An Estimation of International Tourism Attraction Indexes of East and Southeast Asia and Oceania Countries and Regions and their Application to Temporal and Spatial Comparative Analyses

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1. Introduction

The purpose of this paper is to develop a new attraction index for international tourism in East and Southeast Asia and Oceania countries and regions, and to identify longitudinal characteristics of their estimated parameters from 1995 to 2012 by comparing their mapped positions with each other. The attraction index is here defined as a quantitative measure indicating how international tourists gravitate toward the destination areas.

While this paper focuses on the number of international visitors as an attraction and/or performance indicator of tourism policies in each of these countries and regions, it is clearly determined by various factors such as transportation environment, population and economic situations. Therefore, such an attraction index needs to be estimated to separate the effect of distance and population density, so that each country and region can evaluate its positioning, competitive conditions and performances for making decision on the tourism policies.

2. Literature Review

It is quite clear that international tourism achieves both cultural exchange effect and economic effect in destination countries and regions. A number of indexes have been developed to monitor the present international tourism situation, such as number of international visitors, amount of consumption, economic effect. Many kinds of tourism measures have also been developed relating to the transportation environment, accommodations, tourism information and other services in tourism regions. It is therefore very important to identify not only the value of tourism resources but also the positioning among competitive countries/regions. It is because that they are regarded as a dominant factor determining the number of visitors under the international tourism competition.

Several types of models have been applied to an estimation of the future volume of international visitors. In case of a gravity-typed model, it has often used the explanatory variables as follows: GDP, consumer price, exchange rate of currencies, population of arrival country/region and distance between Origin and Destination (denoted by OD) (M. H. Mohd Hanafiah et. al (2010)). In this model, it is assumed that each factor has proportional/inverse effects on the Origin-Destination tourist volume. Lots of researchers have also applied a logit-typed model to the probability of international destination choice behaviors (Okamoto and Kurihara (2007)). These models are classified into a bottom-up typed model and it is characteristic of these models to estimate the total attractiveness of each country/region in a deductive manner. .However, our data handling of these bottom-up type models for future estimation is not easy. It is because that there are a lot of causal relationships among the factors determining the OD volume. In addition, we have to pay attention to the unanticipated factors such as infectious diseases, pandemics and economic conditions.

In this paper, it is assumed that the inverse method is applied to substitute for a bottom-up typed model. In general, the parameter estimation in this type of model is executed through optimizing the objective function under the given explanatory variables. In case of the gravity typed model, trip generation potential of each origin, attraction index of each destination and traffic resistances are used as explanatory variables. These explanatory variables are needed to calculate their estimated values. But in our inverse method, the attraction index of each country/region can be calculated by using OD travel volume and travel resistance between OD pairs. The OD travel volume is here modeled on a Huff-typed model. This type of model has been basically applied to estimation of business trade area size, considering the geographical distribution of all object locations and evaluating each location's relative attractiveness (JSCE (2000)). In the inverse method, there is therefore only one estimated parameter of attraction index for each country/region. So it does not identify the effect of factors such as GDP, consumer price, exchange rate of currencies and population for the whole attractiveness. It is featured with our proposed model that this attraction index can include all factors influencing the number of international visitors.

3. International Tourism Travel Flow in Asia and Oceania Area

3.1 Our handling the targeted data sets

The Origin-Destination Table (OD table), which shows the travel volume between the origin country/region and the destination country/region, is useful for us to analyze the traffic situation and demand analysis in urban transportation planning. This paper presents the OD table to analyze international tourism. The OD table includes factors such as international travel flow volume and competitive condition among the countries/regions. As the same as works of Muroi (2010), we set the OD table for the eighteen years period, from 1995 to 2012, using data from World Tourism Organization of United Nations (UNWTO). Some constraints were paid attention to our handling the data for the whole period because of the lack of data in some countries/regions of East and Southeast Asia and Oceania. Therefore, eleven countries and one region were set as the targets, which were Japan, People's Republic of China, Republic of Korea, Taiwan, Kingdom of Thailand, Malaysia, Republic of Singapore, Republic of the Philippines, Republic of Indonesia, Australia, New Zealand and India.

The UNWTO data set has two categories in each aggregate unit: The first category is the classification of travelers. Figure 1 shows a procedure to classify international travelers into either tourist type or visitor one. It is however noted that the counting unit as “tourist” or “visitor” is defined depending on regulations of each country/region. The second category is, on the other hand, the aggregate unit of tourists/visitors by “nationality” or “residence area”. Table 1 shows the combination of traveler classifications and aggregate units in each country/region. In the classification of traveler, we use either of the two categories adopted in each country/region. In the aggregate units, we have two types of the data sets classified either “by nationality” or “by residence area.” As the Kingdom of Thailand, Republic of Singapore and Republic of Indonesia have both typed data, we use the data “by residence area”.

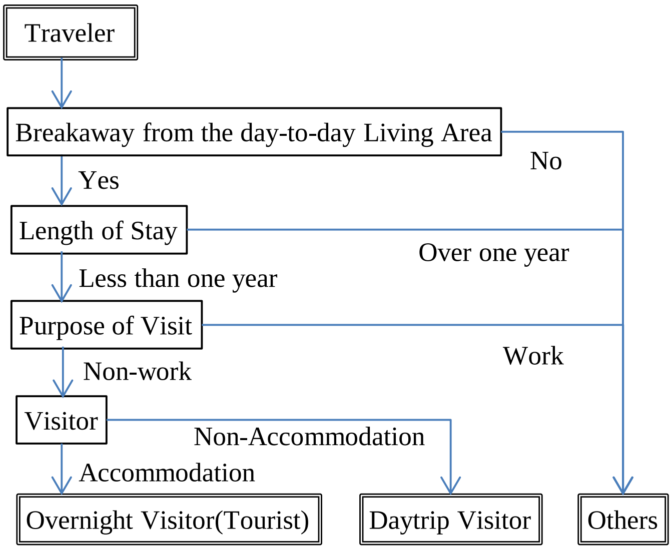

Figure 1. Definition of Tourist, Visitor and Others

Table 1. Classification of foreign traveler data by arrival country and region

Country/Region	Classification		Aggregate Unit	
	Visitor	Tourist	Nationality	Residence
Japan		○*	○	
People's Republic of China	○		○	
Republic of Korea	○		○	
Taiwan	○			○
Kingdom of Thailand		○	○	○
Malaysia		○		○
Republic of Singapore	○		○	○
Republic of the Philippines		○		○
Republic of Indonesia		○	○	○
Australia	○			○
New Zealand	○			○
India		○	○	

