A LINEAR EXPENDITURE MODEL FOR TOURISM DEMAND

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Abstract: This study builds a linear expenditure model for demand analysis of domestic US tourism. The model starts with the assumption of consumer utility maximization under budget constraints and uses five commodity groups: transportation, lodging, food service, entertainment/recreation, and other goods and services. The findings suggest that among the tourism-oriented products, transportation is the most price sensitive product. The widely held perception that tourism products are a luxury may result from the income effect on transportation. The study reveals that the possibility for budget cutting is greatest for transportation and for food service is least. Keywords: linear expenditure systems model, elements of tourism, income and price elasticities, cross price elasticities, minimum subsistence levels.

Résumé: Un modèle linéaire de dépenses pour la demande touristique. Cette étude construit un modèle linéaire de dépenses pour analyser la demande du tourisme intérieur aux USA. Le modèle commence par l'hypothèse de la maximisation de l'utilité par le consommateur sous des contraintes budgétaires et utilise cinq groupes de produits: transports, logement, service alimentaire, distractions et récréation, et d'autres biens et services. L'article suggère que parmi les produits du tourisme, les transports sont le produit le plus sensible aux prix. La perception très répandue que le tourisme est un luxe peut provenir de l'effet des revenus sur les transports. L'étude montre que la possibilité de réduire le budget est la plus grande pour les transports et la moindre pour le service alimentaire. Mots-clés: modèle linéaire des systèmes de dépenses, éléments du tourisme, élasticité des revenus et des prix, élasticité des prix mélangés, niveaux minimum de subsistance.

INTRODUCTION

Three elements necessary to tourism are tourism-oriented products, resident-oriented products, and background tourism elements (Jafari...
Tourism-oriented products include accommodations, food service, transportation, travel agencies and tour operators, recreation and entertainment, and other travel trade services (Table 1). As tourists extend their stay at destination sites, they may increase their use of resident-oriented products, such as hospitals, bookstores, or barber shops. When utilizing tourism and resident-oriented products, tourists also are exposed to or experience the background tourism elements such as natural, sociocultural, and manmade attractions that frequently constitute their main reasons for travel.

Some background tourism elements are often free goods (supply) as plentiful as sunshine (Jafari 1983). However, for most tourism- and resident-oriented products, tourists have to pay in exchange for the product. For instance, to use accommodations and public transportation, or to get health service, tourists have to compensate providers. Therefore, supply and demand of tourism- and resident-oriented products have similar economic characteristics and can be analyzed in the same context, in contrast to the background tourism elements (Gunn 1980; Leiper 1979).

In general, poor performance of one travel-related industry affects the tourism industry as a whole (Jafari 1983). Poor-quality service of one tourism sector may ruin the whole travel experience and can create a negative image of the destination. In addition to the service performance, there is the tourism development that should also be balanced. For instance, if the hotel industry is overdeveloped, compared to other tourism industries at the destination, that industry may suffer a low occupancy rate. If the industry is underdeveloped, the destination cannot accommodate all potential tourists, and thereby loses revenue. Moreover, economic activities in a country are often highly correlated. For example, if sales of manufactured goods increase, other industry performances are also boosted. Income acquired from manufacturing businesses further entices spending on other goods and services, and consequently, other businesses are improved. Thus, in this context, it can be observed that expenditures on different tourist goods and services are interrelated and tourist expenditures are related to the demand for nontourist goods as well. Therefore, the estimation of the demand for tourism may lead to a system approach (Adnur 1980; Baud-Bovy 1982; Groote 1983; Inskeep 1988; Leiper 1979).

<table>
<thead>
<tr>
<th>Tourism-Oriented Products</th>
<th>Resident-Oriented Products</th>
<th>Background Tourism Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lodging</td>
<td>Hospitals</td>
<td>Natural Attractions</td>
</tr>
<tr>
<td>Food Service</td>
<td>Shopping Malls</td>
<td>Sociocultural Attractions</td>
</tr>
<tr>
<td>Transportation</td>
<td>Barbar Shops</td>
<td>Man-made Attractions</td>
</tr>
<tr>
<td>Travel Agencies and Tour Operators</td>
<td>Police</td>
<td></td>
</tr>
<tr>
<td>Entertainment/Recreation</td>
<td>Fire Station</td>
<td></td>
</tr>
<tr>
<td>Other Travel Trade Services</td>
<td>Bookstore</td>
<td></td>
</tr>
</tbody>
</table>

Source: Jafari (1982).
The purpose of this study is to build a linear expenditure model for demand analysis of domestic tourism of the United States. The implications drawn from the resulting income elasticities, price elasticities, cross-price elasticities, and minimum subsistence levels can further the understanding of tourism behavior.

