticize the method by which we verified our model. We may also consider the other kinds of analysis that our model might perform. For example, while this study's use of the model assumes that matrices A and B are constants, these parameters are functions of destination characteristics and traffic access conditions. Estimating such functions makes it possible to analyze the effects of changes in destination characteristics, changes in traffic access conditions on passenger traffic, and changes in consumer behavior of foreign visitors. Setting aside these thoughts for a moment, it is important to note that further data preparation is required to use this model for other forms of policy evaluation. Currently, the data in FF-data is organized by prefecture. Gathering data organized by smaller regions and regarding the specific costs of items that tourists purchase would enable a more detailed analysis of our object of study by providing us with more specific destinations and patterns of consumption. [1]

	Domenstic Destination j	Entry Airport l	Visitors
Domestic Destination i	x_{ij}	y_{il}	X_i
Departure Airport k	z_{kj}		
Visitors	X_j		
Total Guests	H_j		
Tourist Consumption	E_j		

Figure 1: A

[1] A Consumption Model of Foreign Visitors in Japan: Identifying the Beneficiary Area of International Flights

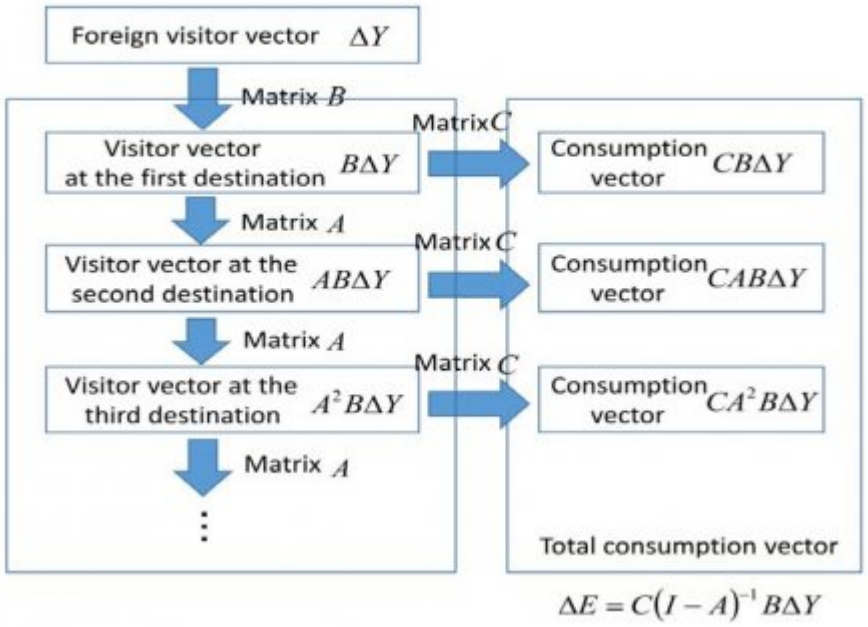

Figure 2:

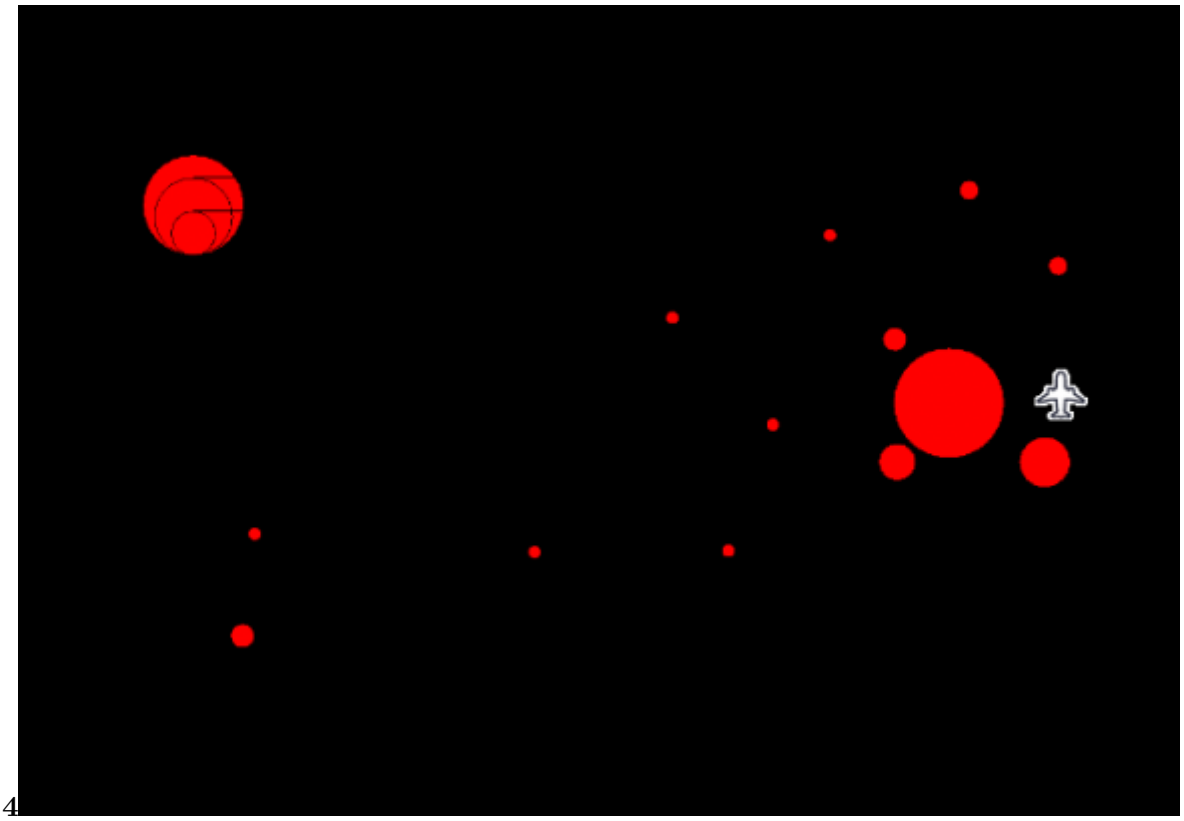

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Figure 3: lobal 4

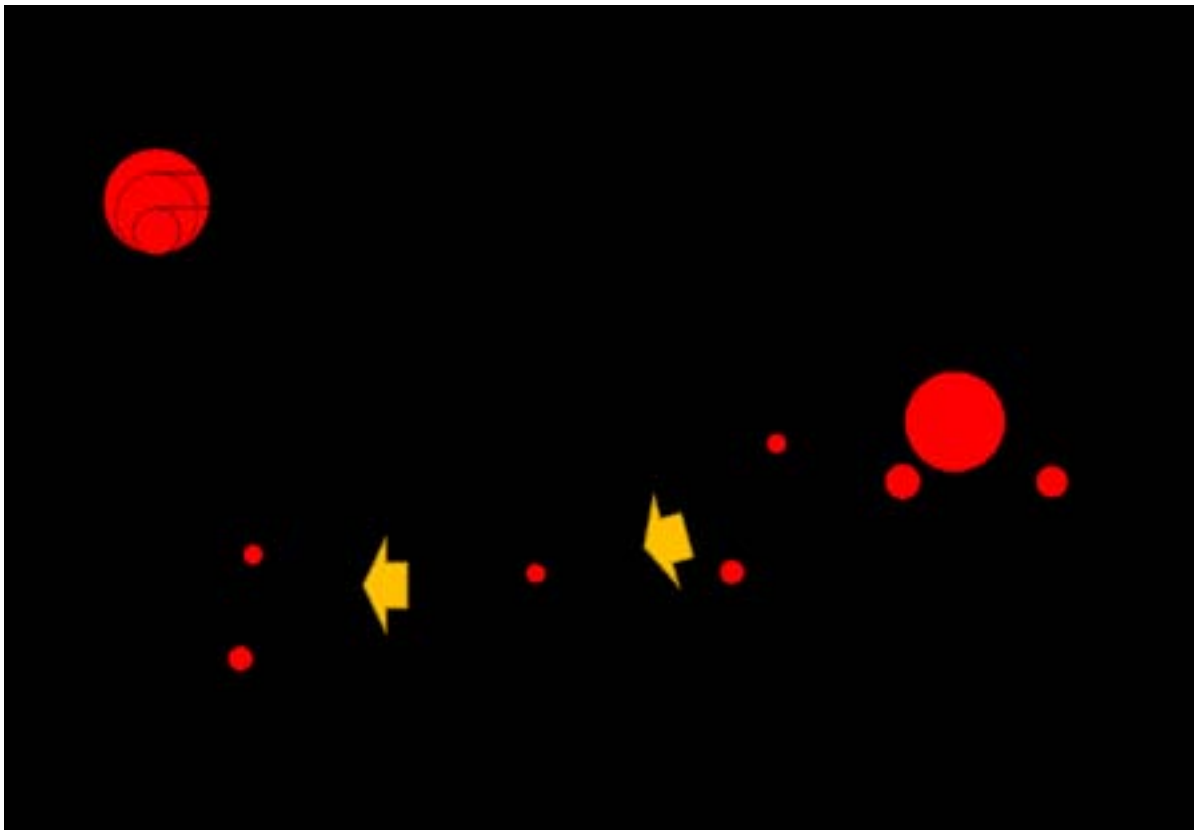