*○: data exist

As shown above, there are some points to keep in mind in using this OD table. First, there are differences in definition of data. This point depends on the statistics institution of each country/region. Second, the OD table counts for not only leisure travels but also business travels. In other words, the analysis of international tourism in this paper shows the present situation of both leisure and business travels. Third, it is difficult to consider the international multi-stop travel including more than two countries. In this analysis, such a multi-stop travel is regarded as an independent travel dividing multi-OD pairs into each arrival country/region.

3.2 Time series variation of outbound and inbound tourists/visitors by country/region

Let us introduce longitudinal situation of international tourism travels focusing on the OD tables from 1995 to 2012. In this paper, the China-Taiwan OD pair and Malaysia-Singapore OD pair were excluded because of the different condition from other OD pairs. Figure 2 shows the trend on the number of outbound tourists/visitors by origin country/region. This figure indicates that all countries/regions have an increasing tendency year by year as a whole. Especially Japan continually had high number of outbound visitors/tourists, and the increasing ratio of China and Korea were significant. Figure 3 shows the trend on the number of inbound tourists/visitors counted in each destination country/region. It can be found that the growth rates of China, Thailand, Korea, Malaysia, Indonesia and Japan are significantly high. Also, their downturns are seen in 1998, 2003 and 2009. It is clearly due to the fact that not only unanticipated economic impact such as Asian Financial Crisis in 1997 and Lehman crash in 2008 but also the disease pandemic cases such as SARS in 2003 and influenza in 2009 have determined the sudden drop down of the international tourism..