MODEL SPECIFICATION AND DATA ANALYSIS

The linear expenditure system model used to accomplish the purpose of this study was first developed by Stone (1954). It assumes that a tourist maximizes his or her utility under budget constraints. The expenditure for one commodity group can be expressed as (Philsps 1983):

\[ z_i = p_i x_i = r_i p_i + B(M - \Sigma r_j p_j) + e_i. \]  

(1)

where

- \( z = \) expenditure on a commodity (transportation, food, recreation, etc.)
- \( p = \) price
- \( x = \) quantity
- \( r = \) minimum subsistence quantity necessary to maintain the minimum level of life,
- \( B = \) coefficient estimate,
- \( M = \) total expenditure,
- \( e = \) error term, and
- \( i = \) subscript denoting own (single) product, and
- \( j = \) subscript denoting all products including \( i \), with \( 0 < B_i < 1 \), \( \Sigma B_i = 1 \) and \( x_i > r_i \).

This equation has two components: the minimum subsistence level expenditure \( (r_i p_i) \) and marginal budget shares \( (B_i) \) with the supernumerary income \( (M - \Sigma r_j p_j) \) (Philsps 1983). The minimum subsistence level expenditure is the amount necessary to maintain the minimum level of life. The marginal budget share indicates the proportional share \( (B_i) \) of the expenditures \( (M - \Sigma r_j p_j) \) by the given product, which remains after minimum subsistence level expenditures on all goods \( (\Sigma r_j p_j) \) are subtracted from the total expenditures \( (M) \). This remaining expenditure is the supernumarary income, which can be allocated among the various consumer products.

Data used in this study span from 1972 to 1987 (16 data points). Data for business receipts related to tourism were obtained from The 1988–89 Economic Review of Travel in America prepared by the US Travel Data Center (1989). Table 2A in The 1988–89 Economic Review of Travel in America has nominal business receipts data, and Table 2B displays the data in 1982 dollars. The data include receipts of air, bus, rail transportation, lodging, food service, and entertainment/recreation. Instead of using all three components of transportation (air, bus, and rail), by adding up the receipts of all three components, a single commodity group (transportation) was created.

Gross national product (GNP) figures in nominal terms, in 1982
dollars, and population were acquired from the *Economic Report of the President* (US Government 1989). GNP rather than gross domestic product (GDP) was used in the analysis. The former is the measure of total domestic and foreign output claimed by residents of a country, including the net factor income from abroad. Expenditures on other goods and services were calculated by subtracting the travel-related expenditure (sum of transportation, lodging, food services, and entertainment/recreation) from GNP.

All expenditure \( (z_j) \) and GNP used in the analysis are the nominal terms to insure that total expenditure \( (\sum z_j) \) equals money income (Parks 1971), and are converted into per capita terms by deflating by population. Nominal prices are obtained by dividing the nominal values by the 1982 dollar values.

In order to allocate the supernumerary income among the various consumer products, equation 1 can be rewritten as:

\[
\begin{align*}
z_1 &= r_1(1 - B_1)p_1 - r_2B_2p_2 \ldots - r_IN_{Mn} + B_M + e_1 \\
z_2 &= r_1B_2p_1 - r_2B_2p_2 \ldots + r_2B_2p_2 + b_2M + e_2 \\
&\quad \vdots \\
z_n &= -r_1B_n p_1 - r_2B_n p_2 \ldots + r_n(1 - B_n)p_n + B_nM + e_n. \\
\end{align*}
\]

with the same restrictions as equation (1).

The linear expenditure system has three conditions: additivity, homogeneity, and symmetry of the substitution matrix. The sum of each component expenditure is equal to the total expenditure (additivity). If the total expenditure \( (M) \) and prices are multiplied by the same number, the expenditure \( (z_j \text{ or } p_j x_j) \) should be multiplied by the same number (homogeneity) (Malinvaud 1970).