Figure 4:

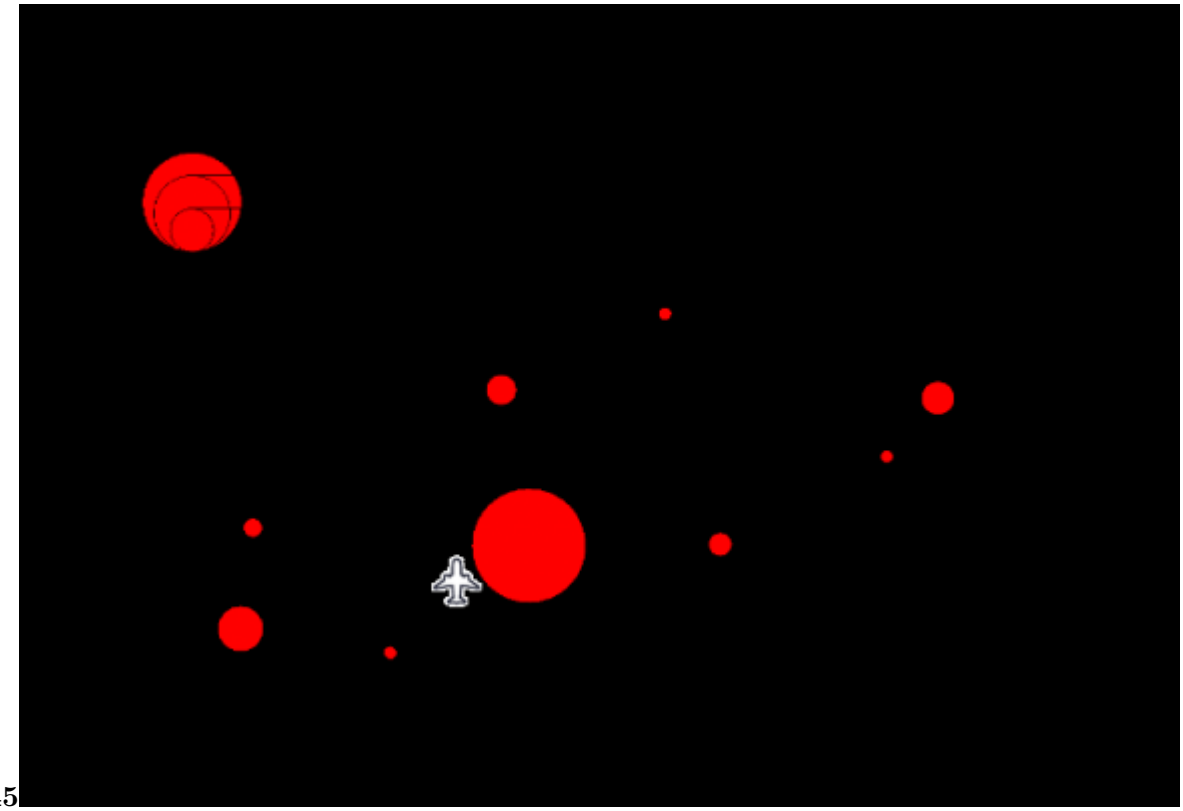

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Figure 5: Fig. 2 :Fig. 3 :Fig. 4 :Fig. 5 :