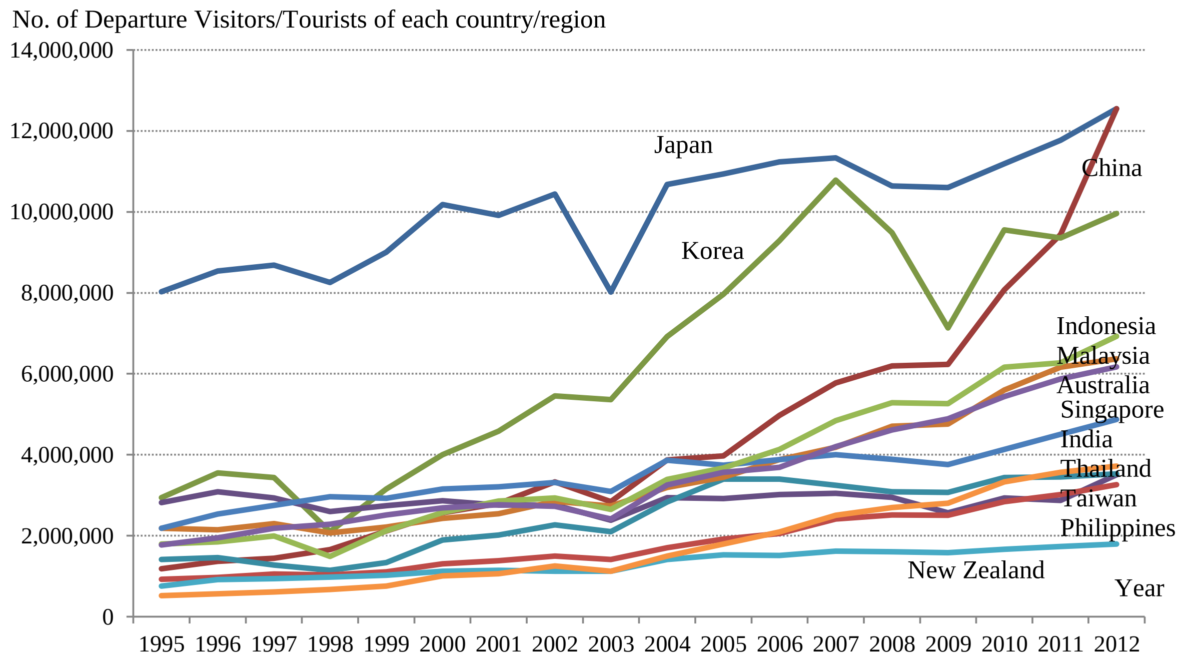

Figure 2. Number of outbound tourists/visitors of twelve countries/region

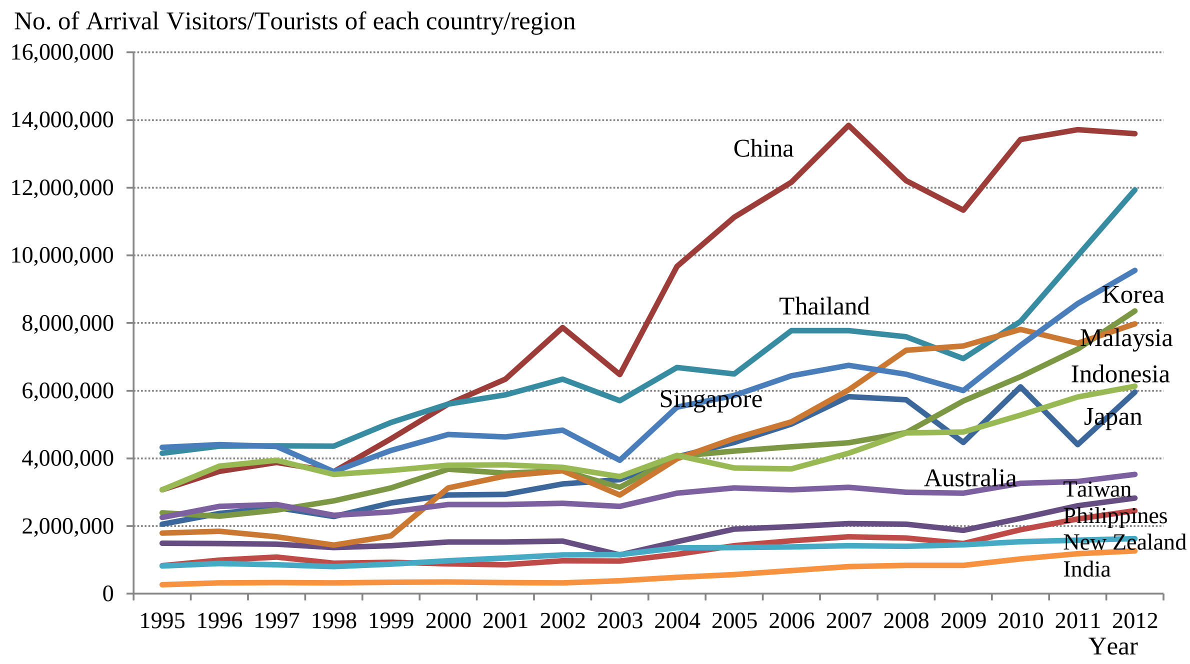

Figure 3. Number of Inbound tourists/visitors of twelve countries/region

Table 2. Major events and occurrences

Year	Major event and occurrence
1997	Asian Financial Crisis
1998	Winter Olympics in Nagano
2000	Summer Olympics in Sydney
2001	9/11
2003	SARS
2003-	Visit Japan Campaign
2004	Sumatra earthquake
2008	Summer Olympics in Beijing
2008	Lehman crash
2009	Influenza Pandemic
2011	The Great East Japan Earthquake

In this paper, it is here assumed that the number of tourists/visitors is determined by two factors as follows: One is the volume of international tourism demand in each of origin countries/regions and the other is the destination choice probability of each of destination countries/regions. The destination choice probability is denoted as a function of GDP, consumer price, exchange rate of currencies, population of the destination country/region, distance between Origin and Destination and the unanticipated events/occurrences. While these events/occurrences are hardly predictable for their timing, location and even for the extent of their effect, it is quite clear that they influence the number of international tourism. Table 2 shows the major events affecting international tourism in East and Southeast Asia and Oceania areas. Among these events/occurrences in the table, the Olympic Games, "Visit Japan Campaign" have had positive influences and others have negative influence on the number of visitors and destination choice probability.

3.3 The characteristics of international tourism travel flow on the OD table

The characteristics of international tourism are here analyzed by using the OD table in 1995 and 2012. Table 3 and Table 4 show the destination choice probabilities for each origin country/region. It is clear that the destination choice probabilities in case of the short distance OD pairs are mostly high. This means that OD distance causes travel resistance in tourism exchange because of cost and time constraints. In Table 5, the ratio denoted ($T_{ij,2012}$- $T_{ij,1995}$)/ $T_{ij,1995}$ is calculated for the purpose of examining longitudinal variation in each of OD pairs. The result shows that, in case of China, the increasing ratios of all of OD pairs tend to register positive value year by year. On the other hand, most of the OD pairs in Singapore and Australia show the drop down of the ratios.

The number of arrivals (tourists/visitors) is usually used as a performance indicator/index on international tourism activities in each country/region. Such an indicator/index, however, can hardly reflect the influence of factors as follows; OD pair distance and the total volume of international tourism demand. It is noted that, if the access distance distribution in a certain country/region be different from that in the other country/region, the number of tourists/visitors by country/region would not be truly equal.

Table 3. Destination choice probabilities on OD matrix in observed area (1995)

	Japan	China	Korea	Taiwan	Thailand	Malaysia	Singapore	Philippines	Indonesia	Australia	New Zealand	India	Total
Japan		16%	21%	11%	10%	4%	15%	4%	6%	10%	2%	1%	100%
People's Republic of China	19%		15%		32%	9%	17%	1%	3%	4%	1%	0%	100%
Republic of Korea	30%	18%		5%	16%	2%	12%	4%	4%	6%	4%	0%	100%
Taiwan	21%		5%		17%	10%	20%	7%	13%	5%	2%	0%	100%
Kingdom of Thailand	4%	12%	5%	10%		38%	18%	1%	3%	6%	2%	1%	100%
Malaysia	2%	12%	1%	2%	49%			2%	23%	5%	1%	2%	100%
Republic of Singapore	2%	12%	2%	3%	20%			1%	48%	9%	1%	2%	100%
Republic of the Philippines	8%	24%	18%	10%	7%	5%	13%		10%	3%	0%	1%	100%
Republic of Indonesia	2%	7%	2%	3%	5%	13%	58%	1%		8%	1%	0%	100%
Australia	4%	7%	2%	1%	11%	8%	20%	4%	18%		23%	2%	100%
New Zealand	4%	3%	1%	1%	4%	3%	9%	1%	4%	71%		1%	100%
India	5%	9%	7%	2%	24%	5%	36%	2%	6%	3%	1%		100%
Total	8%	12%	9%	6%	16%	7%	16%	3%	12%	9%	3%	1%	100%

Table 4. Destination choice probabilities on OD matrix in observed area (2012)