In this study, there are five commodity groups: transportation, lodging, food service, entertainment/recreation, and other goods and services (GNP minus transportation-lodging-food services-entertainment/recreation). However, the estimation was performed by using only four \((N - 1)\) equations, as, due to the constraints that \( \sum B_j = 1 \), the sum of the disturbance terms for each year is zero (Parks 1969, 1971). Thus, the covariance matrix is singular, and the OLS estimation is inefficient. The problem of singularity can be eliminated by estimating for \( N - 1 \) equations. The coefficient estimate \( B \) for the \( N \)th equation can be obtained by an appropriate linear combination. In this study, the equation for other goods and services is deleted, since the major interest of this study is tourism related industry demand analysis.

The income elasticity of demand is \( B/S_i \), where \( S_i = \) share of budget by the commodity group \( i \), since:

\[
\begin{align*}
p_j x_j &= \alpha \ldots + B_j M. \\
p_j \left( \frac{\partial x_j}{\partial M} \right) &= B_j. \\
\left( \frac{M}{x_j} \right) \left( \frac{\partial x_j}{\partial M} \right) &= \left( \frac{M}{x_j} B_j \right) B_i = B_i/S_i. \\
\end{align*}
\]
There are two kinds of price elasticities: uncompensated and compensated price elasticities (White 1985). The uncompensated price elasticity indicates the effect of a 1% price change in the quantity demanded of that good and for other goods. The compensated price elasticity measures this effect under the assumption that real expenditure is held constant. The signs of compensated cross-price elasticities indicate whether the related goods are substitutes (positive) or complements (negative) (White 1985). The uncompensated and compensated price elasticities of demand are, respectively:

\[
\frac{(p_j/x_i)}{(\partial x_i/\partial p_j)} = -\delta_{ij} + (\delta_{ij} - B_j) \left\{ \frac{(r_jp_j)}{(x_jp_j)} \right\}
\]

and

\[
(p_j/x_i)S_{ij} = (B_j - \delta_{ij}) \left\{ \frac{(x_jp_j - r_jp_j)}{(x_jp_j)} \right\}
\]

where \(\delta_{ij} = 1\) if \(i = j\), and \(\delta_{ij} = 0\) if \(i \neq j\) (Abbott and Ashenfelter 1975).

Since only broad commodity groups are considered in this model, income, own (self) price, and cross-price elasticities of demand have implications only on those broad commodity groups: transportation, lodging, food service, entertainment/recreation, and other goods and services. While not all commodity groups are totally dependent on tourism-generated expenditures, the interrelationships should remain relatively proportionate for the general purposes of this study. For instance, the elasticity of transportation may differ from elasticities of air transportation, bus, and rail travel. Elasticities of a hotel chain may differ very much from elasticities of the whole hotel industry.

To estimate four \((N - 1)\) linear expenditure systems equations, the seemingly unrelated regression equation (SURE) procedure was used. The linear expenditure system permits only income and price to explain consumption behavior. However, the consumption behavior is affected not only by income and price, but also by other factors such as preference, lifestyle, and so on. Therefore, the residuals of each equation include information regarding those factors not considered in the equation, and consequently, are clearly correlated with residuals of other equations. Thus, the SURE procedure was employed in estimating the linear expenditure system.

The correlations between residuals from the nonlinear ordinary least square (OLS) estimation are presented in Table 2. Because of the singularity of the residual matrix that causes inefficient estimation,

**Table 2. Correlation Between Error Terms**

<table>
<thead>
<tr>
<th>Tourism-Oriented Products</th>
<th>Transportation</th>
<th>Lodging</th>
<th>Food Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lodging</td>
<td>0.438(^a)</td>
<td></td>
<td>0.701(^b)</td>
</tr>
<tr>
<td>Food Service</td>
<td>0.608(^b)</td>
<td>0.274</td>
<td>0.580(^b)</td>
</tr>
<tr>
<td>Entertainment/Recreation</td>
<td>0.415</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) Significant at the 0.10 level.
\(^b\) Significant at the 0.05 level.

Note: Other goods and services = (GNP minus transportation-lodging-food service-recreation/entertainment). The GNP account includes personal consumption expenditures, gross private domestic investment, net exports of goods and services, and government purchases of goods and services.
only four \((n - 1)\) equations are used in correlation appraisal. If the effects of price and income are removed, food consumption away from home is positively correlated with tourist spending behavior on other tourism-oriented products. By the same reasoning, demand for lodging and transportation are interrelated to each other. For instance, if people travel further, transportation costs increase, and expenditures on food away from home are more than staying at home \((r = 0.608)\). When tourists stay in commercial accommodations, they usually have to purchase food \((r = 0.701)\). Tourists usually stay in commercial accommodations when they travel \((r = 0.438)\). However, entertainment and recreation are not necessarily related with transportation and lodging (insignificant correlations) because many entertainment and recreation activities are accommodated in areas not far from residence. Usually, such activities do not require lodging facilities (insignificant lowest correlation coefficient = 0.274).