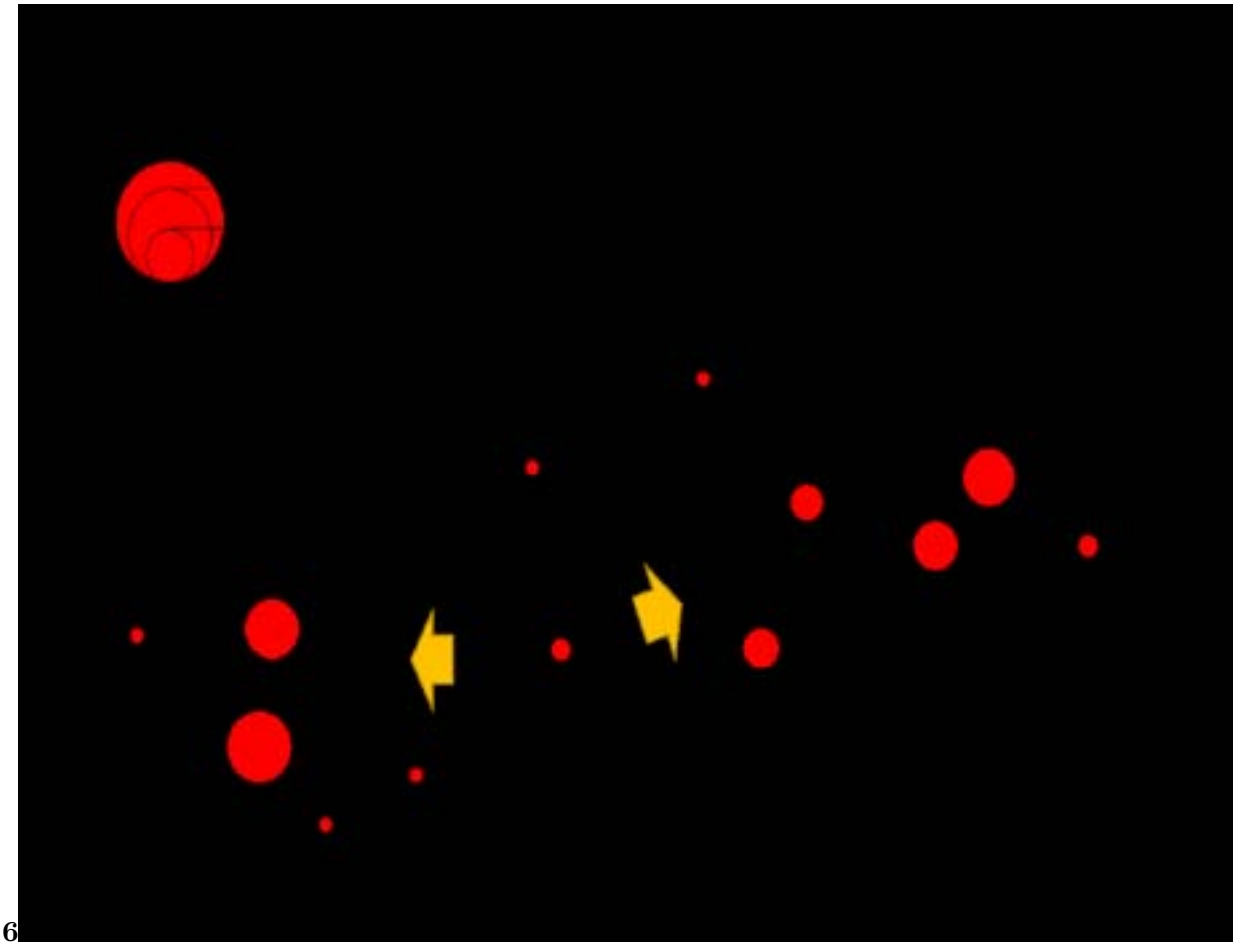

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Figure 6: Fig. 6 :