	Japan	China	Korea	Taiwan	Thailand	Malaysia	Singapore	Philippines	Indonesia	Australia	New Zealand	India	Total
Japan		28%	28%	11%	11%	4%	6%	3%	4%	3%	1%	2%	100%
People's Republic of China	11%		23%		22%	12%	16%	2%	5%	5%	2%	1%	100%
Republic of Korea	21%	41%		3%	12%	3%	4%	10%	3%	2%	1%	1%	100%
Taiwan	42%		16%		11%	7%	8%	6%	6%	3%	1%	1%	100%
Kingdom of Thailand	7%	18%	11%	3%		36%	14%	1%	4%	2%	0%	3%	100%
Malaysia	2%	19%	3%	5%	40%			2%	21%	4%	0%	3%	100%
Republic of Singapore	3%	21%	3%	7%	20%			3%	32%	7%	1%	3%	100%
Republic of the Philippines	3%	29%	10%	3%	9%	16%	20%		7%	2%	0%	1%	100%
Republic of Indonesia	1%	9%	2%	2%	6%	34%	41%	1%		2%	0%	0%	100%
Australia	3%	13%	2%	1%	15%	8%	17%	3%	16%		19%	3%	100%
New Zealand	2%	7%	2%	1%	6%	4%	7%	1%	3%	67%		2%	100%
India	2%	16%	2%	1%	26%	19%	24%	0%	5%	4%	1%		100%
Total	8%	18%	11%	4%	16%	11%	13%	3%	8%	5%	2%	2%	100%

Table 5. Difference of destination choice probabilities ((2012 minus 1995)/2012)

	Japan	China	Korea	Taiwan	Thailand	Malaysia	Singapore	Philippines	Indonesia	Australia	New Zealand	India
Japan		12%	7%	0%	1%	0%	-9%	-1%	-2%	-7%	-1%	1%
People's Republic of China	-7%		8%		-10%	4%	-1%	1%	2%	1%	1%	1%
Republic of Korea	-9%	23%		-2%	-4%	0%	-7%	6%	-1%	-4%	-3%	1%
Taiwan	21%		11%		-6%	-4%	-12%	-1%	-6%	-3%	-2%	1%
Kingdom of Thailand	4%	6%	6%	-8%		-2%	-5%	0%	1%	-3%	-1%	2%
Malaysia	0%	8%	1%	3%	-9%			0%	-2%	-1%	0%	1%
Republic of Singapore	1%	9%	1%	4%	1%			2%	-16%	-2%	0%	0%
Republic of the Philippines	-6%	6%	-8%	-6%	1%	11%	7%		-3%	-1%	0%	0%
Republic of Indonesia	-1%	2%	0%	0%	1%	21%	-17%	0%		-5%	-1%	0%
Australia	-1%	5%	1%	0%	4%	1%	-3%	-1%	-3%		-4%	1%
New Zealand	-2%	4%	1%	0%	2%	1%	-2%	0%	-1%	-4%		1%
India	-3%	8%	-4%	-1%	3%	13%	-12%	-2%	-2%	1%	0%	

4. Research method

In this paper, destination choice probabilities by origin country/region are first calculated by using OD tables of international tourists/visitors. These probabilities are affected by two factors: One is the destination country/region and the other is the OD combination. The former is concerned with the attractiveness for international tourism, determined by population, GDP, and consumer price in destination country/region. On the other hand, the OD combination is totally dependent on the exchange rate of currencies and distance between Origin and Destination. As such a distance between OD pair clearly has huge influence on international travel distribution, simultaneous evaluation of these two factors is necessary to identify the regularity on international tourism travel distribution. It is therefore assumed that these probabilities are based on the Huff model in this paper. Equations (1a) and (1b) show these of this model.

$$\tilde{P}_{ij} = \frac{\dfrac{A_j}{D_{ij}^{\gamma}}}{\sum_k \dfrac{A_k}{D_{ik}^{\gamma}}} \qquad (1a)$$

$$\tilde{P}_{ij} = \frac{A_j \cdot \exp(\gamma D_{ij})}{\sum_k A_k \cdot \exp(\gamma D_{ik})} \qquad (1b)$$

$$\text{Sub to.} \quad A_j > 0, \qquad (2)$$

$$\sum_j A_j = 10n \qquad (3)$$

Where

A_j = Attraction index of a certain country/region j,

D_{ij} = Spatial distance between ij OD pair (mile);

γ = Parameter of distance resistance,

$\tilde{P}_{ij}$ = The estimated destination choice probability for ij OD pair; and

n= Number of objective countries/regions (n=12).

Equation (1a) is for the gravity typed Huff model and equation (1b) is for the exponential typed Huff model. Both types of Huff models show the same as that of Logit typed model. Both Equation (2) and (3) represent the boundary condition and constraint, respectively. If either the attraction index of country/region j increases or the travel resistance decreases, the probability of country/region j would increase in equation (1). The distance between ij pair is here defined by the geometric position of the primary airport in each country/region. The probability is also determined by the competitive condition among the objective countries/region. The developed model has two explanatory variables: one is an OD volume and the other is a travel distance for each OD pair. The model also has two of the parameters relating to an attraction index and distance resistance.

The objective function is also defined as equation (4).

$$\min SSE = \sum_i \sum_j \left(P_{ij} - \tilde{P}_{ij}\right)^2 \qquad (4)$$

Where

P_{ij} = The actual destination choice probability for ij OD pair.

The right side of equation (4) is the Sum of Squared Error (denoted by SSE), which shows the accuracy of the destination choice probability. While equation (4) represents a kind of non-liner problems, the PC software package, called GRG2 (Generalized Reduced Gradient Version2) is applied to the parameters estimation of this equation with minimizing the SSE for the destination choice probability in each year from 1995 to 2012.

5. Discussion

5.1 Verification of the accuracy of our developed model

The inverse method is first applied to estimate the parameters of both attraction indexes and distance resistance by each country/region. The accuracy of our developed model is then verified. Table 6 shows the correlation of coefficients between actual and estimated probabilities denoted by the square of R. The table indicates that the developed model has high goodness of fit because R squared is around 0.8 in observed period.

