Short-run and Long-run structural international tourism demand modeling based on Dynamic AIDS model -An empirical research in Japan-

Atsushi KOIKE [a], Daisuke YOSHINO [b]

[a] *Graduate School of Engineering, Kobe University, Kobe, 6578501, Japan; E-mail: koike@lion.kobe-u.ac.jp*
[b] *Economic Planning Group, Fukken Co., Ltd., Tokyo, 1010032, Japan; E-mail: d-yoshino@fukken.co.jp*

Abstract: When we suggest some policies which promote inbound and/or outbound tourism market, we should not only focus on the tourism demand in a certain region but also national interactions. To solve this problem, this study has developed the methodology for quantitative analysis of demand structure for tourism by focused on the elasticity of destination choice activities. The demand function of destination choice activities is defined as a Dynamic AIDS (Almost Ideal Demand System) model. The main goal of this study is to examine the applicability of AIDS model to estimation of the Japanese international tourism demand.

Keywords: Dynamic AIDS, Elasticities, Inbound and Outbound, Tourism demand

1. INTRODUCTION

In the late 1980s, the Japanese government had formulated “A ten million plan”. This plan had aimed to bring the number of Japanese who traveled abroad to 10 million/year within five years. Thus, they decided to promote the outbound tourism. In the background of this plan, the government had tried to solve a trade imbalance arising from expansion of made-in-Japan products, and they also had made an effort to promote the tourism exchange. This plan had been achieved the goal in 1990. It was earlier than the planned period because of a high-yen and a booming economy in Japan.

After that, because of the bursting of Japan's bubble economy, the government had switched to promote the inbound tourism to get foreign exchanges. From 2003, the government had launched the "Visit Japan Campaign" and they had been trying to increase incoming foreign traveler number to 10 million/year by 2010. Later, in 2007, the government had switched to promote both in- and outbound tourism. Because Japanese foreign travelers put a large amount of foreign currency into the various countries they visit, and it produces huge economic assistance.

Both in- and outbound tourism demands in Japan have been increasing from 1970, and the regional composition ratio of tourism demand has changed from year to year (see Figure 1 and 2). It might be caused by changes of the destination choice activity, which is affected by global economic situations; like consumption expenditure of tourists, fluctuation of price and exchange rates etc. Therefore, if we suggested some policies which promote in- and outbound tourism market, we should focus on not only a certain region but also national interactions.

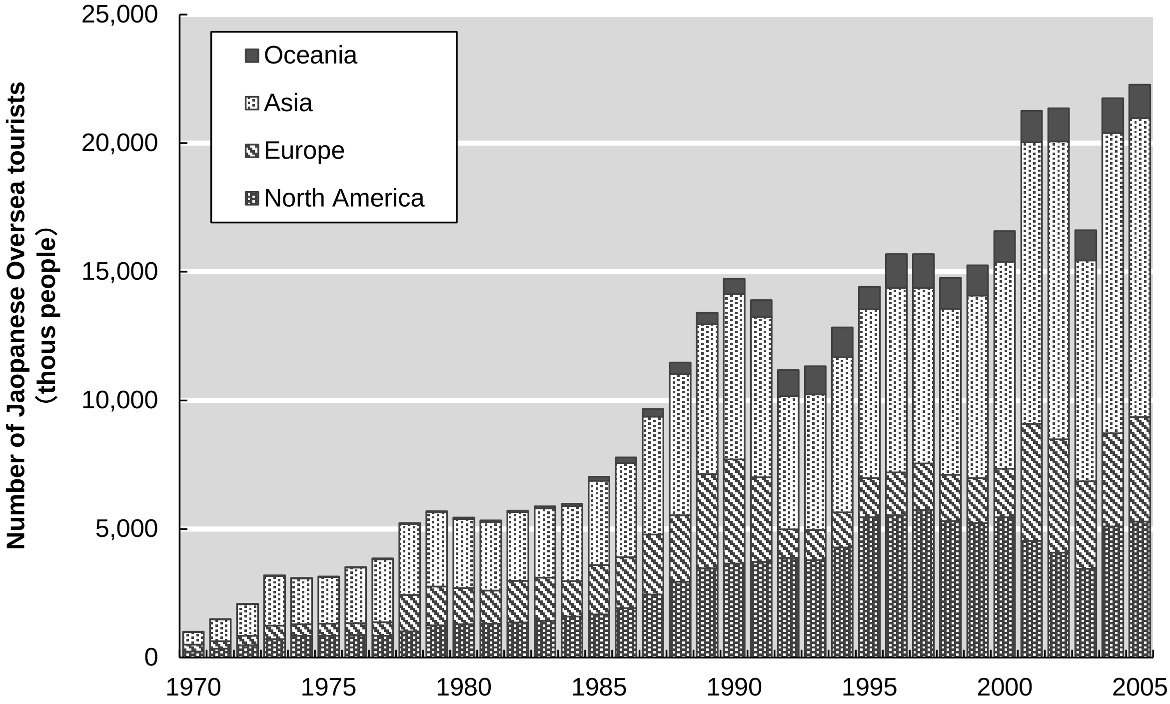

Figure 1. Number of Japanese Oversea Tourists (1970-2005).
Data source: White paper on tourism
(Japanese ministry of land, infrastructure, transport and tourism, 1970-2005)