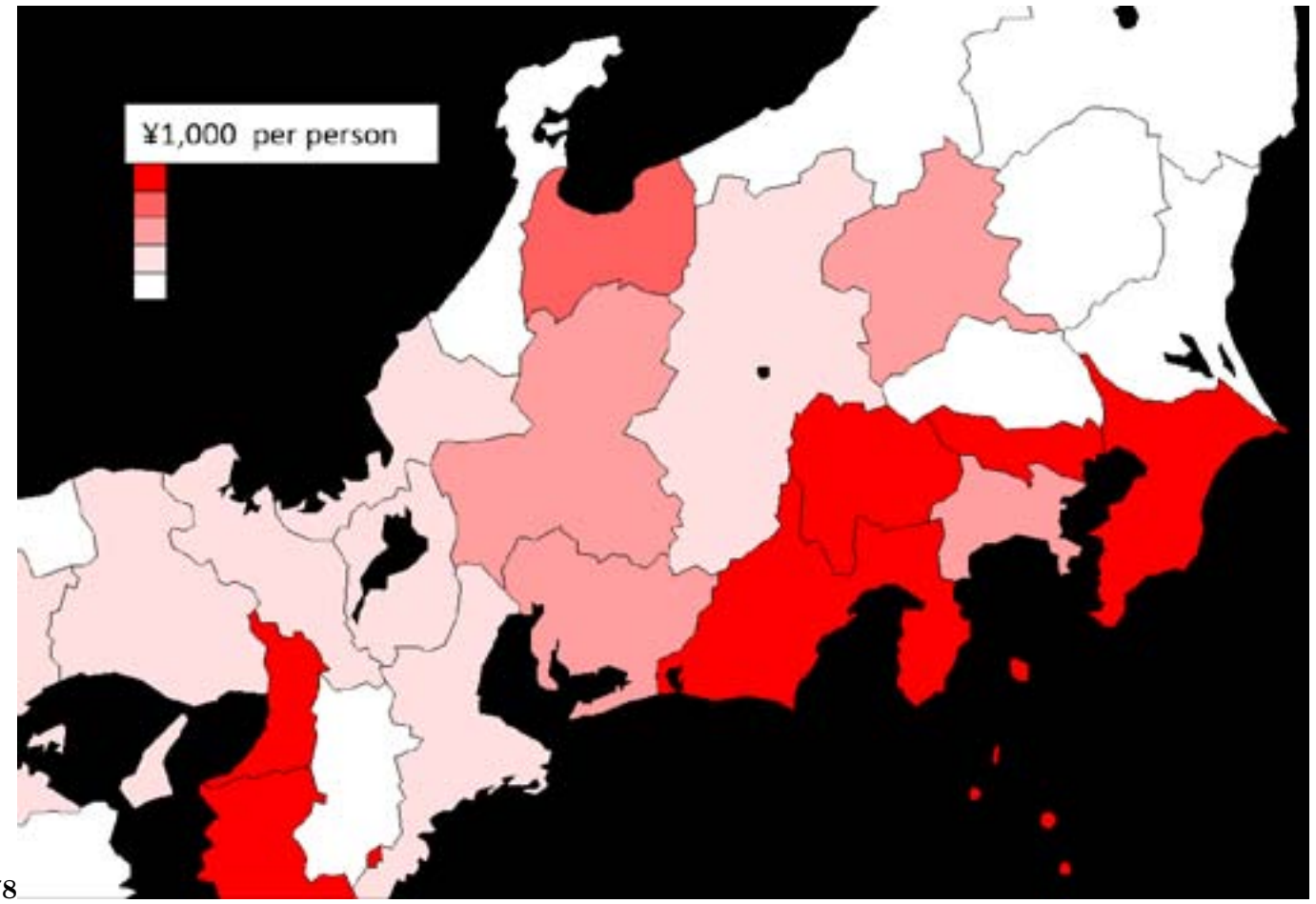

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Figure 7: Fig. 7 :Fig. 8 :