When comparing with two types of Huff models, the accuracy of the gravity typed Huff model is higher than that of the exponential typed Huff model. The standard errors (denoted Std. Error) counting for around 5 percent indicate that the expected errors of estimation values for each OD pair are small in average. From the results of R square and standard errors, the developed model has high accuracy. On the other hand, it was not possible to check the reliability of each attraction index and distance resistance parameter because of the application of the optimization method. As the distance resistance parameter (γ) is larger than 1.0, it is found that distance resistance is sensitive.

Table 6. Estimated parameter (γ) and accuracy indexes on estimation

Year	γ	SSE	Std. Error	R square
1995	1.20	0.289	0.0479	0.817
1996	1.21	0.325	0.0508	0.797
1997	1.23	0.321	0.0505	0.800
1998	1.29	0.335	0.0516	0.804
1999	1.21	0.342	0.0521	0.790
2000	1.26	0.318	0.0502	0.808
2001	1.24	0.284	0.0475	0.828
2002	1.22	0.306	0.0493	0.816
2003	1.39	0.325	0.0508	0.829
2004	1.34	0.337	0.0517	0.819
2005	1.30	0.323	0.0506	0.821
2006	1.29	0.318	0.0502	0.822
2007	1.27	0.291	0.0480	0.831
2008	1.27	0.331	0.0513	0.805
2009	1.27	0.281	0.0472	0.859
2010	1.26	0.269	0.0462	0.858
2011	1.20	0.259	0.0454	0.852
2012	1.19	0.282	0.0473	0.830

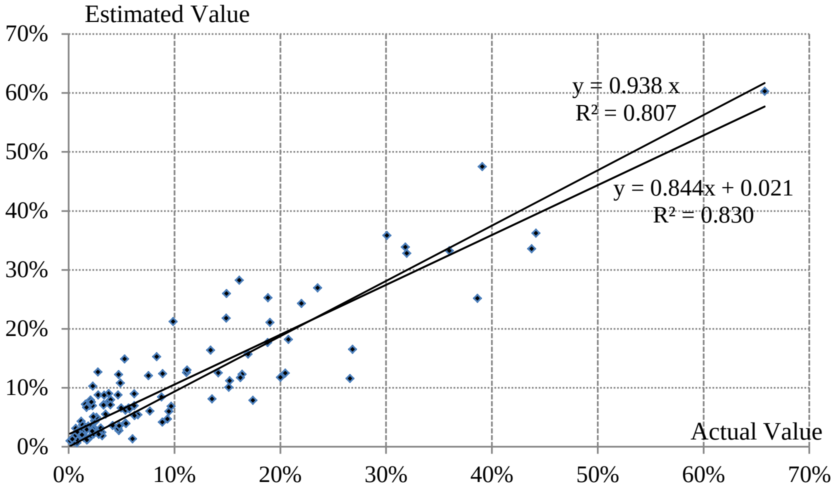

Figure 4. Distribution by actual values and estimated values of the OD probabilities

Figure 4 shows the scatter plot by actual values and estimated ones in 2012. The result indicates high goodness of fit for our model. In this graph, the parameter estimates of our regression analyses are shown for the two cases where there is a constant term and no constant term. In these equations, x means the actual value as an explanatory variable and y does an estimated value as a dependent variable. It is found from the R squared values that both of the estimated models have high goodness of fit..

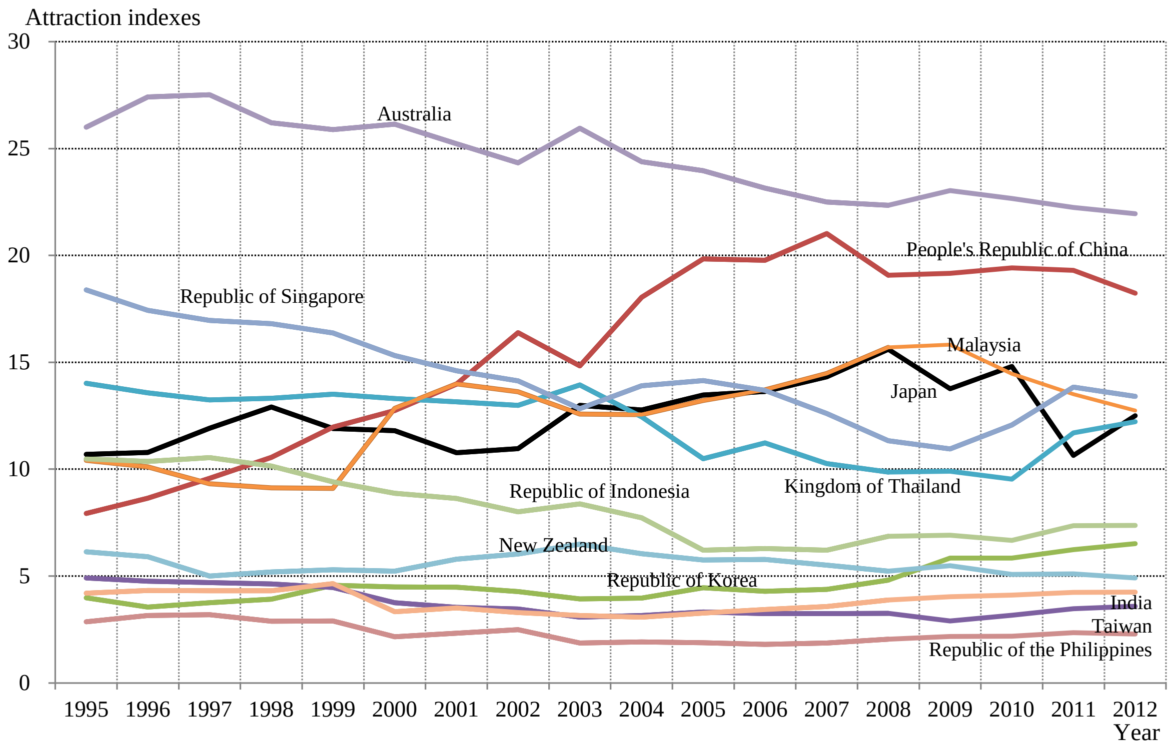

Figure 5. Time series variation of Attraction Indexes by country and region

Figure 5 shows the time series variation of attraction indexes by country/region. In this estimation, the average value of these attraction indexes for all of countries/region is set as 10.0. In 1995, Australia's index is largest among the analyzed countries/region, but it is getting smaller toward 2012. On the other hand, indexes of Malaysia and Japan are getting larger toward 2012. But in recent years, while Malaysia and Japan are getting smaller, Singapore and Thailand are getting larger in international market of Asia and Oceania.