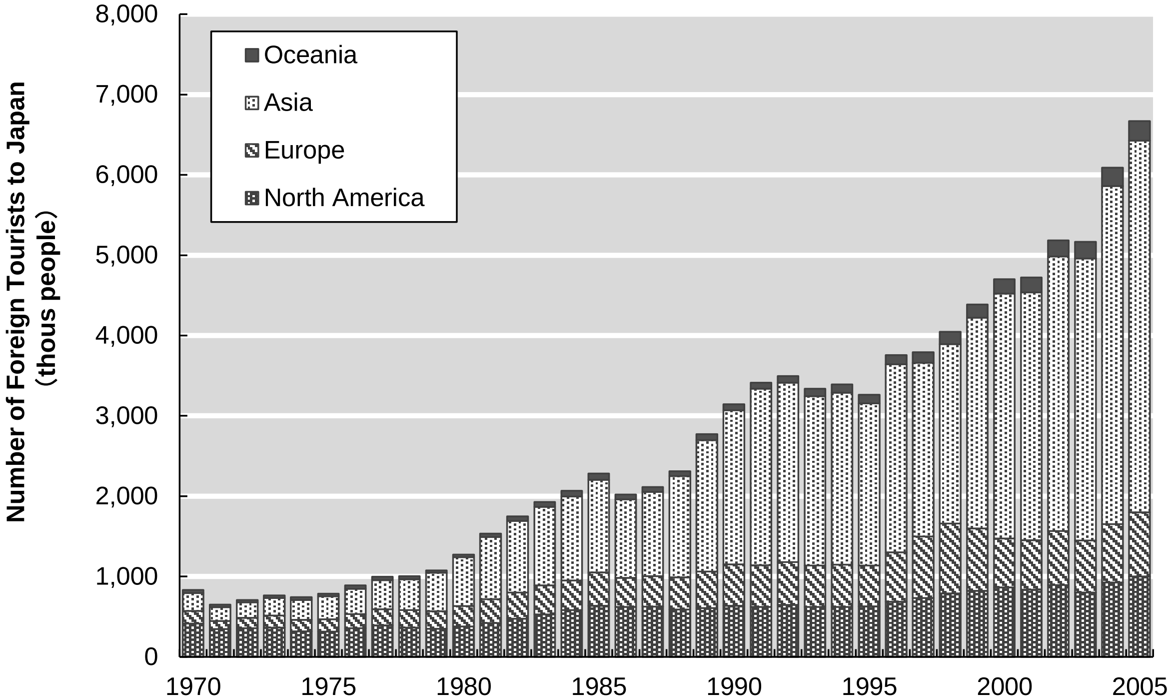

Figure 2. Number of Foreign Tourists to Japan (1970-2005).
Data source: White paper on tourism
(Japanese ministry of land, infrastructure, transport and tourism, 1970-2005)

To solve this problem, this study has developed the methodology for quantitative analysis of tourism demand structure by focused on the elasticity of destination choice activities. The demand function of destination choice activities is defined as a Dynamic AIDS (Almost Ideal Demand System) model. This model developed to estimate various elasticities such as own-price, cross-price, and expenditure. This approach had been applied in European tourism market (ex. Durbarry and Sinclair (2003)). However, there had been no literature deals with Japanese one. Therefore, the main goal of this study is to examine the applicability of AIDS model to estimation of the Japanese international tourism demand.

This paper is organized as follows. Section 2 reviews existing literatures focusing on the estimation of tourism demand. In section 3, the theory and characteristics of the Dynamic AIDS model proposed in this study are described. The following section 4 describes results of the model estimation and key conclusion and future tasks are summarized in section 5.

2. METHODOLOGICAL REVIEW

2.1 Traditional Approach to Estimating Tourism Demand

Much of the literature on tourism demand has examined demand at the national level, although it can also be examines for different components of tourism, such as accommodation or attractions. It is known that tourism demand is responsive to such variables as income, relative prices and exchange rates. What is not known is how the responsiveness of demand to changes in these variables alters during a regions' economic transition and integration into the wider international community. In addition, the degrees of complementarity and substitutability between destinations and the extent to which these change during periods of economic transition should be concerned.

Some kinds of model have been used in literature to estimate tourism demand. The large majority studies of tourism demand have based on single equation models of demand, estimated within a static theory. This kind of model is not derived from consumer demand theory, and it cannot quantify the changes in demand behavior that occur over time.

After that, innovations in the methodology were introduced later in the form of single equation models of demand estimated using and error correction methodology (ex. Loeb, 1982; Uysal and Crompton, 1984). And more recently, Song *et al.* (2000) used the error correction model to estimate the U.K. tourism demand in the form of visits per capita to outbound destinations and demonstrated that the model has good estimation ability.

This modeling approach has the advantage of explicit treatment of the time dimension of tourism demand behavior, and allows for improved econometric estimation of the specified equations. But as Durbarry and Sinclair (2003) noted, the main problem of the traditional single equation model concerns the lack of reliability in the accuracy of the provided results, because the approach lacks a strict basis in consumer demand theory. The AIDS model of tourism demand is clearly superior in this respect.

2.2 About AIDS Model

The third approach to tourism demand estimation involves system of equations models such as the AIDS model. The AIDS model is used in the field of household expenditure analysis, consumption of goods, trade shares, etc. (ex. Blundell and Browning, 1994; Eakin and Gallagher, 2003; Choo *et al.*, 2007). The advantages of the model contain its strict grounding in economic theory, the relative simplicity with which it can be estimated, and the flexibility with which it can be applied to different contexts.

Recent applications in the field of tourism suggest that Deaton and Muellubauer's (1980) AIDS model provides a well-structured framework for modeling tourism demand. It is based on economic theory, satisfies the principle of choice exactly and be used to test homogeneity and symmetry restrictions. Some studies have applied this approach in current tourism demand analysis (ex. Mello *et al.*, 2002; Witt and Witt, 1995; Durbarry, 2002). Until recently, literatures which apply the AIDS had been focused on static solution. The static AIDS model assumes that there is no difference between short- and long-run behaviors. It means consumers' behavior is always in equilibrium. However, it is true that many factors often cause the consumer to be out of equilibrium until full adjustment takes place. Therefore, the assumption of the static AIDS model is unrealistic in some cases.

As a result of the inability of the long-run specification to explain dynamic adjustment of tourism demand, recently, some researches have focused not only long-run solution, but also short-run dynamics by using Dynamic AIDS model (ex. Durbarry and Sinclair, 2003; Li *et al.*, 2010; Chang *et al.*, 2012). For example, Durbarry and Sinclair (2003) examines the magnitudes and determinants of changes in destinations' shares of a major tourist origin market based on the dynamic AIDS model. They used the model to quantify the responsiveness of French tourism demand in European countries to change in price index, and both long- and short-run demand elasticities have been calculated. Li *et al.* (2010) and Chang *et al.* (2012) also estimated to identify the price competitiveness and interdependencies of tourism demand for competing destinations in both long- and short-run error correction specifications.

There are few empirical studies of international tourism demand using econometric models for Japan. As previous estimates from AIDS models in the literature have suggested that useful implications can be made regarding tourism competitiveness, the AIDS approach for both static and dynamic specification will be used to investigate Japan outbound/inbound demands for various destinations/origins whole world.

3. MODEL EXPLANATION AND DATA

3.1 Traditional Static AIDS Model

In this section, the theory and characteristics of the Dynamic AIDS model proposed in this study are described. First of all, we introduce the traditional static AIDS model which forms the bases of Dynamic AIDS model.

Following Deaton and Muellbauer (1980), we define the tourism expenditure function of *i*-th destination region as

$$\ln E(p;u) = \alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j + u\beta_0 \prod_i p_i^{\beta_i} \quad (1)$$

where,

E : total tourists' expenditure,
p : price of tourism,
u : utility,
i : destination region,
j : alternative destinations,

α_0, α_i, β_0, β_i, γ_{ij} : parameters need to be estimated.