\(R^2\)'s of the SURE estimation for transportation, lodging, food service, and entertainment/recreation were 0.989, 0.995, 0.995, and 0.989, respectively. The Durbin-Watson \(d\) Statistic of equations for transportation, lodging, food service, and entertainment/recreation were 0.678, 1.318, 0.825, and 1.117, respectively. Autocorrelation was ignored in estimating the system. If data are transformed because of autocorrelations, the money income differs equation by equation. This difference makes it difficult to impose a restriction that \(\sum B_i = 1\) (for further explanation, see Deaton 1975). Both nonlinear OLS and SURE parameter estimations of the linear expenditure system were tested (see Table 3 for SURE and Table 4 for OLS). SURE gained marginal efficiency over OLS. The significance of \(B\) for lodging and \(r\) for transportation shows marginal improvement.

All parameters are highly significant. \(B\) for other goods and services was calculated by subtracting from one the sum of the other \(B_i\). In the SURE estimation, \(B_i\) for the tourism-oriented commodity equations (transportation, lodging, food service, entertainment/recreation, and other) ranges from 0.010 to 0.027. That of other goods and services (resident-oriented products) is 0.933. Those of OLS show almost no difference from SURE.

The estimates of minimum subsistence level \((r_i)\) have increased a little. The minimum subsistence level for the nonlinear OLS can be

### Table 3. The Linear Expenditure System Estimation Results of SURE

<table>
<thead>
<tr>
<th></th>
<th>(B_i) (Significant)</th>
<th>(r_i) (Significant)</th>
<th>(r_i P_i) (% of (z_i))</th>
<th>(R^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>0.018</td>
<td>51.645</td>
<td>42.401</td>
<td>0.989</td>
</tr>
<tr>
<td>\textit{(S 99.106)}</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(42.8%)</td>
<td></td>
</tr>
<tr>
<td>Lodging</td>
<td>0.010</td>
<td>106.950</td>
<td>84.918</td>
<td>0.995</td>
</tr>
<tr>
<td>\textit{(S115.119)}</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(73.8%)</td>
<td></td>
</tr>
<tr>
<td>Food Service</td>
<td>0.027</td>
<td>344.890</td>
<td>288.670</td>
<td>0.995</td>
</tr>
<tr>
<td>\textit{(S374.315)}</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(77.1%)</td>
<td></td>
</tr>
<tr>
<td>Entertainment/Recreation</td>
<td>0.012</td>
<td>102.790</td>
<td>90.250</td>
<td>0.990</td>
</tr>
<tr>
<td>\textit{(S128.539)}</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(70.2%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.933</td>
<td>9694.869</td>
<td>8017.500</td>
<td></td>
</tr>
<tr>
<td>\textit{(S10978.630)}</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(73.0%)</td>
<td></td>
</tr>
</tbody>
</table>

Note: \(B\) of other goods and services is one minus sum of all other \(B_i\).
Table 4. The Linear Expenditure System Estimation Results of OLS

<table>
<thead>
<tr>
<th></th>
<th>$B_i$ (Significant)</th>
<th>$T_i$ (Significant)</th>
<th>$T_iB_i$ (% of $x_i$)</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td>0.018</td>
<td>49.531</td>
<td>40.665</td>
<td>0.989</td>
</tr>
<tr>
<td>($99.106)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(41.0%)</td>
<td></td>
</tr>
<tr>
<td>Lodging</td>
<td>0.009</td>
<td>106.390</td>
<td>84.474</td>
<td>0.995</td>
</tr>
<tr>
<td>($115.119)</td>
<td>(0.003)</td>
<td>(0.000)</td>
<td>(73.4%)</td>
<td></td>
</tr>
<tr>
<td>Food Service</td>
<td>0.027</td>
<td>341.660</td>
<td>285.970</td>
<td>0.995</td>
</tr>
<tr>
<td>($374.315)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(78.4%)</td>
<td></td>
</tr>
<tr>
<td>Entertainment/Recreation</td>
<td>0.012</td>
<td>99.905</td>
<td>87.717</td>
<td>0.989</td>
</tr>
<tr>
<td>($128.539)</td>
<td>(0.008)</td>
<td>(0.000)</td>
<td>(68.2%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.934</td>
<td>3511.610</td>
<td>7866.100</td>
<td></td>
</tr>
<tr>
<td>($10978.630)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(71.6%)</td>
<td></td>
</tr>
</tbody>
</table>