Table 7 shows the effect of distance resistance on the destination choice probabilities in the case of Japan. In this table, D_{ij} is set as the distance from Japan. The value of $1/Dij^{\gamma}$ is a denominator in the Huff model to affect the degree of decreasing of the destination choice probability. For comparing with Korea, it is assumed that the value of $1/Dij^{\gamma}$ of Korea case is set as 1.00. Since the value of New Zealand, which is the farthest destination from Japan, is about 0.06-0.09, it is clear that the distance considerably affects the decrease of destination choice probability.

Table 7. Ratio of $1/Dij^{\gamma}$ in the case of each travel resistance (Korea=1.00)

	Dij (mile for Japan)	γ=1.39 (2003)	γ=1.19 (2012)
Republic of Korea	758	1.00	1.00
People's Republic of China	1313	0.47	0.52
Taiwan	1330	0.46	0.51
Republic of the Philippines	1880	0.28	0.34
Kingdom of Thailand	2869	0.16	0.21
Republic of Singapore	3312	0.13	0.17
Malaysia	3338	0.13	0.17
Republic of Indonesia	3612	0.11	0.16
India	3656	0.11	0.15
Australia	4863	0.08	0.11
New Zealand	5493	0.06	0.09

5.2 Relationship between attraction indexes and number of arrivals (inbound tourists/visitors)

As shown in Figure 3, international tourism demand is increasing. Especially, in China, Malaysia, India and Japan, the increasing ratio of 2012 triples from that of 1995. The attraction indexes are then compared with the number of arrivals (inbound tourist/visitor) of each country/region to find out their relations.

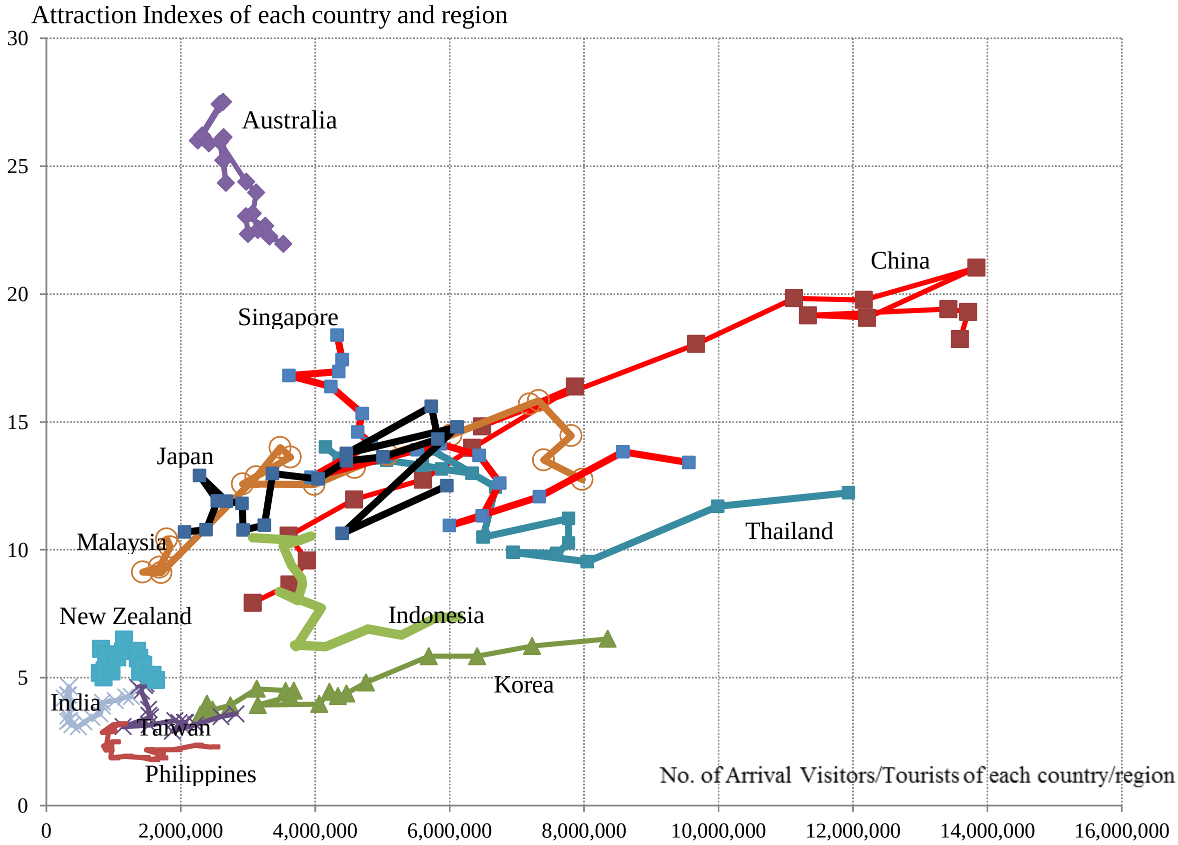

Figure 6. The scatter plot of attraction indexes and number of arrivals (inbound tourists/visitors)

It is found from Figure 6 that the targeted countries/regions can be classified into some groups. China and Malaysia have similar variation that a proportional relationship exists between the attraction index and the number of arrived visitor/tourists in the observed period. Japan seems to be classified into this group. However, there is a clear difference in data occurring before and after The Great East Japan Earthquake of 2011. Since the attraction indexes increased in these countries, they have had advantage to develop in international competition. On the other hand, Australia, Singapore and Indonesia attraction indexes were decreasing in spite of increase in the number of arrivals during the period. Because of the increase in total international tourism demand, the number of arrivals (inbound tourist/visitor) was not seen to reduce in this period. If the total tourism demand shrinks, the degree of these decreasing ratios would be definitely large by weak competition in international tourism. It seems that Thailand and Korea are also classified into this group. Finally, the clear tendency is not found in New Zealand, India, Taiwan and the Philippines in the graph.