The demand functions can be derived directly from equation (1). It is a fundamental property of the cost function (see Shephard, 1970) that its price derivatives are the quantities demanded: $\partial E(p;u)/\partial p_i = q_i$, we find the budget share of *i*-th destination region w_i as

$$w_i = \frac{p_i q_i}{E(p;u)} = \frac{p_i}{E(p;u)} \cdot \frac{\partial E(p;u)}{\partial p_i} = \frac{\partial \ln E(p;u)}{\partial \ln p_i} \tag{2}$$

Hence, logarithmic differentiation of (1) gives the budget shares as a function of prices and utility:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i u \beta_0 \prod_i p_i^{\beta_i} \tag{3}$$

where, the limitation $\gamma_{ij} = \gamma_{ji}$ is imposed.

For a utility-maximizing consumer, total expenditure *x* is equal to *E*(*p*;*u)* and this equality can be inverted to give *u* as a function of *p* and *x*, the indirect utility function. If we do this for (1) and substitute the result into (3) we have the budget shares as a function of *p* and *x*; these are the AIDS demand functions in budget share form:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln\left(\frac{x}{\mathbf{P}}\right) \tag{4}$$

where, **P** is price index, and it is expressed as follows:

$$\ln \mathbf{P} = \alpha_0 + \sum_i \alpha_i \ln p_i + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j \tag{5}$$

The restrictions on the parameters comply with the assumptions and ensure that equation (5) defines **P** as a linear homogeneous function of individual prices. If prices are relatively collinear, **P** will be approximately proportional to any approximately defined price index, for example, the one use by Stone (Deaton and Muellbauer, 1980). Hence, in this study, **P** in equation (5) can be simplified using the Stone price index (Stone, 1954).

$$\ln \mathbf{P} = \sum_i w_i \ln p_i \quad (\textit{Stone price index}) \tag{6}$$

3.2 Formulation of Dynamic AIDS model

A static AIDS specification ignores potential significant short-run elasticity measures that differ from the long-run estimates. Moreover, in the context of tax policy and business strategy, decision-makers are more likely to be more concerned with short-run elasticity estimates and the speed to which these estimates reach their long-run level. A dynamic AIDS model that incorporates such short-run estimates is an error correction representation of the

AIDS model. This form is described as the partial differential equation of first order. In this equation, L means long-run and S means short-run.

$$\Delta w_{it} = \alpha_{it}^{S} + \Sigma_j \gamma_{it}^{S} \Delta \ln p_{jt} + \beta_i^{S} \Delta \ln\left(\frac{x}{P}\right)_t - \lambda\left[w_{it-1} - \alpha_{it-1}^{L} - \Sigma_j \gamma_{it-q}^{L} \ln p_{jt-1} + \beta_{it-1}^{L} \ln\left(\frac{x}{P}\right)_{t-1}\right] \quad (7)$$

where,

Δ : the difference operator ($\Delta x_t = x_t - x_{t-1}$).

This equation captures the dynamics of the tourism demand, showing that current changes in budget shares depend on not only current change in the normal AIDS explanatory variables, but also on the extent of consumer disequilibrium in the previous period. In the long-run, the coefficients of the price variables, γ_{ij} , represent the absolute change in the price of region *j*, ceteris paribus. Thus, the price variable take account of the effective price in the destination region *i* relative to those in other destinations. The β_i coefficients represent the absolute change in the *i*-th expenditure share given a 1% change in real per capita expenditure. The parameter λ measures the speed of adjustment to the long-run equilibrium, for example, λ *=1* adjustment is instantaneous.

The restrictions on the parameters of (1) imply restrictions on the parameters of the AIDS equation (7). We take these in three sets:

Adding-up restrictions:

$$\sum_i \alpha_i^{term} = 1, \sum_i \beta_i^{term} = 0, \sum_i \gamma_{ij}^{term} = 0 \qquad term = L, S \quad (8)$$

Homogeneity:

$$\sum_j \gamma_{ij}^{term} = 0 \qquad term = L, S \quad (9)$$

Symmetry:

$$\gamma_{ij}^{term} = \gamma_{ji}^{term} \qquad term = L, S \quad (10)$$

Provided (8), (9), and (10) hold, equation (7) represents a system of demand functions which add up to total expenditure ($\sum_i w_i = 1$), are homogeneous of degree zero in prices and total expenditure taken together, and which satisfy Slutsky symmetry. There are many constraint conditions in the Dynamic AIDS model. Such case, the SURE estimation method is often used as a parameter estimation method (Zellner, 1962). Therefore, this method is also used in this study.

If these three restrictions are satisfied, Expenditure and price elasticities cannot be directly accessed in (7), given its linear-log form. Nevertheless, the elasticities can be retrieved from coefficients in (7), using follows:

Expenditure elasticity:

$$\eta_i^{term} = 1 + \frac{\beta_i^{term}}{w_i} \quad (11)$$

Own-price elasticity:

$$\varepsilon_{ii}^{term} = \frac{\gamma_{ii}^{term}}{w_i} - \beta_i^{term} - 1 \tag{12}$$

Cross-price elasticity:

$$\varepsilon_{ij}^{term} = \frac{\gamma_{ij}^{term}}{w_i} - \beta_i^{term}\left(\frac{w_j}{w_i}\right) \tag{13}$$

where,

w_i : the sample's average share of destination i in the base year,
w_j : the sample's average share of destination j in the base year.

3.3 Data

The explanation of data is described as follow.

For outbound tourism demand

The data used in the outbound tourism analysis is shown in Table 1. The number of Japanese tourists traveled for each region indicates as a demand variable. It is assumed that three price variables written in Table 1 affect demand of Japanese outbound tourism, the tourism expenditure of Japanese overseas tourists, the prices of commodities in each region, and exchange rate are used as variables of price. The panel data of commodity price is calculated by the mix of costumer price index (time-series data) and price level index (cross-section data). Because of the data availability, the time period is decided as 1970-2005. For your information, these price data aren't organized by regional level. Thus, these regional data are replaced each representative country (i.e. North America: USA, Europe: France, Asia: Korea and Oceania: Australia). In addition, the transportation cost is out of the price index in this study. Its reasons are as follow. First of all, the changes of transport costs are included in changes of commodity price, and relatively speaking, the proportion of transport cost is stable to total expenditure. For example, the escalation of gasoline price affects global markets; therefore, the relative gasoline price will remain unchanged. Secondly, these transport data are not available from each country's statistics. Incidentally, these hypothesizes have been employed by Durbarry and Sinclair (2003) etc.