Note: $B_i$ of other goods and services is one minus sum of all other $B_i$, interpreted as the minimum required quantity when only income and prices are considered. In the nonlinear SURE estimation case, the implication of the minimum subsistence level includes effects of income, prices, and other factors (such as lifestyle and quality of life in a society) by incorporating correlations between residuals of equations. Because tourism is closely related with value, lifestyle, and quality of life, the SURE estimation is conceptually attractive over OLS.

The minimum subsistence level expenditure of the nonlinear OLS estimation comprises 41.0% (transportation) to 76.4% (food service) of the total consumption of each product. The minimum subsistence level expenditures of the nonlinear SURE parameter estimation ranges from 42.8% (transportation) to 77.1% (food service). The greatest increase is shown in the entertainment/recreation sector (2.0%), followed by transportation (1.8%). The expenditure of food service is the largest cost in terms of both mean expenditure and minimum and subsistence level.

Implications of the minimum subsistence level in absolute terms are not the major concern in this study, because of parameter estimator changes by deleting different equations. The key point here is the relative proportional magnitude of the minimum subsistence level of a commodity group, compared to that of other product groups. The relative magnitudes do not change substantially by deleting an equation.

If consumption behavior is considered under the assumption that only income and prices affect the minimum subsistence level (the nonlinear OLS estimation), the purchase of food away from home has the highest level of minimum subsistence (76.4%). The proportional magnitude of the food service subsistence level is followed by lodging (73.4%), other (71.6%), entertainment/recreation (68.2%), and transportation (41.0%). When all factors are considered in estimation (the nonlinear SURE estimation), the minimum consumption level of food service to enable travel is the highest (77.1%), followed by lodging (73.8%), other (73.0%), entertainment/recreation (70.2%), and transportation (42.8%).

For both estimations, the minimum subsistence level of foods purchased away from home is greatest, which implies that expenditures
on food consumption away from home cannot be reduced much compared to other items. The greatest proportional budget reduction is possible for transportation in both estimations. This finding implies that if there is a budget limitation or transportation price hike, visiting closer places may be the most favorable alternative. Therefore, to enable tourists to travel to far destinations, finding a market with sufficient discretionary income that can afford transportation costs is critical. When a target market is in close proximity, appealing to the public in general with a message of transportation cost reduction can be persuasive and attractive.

**DISCUSSION ON ELASTICITIES**

Income elasticities and uncompensated and compensated price elasticities are presented in Tables 5 and 6. The elasticities were calculated by following formulas 5, 6, and 7, with the SURE estimation results. The income elasticity of transportation is greater than one (2.124). Demand for food service is inelastic (income elasticity = 0.846). Other income elasticities of demand are almost unitary (Table 5).

The price elasticities of demand do not show much difference from that of Abbott and Ashenfelter's study (1975), which has two similar commodity groups: food and transportation services. The uncompensated price elasticities of transportation and food of their study were \(-0.637\) and \(-0.605\), respectively. The compensated were \(-0.537\) and \(-0.442\). The uncompensated price elasticities of this study are \(-0.580\) and \(-0.250\) for transportation and food service. The compensated values are \(-0.562\) and \(-0.223\) (Table 6). The differences of the elasticity estimation may be due to differences in data used. Abbott and Ashenfelter (1975) used food consumption at home and away from home.
home, as well as alcoholic beverages. Transportation data included locally purchased and intercity transportation, as well as user-oriented transportation services. However, this study utilized data only from food service receipts of eating and drinking places, and transportation data that only included business receipts of air, bus, and rail services.

Uncompensated own price elasticities ranged from \(-0.250\) (food service) to \(-0.951\) (other). The compensated are from \(-0.018\) (other) to \(-0.562\) (transportation). The difference of the uncompensated and compensated price elasticities for other goods and services is the greatest (0.933). The next greatest difference is that of food service (0.027). Cross-price elasticities caused by other goods and services, and food services are the greatest, for both uncompensated and compensated. Cross-elasticities in the transportation equation are greater than those in other equations.