5.3 Relation between some events/occurrences and attractive indexes

The estimated attraction indexes are not always in proportion to the actual values of number of arrivals. This implies that the destination choice probability is determined not only by the volume of international tourism demand but also by the other factors. It is therefore necessary for us to analyze the effect of some events/occurrences on the destination choice probability in international tourism competition. These events/occurrences included the Olympic Games, epidemic of influenza and economic downturn.

Table 8. Fluctuation of ratios of attraction index and actual tourist number by major event/occurrence

	Arrival Country	Attraction Index ($A_{j,t-1}$,①)	Attraction Index ($A_{j,t}$,②)	(①-②) /①	Increased ratio of number of Arrival Tourist
Asian Financial Crisis('97)	Thai	13.7	13.3	-3%	3%
	Korea	3.6	3.8	6%	10%
	Philippines	3.2	3.3	2%	10%
Winter Olympics in Nagano('98)	Japan	11.9	12.9	8%	2%
Soccer World Cup in Japan/Korea('02)	Japan	10.7	10.9	2%	26%
	Korea	4.5	4.3	-4%	0%
Visit Japan Campaign('03-)	Japan	10.9	13.0	19%	21%
SARS('03)	China	16.4	14.8	-9%	1%
Sumatra earthquake('05)	Indonesia	7.7	6.2	-20%	-16%
Summer Olympics in Beijing('08)	China	21.0	19.1	-9%	-11%

Table 8 shows fluctuation of ratios of attraction index and the actual number of arrival tourists by major events/occurrences. The table results that the Olympic Games and "Visit Japan Campaign" had positive influences and the other major events/occurrences had negative influences on the destination choice probability. In the case of the Asian financial crisis in 1997, all of the ratios of number of arrivals in each of three Asian countries increased in spite of economic retreat. But the ratios of the attraction index are smaller than those of actual number of arrival tourists.

This implies that such an economic crisis does not cause the number of arrivals of the countries to decrease because of an increase of the total demand of international tourism. It also indicates that, in most of the cases of events/occurrences, the ratio of attraction index has tendency to fluctuate within a smaller range rather than that of the number of actual arrival tourists does.

Only in case of Winter Olympics in Nagano, the ratio of attraction index fluctuated larger than that of the actual number of arrival tourists. On the other hand, the act of terrorism in US on September 11, 2001 affected the total demand of international tourism but did not affect the distribution patterns of the tourist's destination choice behaviors among East and Southeast Asia and Oceania.

5.4 Positioning of destination countries/regions among international tourism competition

The positioning analysis in the marketing research aims to identify the competitive situation among the alternative choice sets with mapping their positions in current international tourism.

The demand in Japanese market is the second largest in international tourism market of East and Southeast Asia and Oceania. Figure 7 shows positioning of the destination countries/regions from Japanese outbound tourists. The horizontal axis shows the estimated attraction index and the vertical axis shows the travel resistance ($1/Dij^{\gamma}$). The twelve countries and regions are plotted in 2008. The squared measure of each circle shows the gravitational value that is calculated by the attraction index multiplied by the travel resistance. The ratio represented in the internal circle is actual choice probability of each country/region as the destination of Japanese outbound traveler.

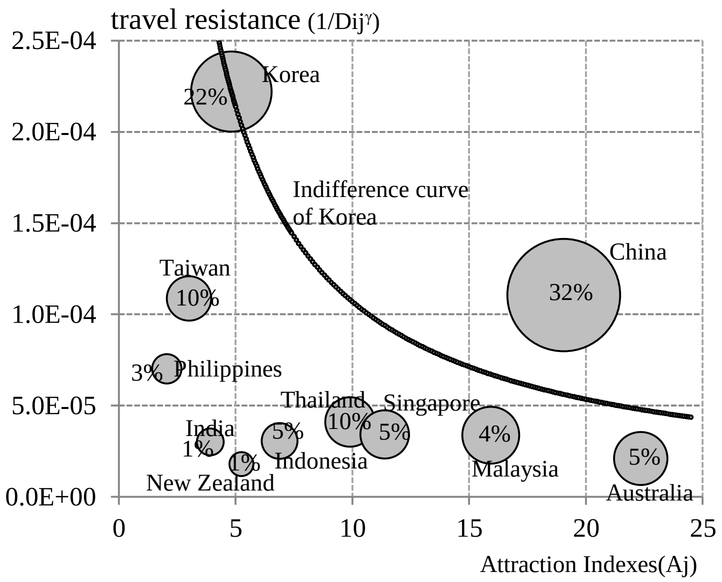

Figure 7. Positioning of destination countries and region from Japan

In Figure 7, the indifference curve of Korea is also drawn in inverse proportionality. Australia's attraction index is largest among the analyzed areas, but the gravitational value shown as the squared measure is almost equal with Malaysia and Singapore because of the long distance from Japan. China has the largest gravitational value due to large attraction index and the proximity from Japan.