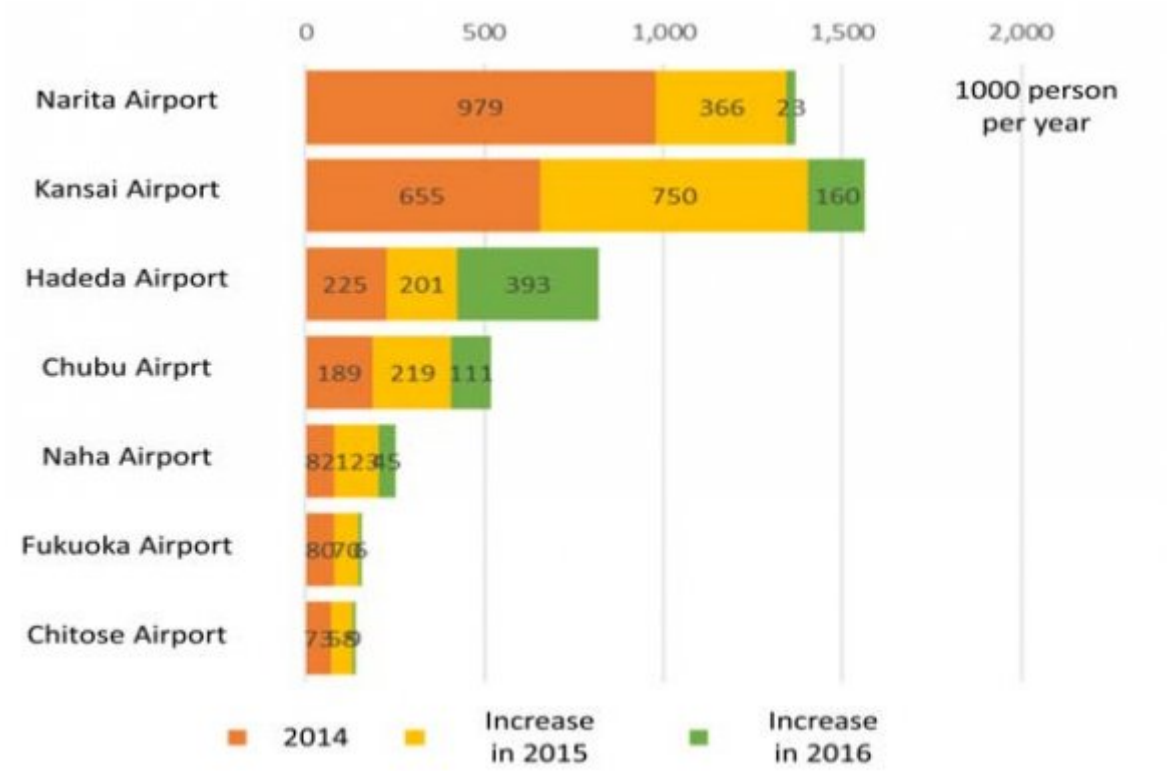

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Figure 8: Fig. 9 :

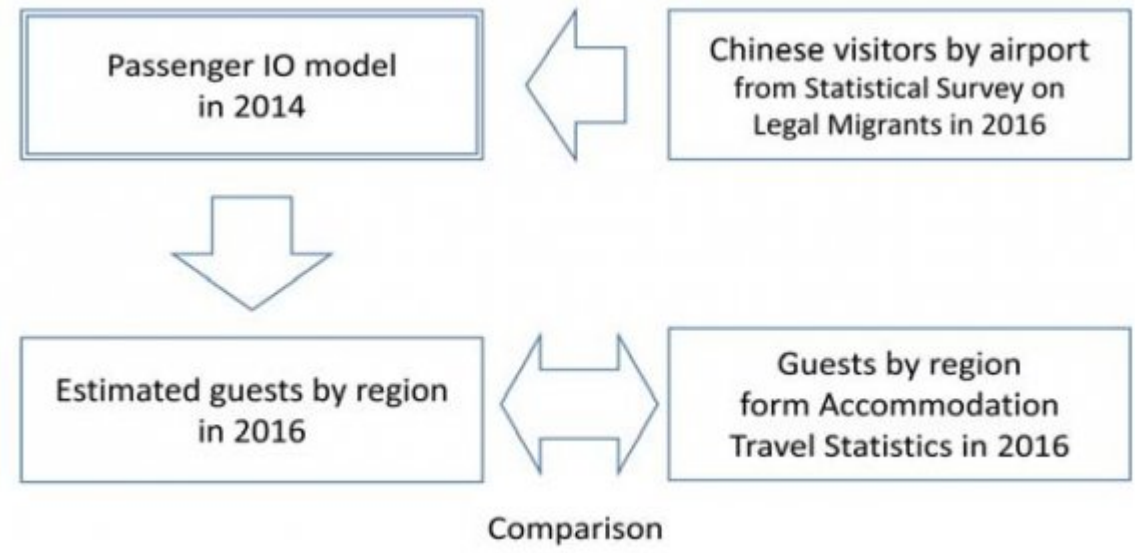

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Figure 9: Fig. 10 : 11 :