The income elasticity of demand for transportation is greater than one (2.124) (Table S), suggesting that transportation is a luxury product. The increased rate of spending on transportation is greater than that of income. This finding suggests that tourists tend to travel farther when their income increases, if the expenditure on transportation is proportional with the distance of travel. Yet the distance that they travel increases at a faster rate than the increased rate of income. On the other hand, spending increases on food is less than income increases, and expenditures on other products increase at about the same rate as income.

All uncompensated price elasticities have minus signs that imply that as prices increase, quantities demanded for those goods decrease. The uncompensated own price elasticity indicates a percentage change of the quantity demanded because of one percent change of the price, under the budget constraints. For instance, with 1% increase of the transportation price, 0.58% of the transportation quantity demanded decreases, and total expenditures on transportation increase (because the price elasticity of demand is inelastic). The uncompensated own prices elasticities of lodging, food service, and entertainment/recreation do not show much difference. They are between \(-0.249\) and \(-0.306\). The uncompensated own price elasticity of other goods and services are almost unitary (\(-0.951\)). In the uncompensated price elasticity context, the resident-oriented product is more price elastic than the tourism-oriented products. This finding may be due to a stable market with many higher income tourists or business people who travel, even though there is a price increase.

The uncompensated cross-price elasticity indicates the percent change of quantity demanded for a commodity group when there is a 1% change in related goods' prices. For example, as the food service price rises by one percent, the transportation quantity demanded decreases by 0.052%. All uncompensated cross-price elasticities have minus signs. As spending on one commodity group increases because of a price hike, expenditures on other goods are reduced to meet the budget constraints. If the price of any good increases, people tend to decrease spending on transportation most, as cross-elasticities in the transportation equation are greatest. If the price of other goods and services increases by one percent, 1,456% of transportation quantity
demanded decreases. Cross-price elasticities are very small, except for other goods and services. Because the budget share of other goods and services is relatively large, the cross-price elasticities of it are greater than others.

The compensated own price elasticities range from $-0.018$ (other) to $-0.562$ (transportation). The compensated price elasticity considers the pure substitution effects of the price change for given budget constraints, when the real expenditures are held constant. In other words, the compensated price elasticity measures the influence of price change on a commodity group demanded under budget constraints, when there is no real expenditure difference. Among the tourism-oriented products, transportation is the most price sensitive product.

Compensated cross-price elasticities have the same implication as the uncompensated cross-price elasticity, except for the meaning that real expenditures hold constant. Moreover, the compensated cross-price elasticities indicate whether the goods are complements or substitutes. Since all signs of compensated cross-price elasticities are positive, all the products considered in this model are substitutes. However, the substitution effects between tourism-oriented goods, as one particular tourism-oriented product price increases, do little to change the overall spending pattern. Among these small substitution effects of the spending pattern, the change of food service price contributes most to the quantity demanded for other products. On the other hand, the influence of resident-oriented product is greater than that of tourism-oriented products. The compensated cross-price elasticities caused by other goods and services are between 0.214 and 0.538. This is due to a large budget share of other goods and services.

The differences between uncompensated and compensated own price elasticities are less than 0.1, except for the other goods and services (0.933). These findings indicate that, in the real expenditure, tourism-oriented products are more price sensitive compared to resident-oriented products, which almost never change in real terms, in contrast to the uncompensated own price elasticities.

CONCLUSIONS

To achieve the purpose of the study, a linear expenditure system was developed. The system starts with the assumption of consumer utility maximization under budget constraints and constructs the model as a function of income and prices of commodity groups. The system is useful for both forecasting and for demand analysis. By entering expected independent variable values for the coming years in the model, the future expenditures on a commodity group can be estimated. From the income and price elasticities, effects of income and price changes on the quantity demanded can be analyzed. A minimum subsistence level estimator can be helpful in the demand analysis because of its implication concerning the irreducible consumption level, which is useful as an important indicator of market stability.

The estimations may require further verification by utilizing other consumer demand systems methods, such as the almost ideal demand
system, the Rotterdam model, and the indirect addilog model (Deaton 1974; Parks 1969; White 1985). Experiments with other estimation methods (such as the maximum likelihood estimation) are necessary, in addition to the iteration process used in this study.

While definitive models are not yet available, attempts should be made to further refine the works presented here to explain more fully tourist choices and expenditure patterns.

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