From these results, such a mapping is evaluated as a useful tool for representing the competitive condition in international tourism. In addition, using the indifference curve in mapping, we can discuss how to increase the number of arrivals in the objective country. For instance, we can examine to identify how much gap exists in the horizontal axis between present attraction index value and the indifference curve of an objective country.

Let us here discuss the cause of the error between gravitational value and the indifference curve. For example, Taiwan, Thailand gravitational value is about 10 percent, but the positions are plotted on lower left section of the figure from the indifference curve of Singapore, Malaysia and Australia.

Finally, let us refer to the inbound tourism in Japan. Of a particular concern is paid to the promotion strategies for Korea and Malaysia. These countries are one of the most important markets to attract visitors in “Visit Japan Campaign” by Japan Tourism Agency. In Figure 8, Japanese gravitational value is the second largest. Both attraction index and travel resistance have an advantage for other countries/region except for China. The destination choice probability of Japan is expected to be very high in the targeted countries/regions. It is therefore important in tourism policy making to create first-time visitors’ satisfaction so that they will shift to repeaters in the future.

In the case of Malaysia, there is no advantage for Japan as tourism destination because of the long distance. As shown in Figure 9, the major destinations shown in the large circle are Malaysia and Thailand. The gravitational value is small, but the attraction index of Japan is larger than these countries. It is therefore necessary to promote the original and unique resources of Japan, which are different from those of Malaysia and Thailand to develop inbound tourism in Japan.

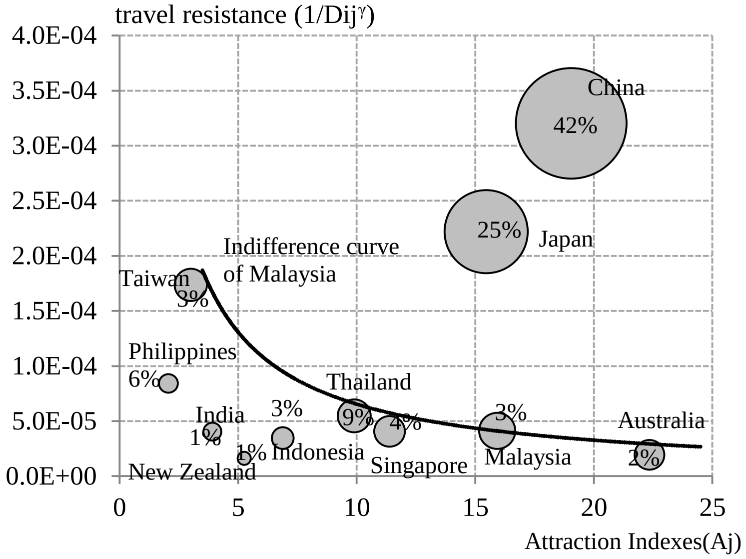

Figure 8. Positioning of destination countries and region from Korea

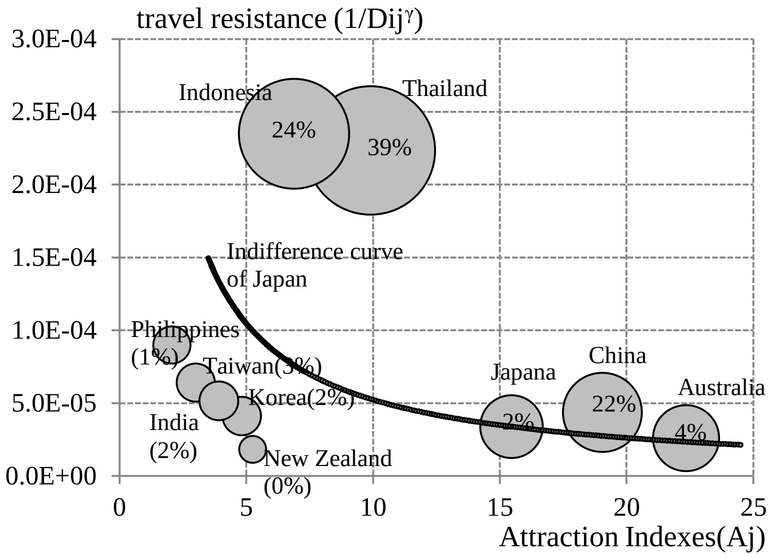

Figure 9. Positioning of destination countries and region arrived from Malaysia

6. Conclusion

The purpose of this paper is to develop attraction indexes of international tourism in East and Southeast Asia and Oceania countries/regions. The attraction index is here defined as a quantitative measure how international tourists gravitate toward the destination areas.

For the purpose of this paper, the destination choice probabilities by country/region were first calculated by using the OD matrices of international visitors by UNWTO from 1995 to 2012. Second, our developed inverse method was applied to the estimation of attraction indexes by country/region for each year. The result indicates that our gravity-typed Huff model has significantly high goodness of fit.

Our time series and cross sectional analyses also indicate some unique properties of the parameters of attraction indexes. In 1995, Australia's index is largest among the analyzed countries/region, but is getting smaller toward 2012. On the other hand, the indexes of China, Malaysia and Japan are increasing toward 2012. The estimated values and the actual values are not in a proportional relationship because of separation of the effect of distances and population densities. These analyses also indicate that some events such as the Olympic Games, epidemic of influenza, and economic downturn have significant effects on international tourism. It can be also found that the poisoning of each country/region by only two factors because of applying Huff typed model. As a result, our proposed attraction indexes enable us to grasp the competitive situations among objective area with comparative ease although there remain some advanced refinements.

In this paper, eleven countries and one region in East and Southeast Asia and Oceania were used to estimate the attraction indexes due to the data constraint. One of the future issues is to expand the analyzed area into the rest of the world. When our including European countries as one of destinations in international tourism, it has difficulty in considering the competitive condition because of the high modal choice probability by vehicle. Furthermore, the estimated attraction index involves roughly one parameter. It would also be another set of future issues to examine how to set the level of service (LOS) in each OD pair.

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