For inbound tourism demand

The relative prices data are common in in- and outbound analysis. Only tourism demand data in inbound analysis is different from outbound study; the number of foreign tourists to Japan (1970-2005, source: White paper on Tourism) indicates inbound demand.

Because of model characteristics, however, we should be careful that the inbound analysis based on AIDS model has two technical problems. First of all, this model should deal with four consumers (i.e. North America, Europe, Asia and Oceania) ideally. Nevertheless, the AIDS model assumes only one consumer. Thus, this model has the theoretical mismatch. Secondly, the inbound case, the AIDS model cannot consider relative prices except Japan, because this model determines only one demand (tourism demand to Japan). These two problems should be suggested an improvement, but in this study, we analyzed as the trial implementation which remains these problems. The detailed future plan is shown in the final section.

Table 1. Data List

Data			Source	Period
Demand / Price	**Item**	**Region**		
Demand	Number of Japanese traveler	North America, Europe, Asia, Oceania	*Except Oceania ・ **White paper on Tourism**: Japanese ministry of land, infrastructure, transport and tourism. (except Oceania) *Oceania ・ **Australian bureau of statistics HP**	1970-2005
Price	Consumer price index (time-series data)	Japan, USA, France, Korea, Australia	・ **World statistics** and **International statistical directory**: Japanese bureau of statistics	1970-2005
	Price level index (cross-section data)	Japan, USA, France, Korea, Australia	・ **World statistics**: Japanese bureau of statistics	2005
	The yen exchange rate	Japan, USA, France, Korea, Australia	*Except Korea ・ **The new Japan historical statistics list**: Japanese bureau of statistics *Korea ・ **East Asia historical economic statistics, Vol.1 (Korea)**: Takushoku university Asian information center ・ **World Bank HP**	1970-2005

4. EMPIRICAL RESULTS

4.1 Results of Outbound Tourism Demand

Parameter estimation

The estimation results of parameters are shown at Table 2. About half or more parameters are significant in cases at least at the 5% level. R^2 in the long-run Asia is relatively high (0.5977), but the other regions show low scores. Thus, the future challenge is to improve the goodness of fit of the data for the model. In addition, because the Durbin-Watson ratio (DW) is not enough in the long-run model, the first order serial correlation about error terms may not be rejected. In other words, there exists the error correlation and the coefficient determination may be estimated as excessively-high. As shown in the table, the adjustment factor λ is 0.2912. Therefore, the adjustment period to the long-run equilibrium ($1/\lambda$) is about 3.4 years.

Table 2. Estimated Parameter (Outbound)

Long-run

		α_i^L	β_i^L	γ_{i1}^L	γ_{i2}^L	γ_{i3}^L	γ_{i4}^L	R^2	DW
1.North America	estimate	0.3378	-0.0218	0.1537	-0.0446	-0.0685	-0.0406	0.3013	0.6067
	SE	0.1191	0.0132	0.0553	0.0788	0.0170	0.0576		
	t-stat	**	+	**		**			
2.Europe	estimate	0.0856	-0.0171		0.0629	-0.0150	-0.0033	0.1083	0.5401
	SE	0.2250	0.0285		0.1780	0.0233	0.1321		
	t-stat								
3.Asia	estimate	0.1081	-0.0149			0.0352	0.0482	0.5977	0.6863
	SE	0.0495	0.0039			0.0188	0.0235		
	t-stat	*	**			+	*		
4.Oceania	estimate	0.4685	0.0538				-0.0043		
	SE	0.1644	0.0216				0.1118		
	t-stat	**	**						

Short-run

		β_i^S	γ_{i1}^S	γ_{i2}^S	γ_{i3}^S	γ_{i4}^S	λ	R^2	DW
1.North America	estimate	-0.1240	-0.0002	-0.0006	0.0006	0.0002	0.2912	0.4686	1.8737
	SE	0.0876	0.0003	0.0004	0.0003	0.0003	0.1157		
	t-stat						**		
2.Europe	estimate	0.0773		-0.0011	0.0016	0.0001		0.2485	1.3568
	SE	0.0673		0.0015	0.0009	0.0013			
	t-stat				+				
3.Asia	estimate	0.0492			-0.0015	-0.0007		0.4154	2.3983
	SE	0.0154			0.0009	0.0006			
	t-stat	**			+				
4.Oceania	estimate	-0.0025				0.0004			
	SE	0.0430				0.0013			
	t-stat								

NOTES:
1) estimate: estimated parameter, SE: standard error, t-stat: t-statistic.
2) R^2: coefficient of determination, DW: Durbin-Watson ratio.
3) +, * and ** denote acceptance at the 10%, 5% and 1% significance levels respectively.

Elasticities

The effects of the different variables on Japanese outbound tourism demand are indicated by the elasticity values. The estimated values are shown in Table 3.

Table 3. Expenditure, Own-price, and Cross-price elasticities (Outbound)

Short-run					
Destination	Expenditure Elasticity	Price Elasticity			
		North America	Europe	Asia	Oceania
North America	0.826	-0.999	-0.003	0.0003	0.176
Europe	1.680	-0.009	-1.002	0.016	-0.686
Asia	1.491	0.003	0.022	-1.014	-0.503
Oceania	0.966	0.003	0.001	-0.009	-0.961

Long-run					
Destination	Expenditure Elasticity	Price Elasticity			
		North America	Europe	Asia	Oceania
North America	0.969	-0.765	-0.062	-0.096	-0.046
Europe	0.849	-0.302	-0.442	-0.128	0.023
Asia	0.851	-0.595	-0.146	-0.644	0.533
Oceania	1.714	-0.966	-0.063	0.621	-1.305

Expenditure Elasticity The expenditure elasticity is positive in all regions. It means the expansion of Japanese outbound tourists' expenditure push up tourism demands. In Europe and Asia, the elasticity score is higher than 1 in short-run. It means 1% increase in Japanese tourists' expenditure gives rise to more than 1% increase Japanese tourists' demand to these countries. Instead, about long-run, scores in these counties are lower than 1. It means 1% increase Japanese tourists' expenditure pushes up less than 1% insignificant change. Specifically, demands of Japanese tourists to Europe and Asia are greater gains in the short-term, but these effects break down in the long-run. We saw exactly the opposite in Oceania; the short-run elasticity is lower than 1, and higher than 1 in long-run equilibrium. North America shows different trends; both elasticities are less than 1. It means the change of expenditure has an insignificant effect on the tourism demand to North America.