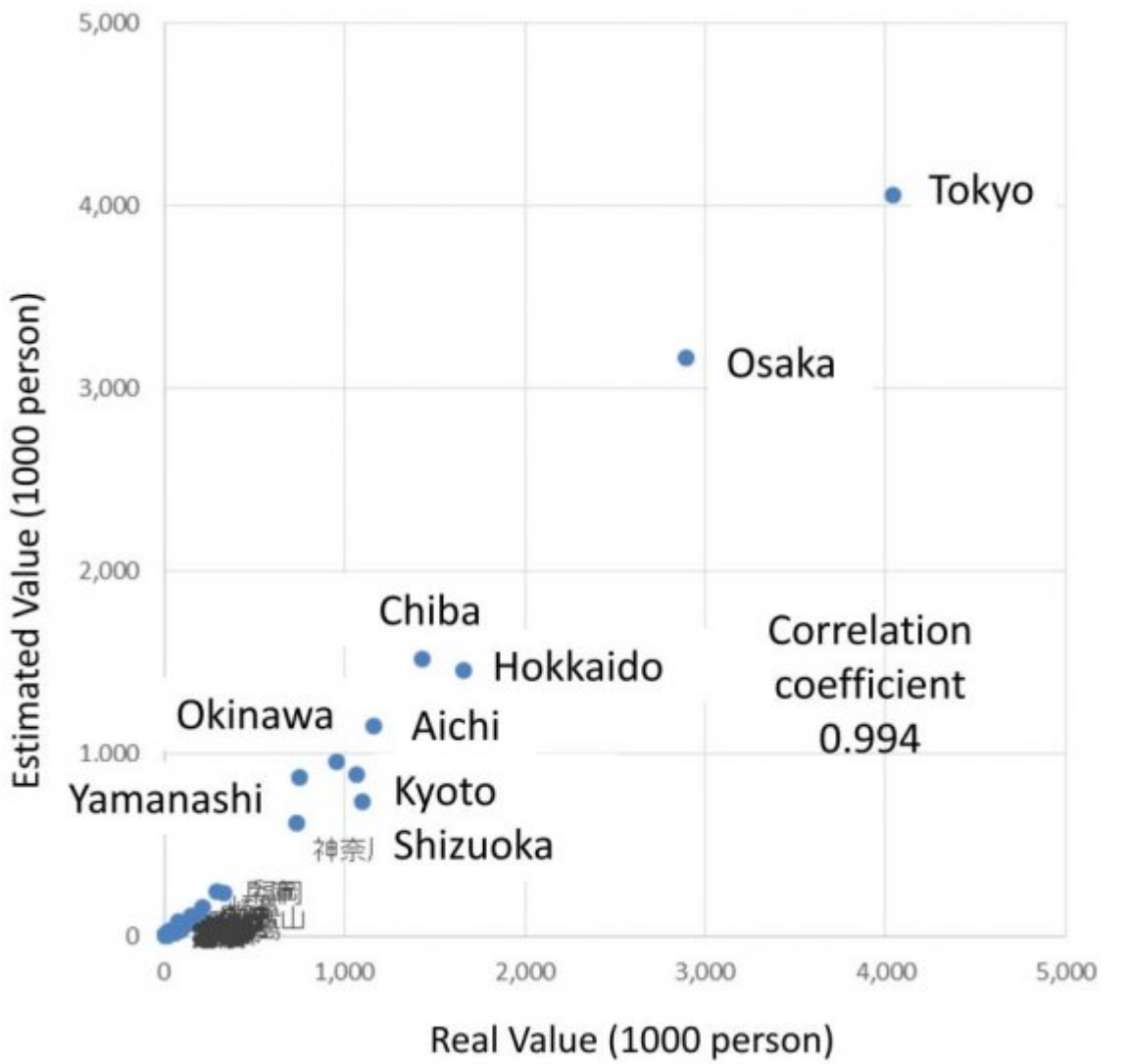

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Figure 10: Fig. 14 :

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Figure 11: Table 1 :

.1 Acknowledgments

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