The forecasting of tourism demand change which is caused by changes of tourists' consumption expenditure (ex. decrease of GDP in Japan) is available by using this elasticity. In this case, tourists to Europe and Asia will be decreased in short-term. After that, the tourism demand for Oceania will be decreased. Instead, demand for North America will be less subject to changing of expenditure, and the robustness is stronger than other region.

Own-price Elasticity The own-price elasticity which is the diagonal value in the Tabe 3 is negative in all regions. It means the increase of price and exchange rate with Japan will decreases the Japanese tourists' tourism demand. The interpretation of the elasticity is same with expenditure one. For example, a 1% increase in relative prices of Europe results in a 1.002% decrease in Japanese demand for tourism in the short-run. But about long-run, the rate of decrease will rebound to 0.442%. Asia will be same trends with Europe. Similar with the result of expenditure elasticity, Oceania will be exactly different trends with Europe and Asia, and North America is less subject to changing of the own-price.

These days, the number of Japanese who traveled abroad has been increasing the influence of the high-yen. From this result, these prices change will have a greater impact for demand for Europe and Asia in short-run, but this impact will be decreased in long-term.

Cross-price Elasticity The own-price elasticity values are high relative to those of the cross-price elasticity, which are the off-diagonal values in the Table 3. These give the sensitivity of demand for each destination to an increase in its prices relative to those of its competitors. For example, in the long-run, the results indicate that a 1% increase in Oceania price results in a decrease of 0.966% in Japanese demand for North America, an insignificant change in demand for Europe, and an increase of 0.621% in demand for Asia.

From the difference of sign of elasticity, in the short-run, the decrease in Oceania price results decrease of Japanese tourism demand to North America, but it increase of its demand to Europe and Asia. In means Oceania-North America has a gross-substitution relationship, and Asia/Europe-Oceania has a gross-complementary (see Figure 4). This relationship will be changed in the long-run, almost cross-price elasticities will be minus. It means the decrease of price will increase Japanese tourism demand to almost region. However, only Oceania shows different trends. The decrease of Oceania price will decrease Japanese tourism demand to Asia. There is a gross-complementary relationship between Asia and Oceania.

Compare with short- and long-run, the elasticity values in the long-run are higher than short-run values. In means the changing prices of other regions will increase year by year. In addition, some regions have different sign between short- and long-run. For example, between Asia and Oceania, there is the gross-complementary relationship (elasticity < 0) in short-run, but there is the gross-substitution (elasticity > 0) in long-run. We should be careful that regional relationship may change significantly.

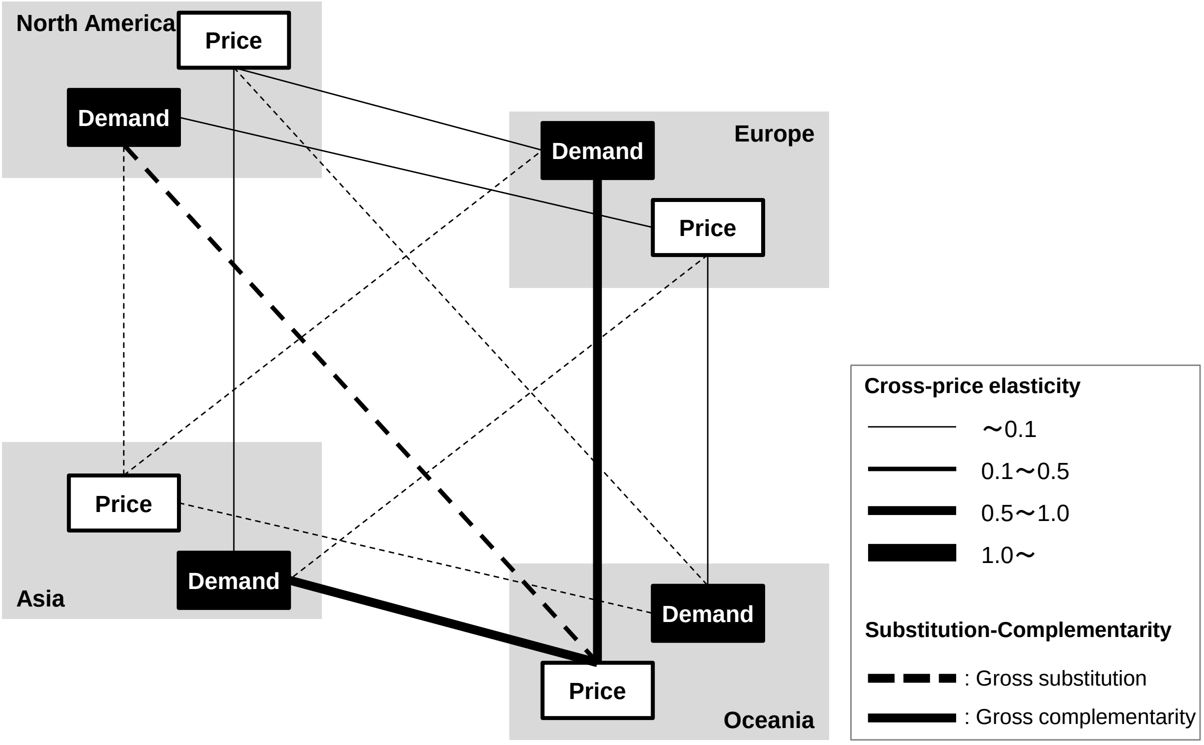

Figure 3. Interregional substitution-complementarity relationships (Outbound / Short-run).

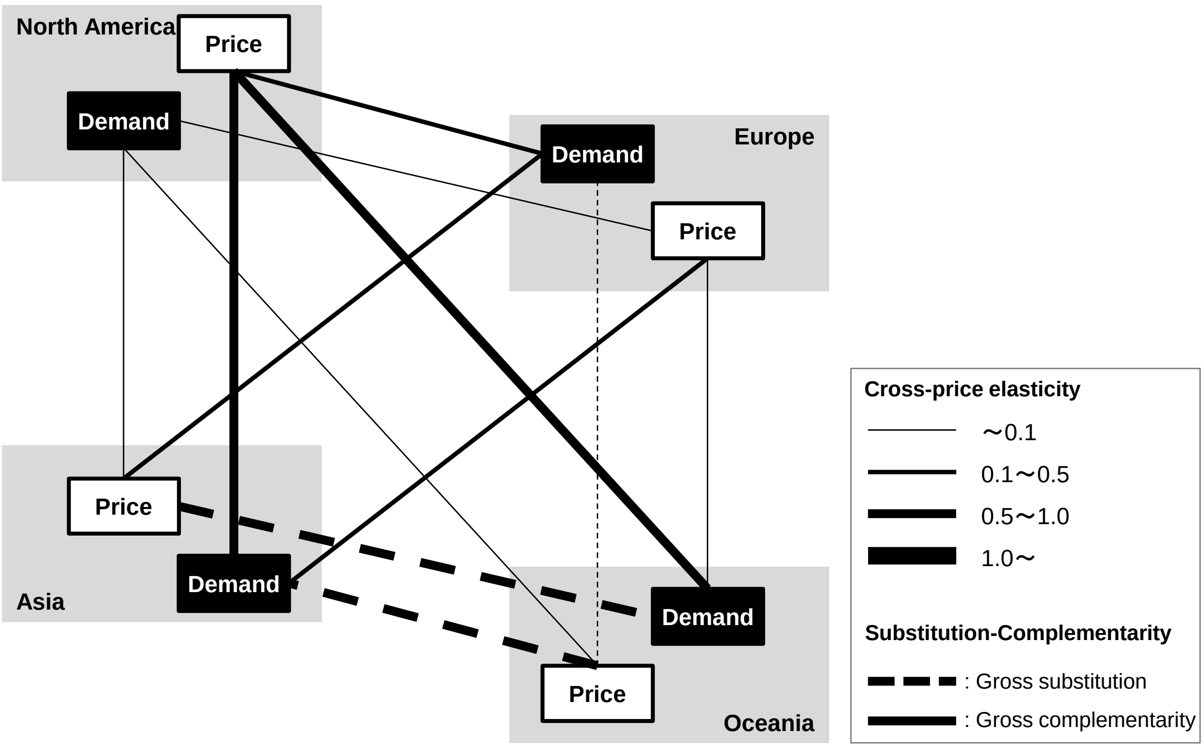

Figure 4. Interregional substitution-complementarity relationships (Outbound / Long-run).

4.2 Results of Inbound Tourism Demand

Parameter estimation

The estimation results of parameters are shown in Table 4. Same with outbound analysis, there are some problems about the model accuracy, but we use these parameters to calculate elasticities as the trial implementation in this study. The elaboration of the model structure and selection of variables are remained as the future study. The adjustment period to long-run equilibrium ($1/\lambda$) is about 42.7 years. This term is longer than outbound one (3.4 years).

Table 4. Estimated Parameter (Inbound)

Long-run									
		α_i^L	β_i^L	γ_{i1}^L	γ_{i2}^L	γ_{i3}^L	γ_{i4}^L	R^2	DW
1.North America	estimate	-0.5648	-0.1794	0.2077	-0.0350	-0.1195	-0.0532	0.8498	0.5801
	SE	0.1379	0.0242	0.0285	0.0228	0.0153	0.0274		
	t-stat	**	**	**		**	*		
2.Europe	estimate	0.1461	0.0034		0.0505	-0.0195	0.0041	0.7644	0.5535
	SE	0.1180	0.0237		0.0343	0.0162	0.0325		
	t-stat								
3.Asia	estimate	1.2624	0.1596			0.1488	-0.0097	0.7702	0.4370
	SE	0.0936	0.0167			0.0149	0.0194		
	t-stat	**	**			**			
4.Oceania	estimate	0.1564	0.0164				0.0588		
	SE	0.1380	0.0282				0.0460		
	t-stat								

Short-run									
		β_i^S	γ_{i1}^S	γ_{i2}^S	γ_{i3}^S	γ_{i4}^S	λ	R^2	DW
1.North America	estimate	-0.3448	-0.0018	-0.0004	0.0019	0.0004	0.0234	0.4263	1.9202
	SE	0.0765	0.0018	0.0004	0.0015	0.0005	0.1186		
	t-stat	**							
2.Europe	estimate	-0.0217		0.0000	0.0001	0.0003		0.0580	1.5658
	SE	0.0181		0.0004	0.0004	0.0003			
	t-stat								
3.Asia	estimate	0.3787			-0.0014	-0.0005		0.5311	1.9568
	SE	0.0654			0.0013	0.0004			
	t-stat	**							
4.Oceania	estimate	-0.0122				-0.0002			
	SE	0.0211				0.0003			
	t-stat								

NOTES:
1) estimate: estimated parameter, SE: standard error, t-stat: t-statistic.
2) R^2: coefficient of determination, DW: Durbin-Watson ratio.
3) +, * and ** denote acceptance at the 10%, 5% and 1% significance levels respectively.

Elasticities

Same with outbound case, the effects of the different variables on foreign tourists' demand to Japan are indicated by the elasticity values (as shown in Table 5).

Table 5. Expenditure, Own-price, and Cross-price elasticities (Inbound)

Short-run					
Origin	Expenditure Elasticity	Price Elasticity			
		North America	Europe	Asia	Oceania
North America	0.411	-0.992	0.0004	-0.008	0.589
Europe	0.625	-0.001	-0.999	-0.006	0.381
Asia	2.332	-0.018	-0.002	-0.980	-1.333
Oceania	0.831	0.008	0.005	-0.010	-0.835

Long-run					
Origin	Expenditure Elasticity	Price Elasticity			
		North America	Europe	Asia	Oceania
North America	0.694	-0.774	-0.039	0.158	-0.039
Europe	1.059	-0.581	-0.132	-0.407	0.060
Asia	1.561	-0.185	-0.107	-1.140	-0.128
Oceania	1.227	-0.639	0.041	-0.402	-0.225

Expenditure Elasticity The expenditure elasticity values are positive in all regions. It means the increase in expenditure of foreign tourists to Japan results increase in each city's tourism demand to Japan. Especially in Asia, the demand to Japan is the elastic whenever (elasticity > 1). It means that the expansion of Asian tourists' expenditure will have big impact to increase tourism demand to Japan. Because of the recently economic growth in Asian countries, foreign tourists' expenditure will be increased. Its growth may expand the tourism demand to Japan.

In Europe and Oceania, the impact of increase in expenditure each region is insignificant in short-term, but significant in long-run. About North America, the impact of expenditure changing is less than other regions.

Own-price Elasticity The own-price elasticity values are negative in all regions. However, compare with short- and long-run, the trend is different between Asia and other cities. Asian demand is price inelastic in short-run, but it changes to price elastic in long-run. It shows that Asian demand is affected further by increase in relative price as the equilibrium nears. Other regions are similar trend in short-term, but increase in relative price results insignificant effects on demands in long-run.

For example, if the trend of high-yen continues in the future, the trend of travel demand to Japan is unlikely quite different by region in short-run, but in long-run, Asian tourists' demand may be decreased.

Cross-price Elasticity As the general trend, the cross-price elasticity values are almost zero in short-run, but these scores will increase with time. It is similar trend with outbound analysis. However, short-run Asian elasticity is different from other regions. Asian tourism demand to Japan is resilient for relative price change in Oceania (-1.333). This value is higher than Asian own-price elasticity value (-0.980), and there are strong gross-complementary relationship. But in the long-run, almost region will be gross-complementarity (see Figure 5 and 6).

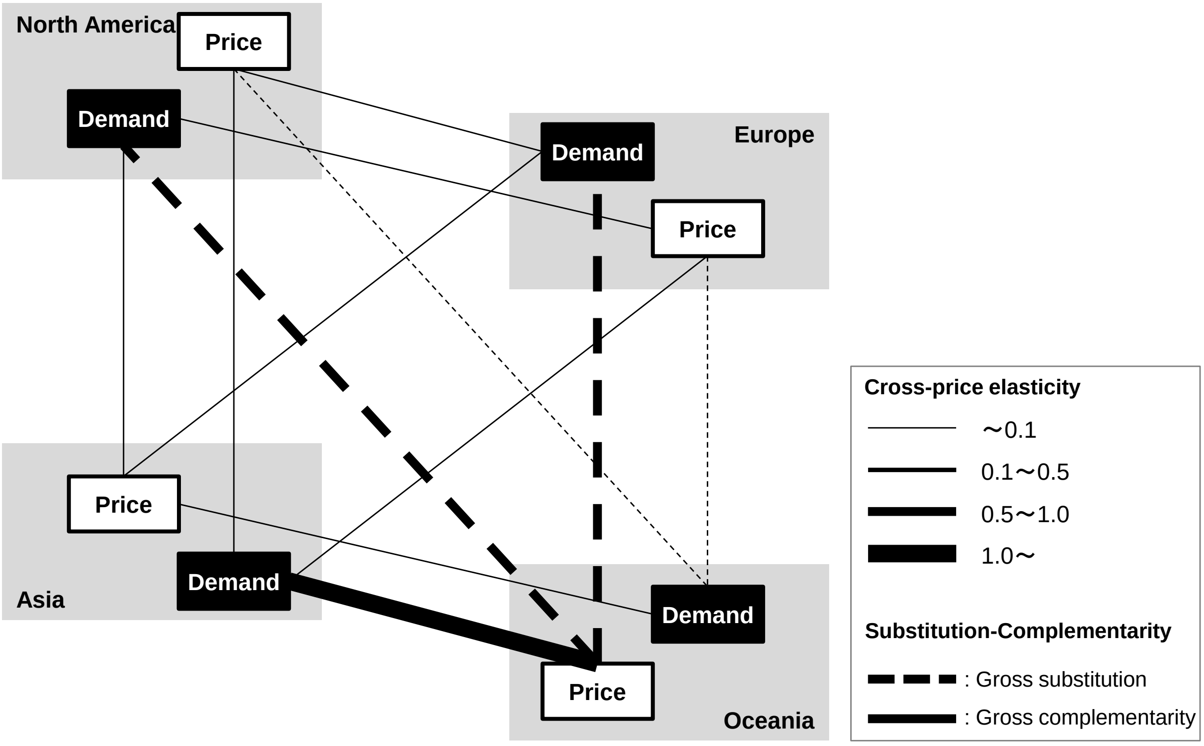

Figure 5. Interregional substitution-complementarity relationships (Inbound / Short-run).

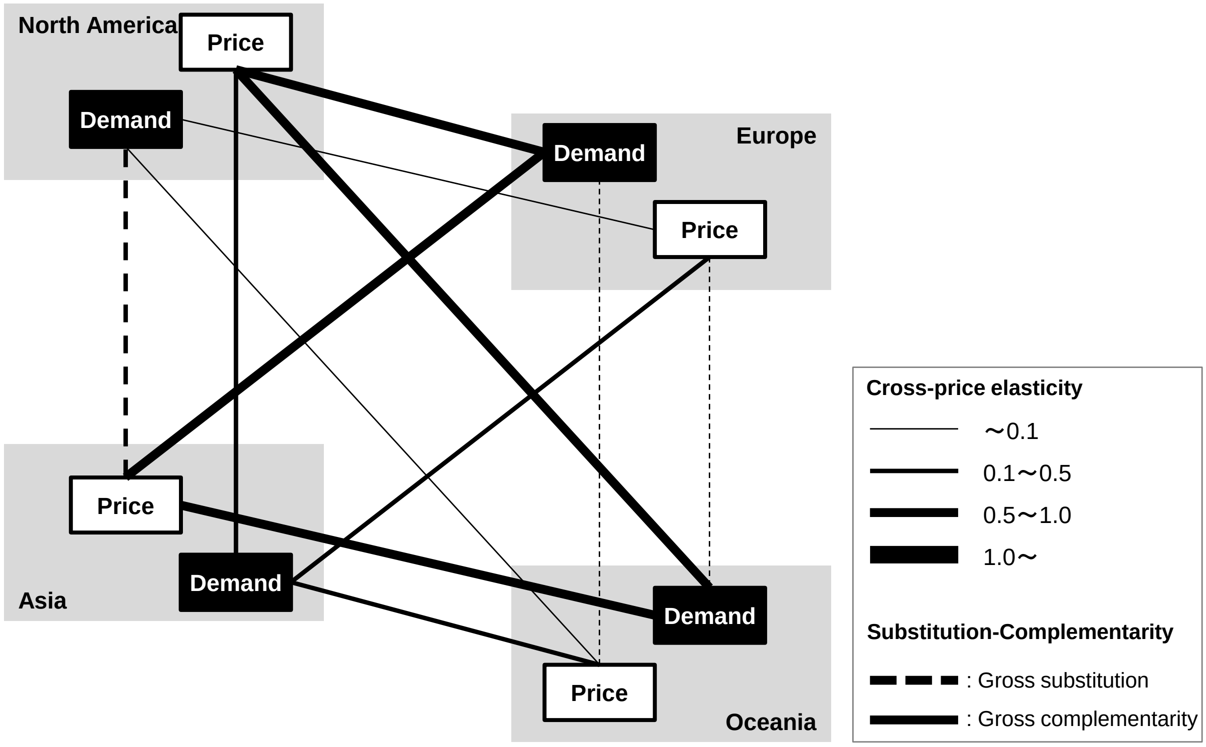

Figure 6. Interregional substitution-complementarity relationships (Inbound / Long-run).

5. CONCLUSION AND FUTURE STUDY

5.1 Conclusion

The tourism demand structure is unique in each region. Therefore, it is very important for us to make tourism policies by considering tourism demand structure in each region. In this study, the Japanese demand for tourism in the world and foreign tourists' demand for Japan have been examined using both the long-run static and the short-run Dynamic AIDS model. This study will provide some basic information to consider how to promote international tourism. We have some suggestion as the possibility of future development for policy analysis.

First of all, based on this model, we can estimate changes of the tourism demand which is affected by economic factors (ex. contraction of GDP in Japan, continuing strong yen, economic growth in foreign countries etc.). It helps us to be the proactive approach to promote tourists or control of a decline in tourists. In addition, we can consider the timeline by using this model. It means that we don't calculate elasticities only in long-run equilibrium position, but also adjustment process to equilibrium. We should consider policies which adapted to each period.

Secondly, this result is developed as not only external policies (ex. concentration on the region should do aggressive sales activities, control of a decline in tourist, etc.) but also domestic policies. For example, this study will provide us the basic information to consider the position to receive foreign tourists.

Thirdly, as previously explained, the international tourism demand is affected by price change not only in home region and partner, but also third region. To estimate more detailed future tourism demand, we should check the substitute and complementary relationship between each region, and simulate effects in case the price change is occurred in one region.

Finally, we'd like to show the application of this study for policy analysis. Nowadays, the development of inbound tourism promotes the giving of incentives for Japanese economy rather than outbound one. Thus, this here takes inbound tourism as an example of the application for policy analysis. From the result of inbound analysis, the Asian income growth will promote tourism demand to Japan in the short-run. Therefore, Japan should be targeted at gathering Asian tourists in the short term. However, the combinations of almost regions will be gross-complementary relationship in the long-run. It means that the decrease of relative price will increase tourism demand in all regions. Thus, Japan should plan to meet the expected wide demand from across the world in the long-run.

5.2 Future Study

On the other hands, there still remains future works to improve this study. First of all, some statistics of model (t-statistics, DW-ratio and R^2) are statistically-unwarranted; explanatory variables should be review.

Secondly, we can understand the correlation between objective variable and explanatory variable in AIDS model. However, we cannot understand the cause and effect relationship between these variables. We should be careful in the interpretation of study.

Thirdly, in this study, the whole world is divided into four regions because of data limitation. But this is quite macroscopic analysis for detailed policy making, so future, when performing detailed policy making, the analysis which deal with smaller zone is required.

In addition, as we mentioned previous sector, the inbound analysis has a problem of consistency with AIDS model. Because of data availability we carried out trial calculations in defiance of the problem, the model structure should be review in future study.

Finally, Because of data limitation, the tourism demand structure is estimated by pooled data which contained all-purpose oversea trip. However, the demand structure may be different by region. For example, the price elasticity may be quite different between sightseeing and business purposes. We have no data about purpose of trip in outbound tourism, but we can get purpose of trip data in each region about inbound from the immigration statistics. From this, as a ratio of tourists (sightseeing purpose) to the total visitor to Japan is variability among region like; Asia: 80%, Europe: 61%, North America: 50% and Oceania: 70%. To elaborate this model, the disaggregation of trip purpose will be essential.

REFERENCES

Japanese ministry of land, infrastructure, transport and tourism (1970-2005) White paper on Tourism. (in Japanese)

Loeb, P.D. (1982) International travel to the United States: an econometric evaluation, *Annals of Tourism Research*, 9, 7-20.

Uysal, M. and Crompton, J. (1984) Determinants of demand for international tourism flows to Turkey, *Tourism Management*, 5, 288-297.

Song, H., Romilly, P. and Liu, X. (2000) An empirical study of outbound tourism demand in UK, *Applied Economics*, 32, 611-624.

Durbarry, R., Sinclear, M. T. (2003) Market shares analysis -The case of French tourism demand-, *Annals of tourism research*, 30(4), 927-941.

Blundell, R. and Browning, M. (1994) Consumer demand and the life-cycle allocation of household expenditures, *Review of Economic Studies*, 61, 57-80.

Eakins, J. M. and Gallagher (2003) Dynamic almost ideal demand systems: An empirical analysis of alcohol expenditure in Ireland, *Applied Economics*, 35, 1025-1036.

Choo, S., Lee, T. and Mokhtarian, P. L. (2007) Do transportation and communications tend

to be substitutes, complements, or neither? –U.S. consumer expenditure perspective, 1984-2002-, *Transportation Research Record*, 2010, 121-132.
Deaton, A., Muellbauer, J. (1980) An almost ideal demand system, *The American Economic Review*, 70(3), 312-326.
Mello, M.D., Pack, A. and Sinclair, M. T. (2002) A system of equations model of UK tourism demand in neighboring countries, *Applied Economics*, 34, pp.509-521.
Witt, C. and Witt, S. (1995) Forecasting tourism demand: A review of empirical research, *International Journal of Forecasting*, 11, 447-475.
Durbarry,R.: Long run structural tourism demand modeling (2002) An application to France, Tourism and Travel Research Institute, University of Nottingham, United Kingdom.
Li, G., Song, H. and Witt, S. (2010) Modeling tourism demand: A dynamic linear AIDS approach, *Journal of Travel Research*, 43(2), 141-150.
Chang, C. C., Khamkaew, T. and McAleer, M. (2012) Estimating price effects in an almost ideal demand model of outbound Thai tourism to East Asia, Documentos de Trabajo del Instituto Complutense de Análisis Económico (ICAE), 2012(2).
Shephard, R. W. (1970) Theory of cost and production functions, Princeton University Press.
Stone, R. (1954) The measurement of consumers' expenditure and behavior in the United Kingdom, 1920-1938, 1, Cambridge University Press.
Zellner, A. (1962) An efficient method of estimating seemingly unrelated regressions and tests for aggregation bias, Journal of the American Statistical Association, 57(298), 348-368.
Japanese bureau of immigration: Immigration statistics (2010), www.moj.go.jp/housei/toukei/toukei_ichiran_nyukan.html. Accessed Nov. 5, 2010. (in Japanese)
Australian bureau of statistics (2011) Overseas Arrivals and Departures, www.abs.gov.au/. Accessed Nov. 1, 2011. (in Japanese)
Japanese bureau of statistics (2011) International statistical directory, 1970-1993. Accessed Nov. 1, 2011. (in Japanese)
Japanese bureau of statistics (2011) World statistics. www.stat.go.jp/data/sekai/index.htm. Accessed Sep. 10, 2011. (in Japanese)
Japanese bureau of statistics (2006) The new Japan historical statistics list. (in Japanese)
Takushoku university Asian information center (2006) East Asia historical economic statistics, Vol.1 (Korea), Keiso Shobo. (in Japanese)
World Bank (2011) www.worldbank.org/. Accessed Nov. 1, 2011.