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More or Better?
Quantity and Quality Issues in Tourism Consumption

by

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More or Better?

Quantity and Quality Issues in Tourism Consumption

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Abstract

The tourism industry is facing a dilemma whether to increase capacity or improve quality in order to meet growing tourism expenditures. The ability to decompose expenditures into their quality and quantity components can provide insight for the industry's decision-makers. A theoretical model of household demand for tourism was developed while distinguishing between quality and quantity of the households' vacations. Income and price elasticities for both level of quality and number of vacation days are derived. By applying the model to Israeli data, it was found that about half of the increase in tourism expenditure is due to increases in the level of vacation quality and the other half to changes in the number of vacation days.

Keywords: quality and quantity; unit value; income and demand elasticity

INTRODUCTION

Tourism expenditure worldwide was reported at US $533 billion in 2003; it has been increasing at an annual rate of 4 percent since 1995 (WTO). This continuous growth in expenditure reflects not only an increase in the number of vacation days but also an increase in the quality of the consumed tourism services. Most of the papers analyzing household tourism demand do not distinguish between vacation quality and quantity. Therefore, it is difficult to identify which part of the increase in tourism expenditure pertains to an increase in the number of vacation days and which to an increase in its quality. The emergence of boutique hotels, spas and other luxury-tourism facilities indicates a shift in preference towards high-quality tourism services. To analyze the rising expenditures and use that information for planning and forecasting in the tourism industry, it is important to investigate the make-up of those expenditures. In this paper, the demand for tourism in Israel is estimated while distinguishing between quantity and quality of the consumed vacations. About half of the increase in tourism expenditure is found to be due to an increase in the level of vacation quality and the other half to a change in the number of vacation days.

In studies estimating demand for vacations using cross-sectional data of household expenditure surveys, the underlying assumption is that prices are constant across households. As a result, the demand function collapses into the Engel curve, price elasticities cannot be obtained and income elasticities are estimated under the assumption that prices do not vary. In the following examples of such studies, the income elasticities were estimated to be larger than one in most cases. Davies and Mangan (1992) used a UK family expenditure survey and estimated the mid-point income elasticity to be 2.1. Poor households had an elasticity of 4 and wealthy ones an elasticity of 1.5. Similarly, Van Soest and Kooreman (1987) and Melenberg and Van Soest (1996) studied the factors determining vacation expenditures in Dutch households. They also used cross-sectional data, but unlike Davies and Mangan (1992), they took into consideration the fact that only a fraction of the households have non-zero expenditures. In the first Dutch study, it was found that vacations abroad are a luxury good with an income elasticity of 2.1, whereas domestic vacations are a basic good with an income elasticity of only 0.7 (Van Soest and Kooreman, 1987). In the latter study (Melenberg and Van Soest, 1996), using parametric and semi-parametric modeling, income elasticity was found to be 1.7. In other papers analyzing leisure and recreation expenditures based on cross-sectional data (Costa, 1997, 1999; Weagley, 2004), similar findings of income elasticities larger than one have been reported.

All the aforementioned works make the implicit assumption that prices are constant across households. Accordingly, an income elasticity larger than one implies that if a household enjoys an increase in income it will increase its tourism expenditures more rapidly. However, since prices are constant, this means that the increase in expenditures reflects only an increase in the number of vacation days. It does not reflect changes in the quality of the vacations. Another problem with such estimates has been reported by Polinsky (1977), who showed that econometric estimates of expenditure function using cross-sectional data are biased if prices do vary across households. It is shown below that in the case of vacation consumption, prices vary across households.

The problem of obtaining prices from household expenditure surveys has been overcome in recent papers on demand for food. Additional data on the quantity consumed enabled researchers to obtain prices (unit values). Since expenditures are the product of a good's price and quantity, dividing expenditures by number of units consumed yields price (Cox and Wohlgenant, 1986; Deaton, 1988; Nelson, 1991; Dong, Shonkwiler and Capps, 1998). Using unit values enables an estimation of price elasticity and an unbiased estimation of income elasticity. It also enables the distinction between quality and quantity decisions for vacations consumed.

The unit value differs from the price of a homogeneous good if an aggregate commodity, such as vacation, is considered. Expenditure on vacations includes hotel nights consumed locally and abroad, travel, and other related recreational activities. Thus, vacation is a heterogeneous commodity and its unit price reflects differences in quality. For our purposes, a unit of tourism consumption is one vacation day. Accordingly, the unit value per day of vacation taken by a high-income household is probably higher than that paid for by a low-income family. A higher unit value per day of vacation reflects a household's decision to stay, for example, in a five-star hotel rather than a two-star hotel. A vacation day during the high season is a better quality product than in the off season because the weather is better or it is more convenient in terms of school or work vacation policies. Unlike prices of homogeneous goods, the unit value is not independent of income. This means that the unit value as a price is endogenous to the household and it should be accounted for in the derivation of elasticities and in the estimation procedure.

In this paper, two demand models for vacations with and without unit values are compared. In both cases, the estimation takes into consideration the fact that some of the households have zero expenditure and thus information about the vacation's unit value and expenditure is not available for them.

QUALITY AND QUANTITY ISSUES IN HOUSEHOLD CONSUMPTION

Houthakker (1952) and Theil (1952) studied the impact of variations in quality on the economic analysis of household consumption. Nelson (1991) found this model to be problematic and offered an alternative approach, which was further developed by Dong et al. (1998). The latter approach is followed here.

Theoretical Model

The maximization problem of a household is defined as follows:

$$U = U(x_1, x_2, ... x_R) \quad (1)$$
$$s.t. \quad \sum_{i=1}^{R} p_i x_i = Y$$

where x_i and p_i are the quantity and price of *R* elementary goods, respectively. In the case of vacations, x_k is the number of vacation days the household spends at site *k*. Prices of each of the elementary *x*'s are constant across households and exogenous.

Accordingly, the demand function of each elementary good is:

$$x_i = x_i(p_i, Y) \quad (2)$$

To understand the consumption patterns of tourism as one commodity, one cannot analyze each type of vacation separately. The different elements of the vacation need to be aggregated into one composite commodity. To overcome the problem of aggregating “apples with oranges,” homogeneous separability of preferences should exit. According to Nelson (1991), this can be achieved by assuming that prices within an aggregate commodity vary proportionally. For example, in the high season, prices of different tourism services go up. Since the only aggregate commodity we are interested in here is vacation, we have only two composite goods, vacations and all other goods. In this case, the price of each of the elementary goods in the composite-goods vacation can be written as follows:

$$p_i = \hat{p}_V q_i \quad \forall i \in G_V \tag{3}$$

where q_i is the number of quality units in the aggregate-commodity vacation (V); for example, q_i for a five-star hotel is higher than for a three-star hotel. $\hat{p}_V$ is the price of one unit of vacation quality (Nelson defines it as a group-specific price-level indicator), G_V is the sub-group of elementary goods that belong to the composite-commodity vacation.

By the Hicksian composite commodity theorem, the composite-commodity vacation can be defined as:

$$V = \sum_{i \in G_V} q_i x_i \tag{4}$$

V can be interpreted as the number of quality units of vacation consumed by the household. The number of days of each vacation cannot be summed up because they differ in their quality. However, converting the vacation days into quality units enables their summation and the creation of a quantity measure of the aggregate commodity.

Similarly, we can define all other goods as *Z*:

$$Z = \sum_{i \notin G_V} q_i x_i \tag{5}$$

The problem faced by the household in (1) can now be rewritten in terms of commodities, and not elementary goods, as follows:

$$\begin{aligned} &U = U(V, Z) \\ &s.t. \quad \hat{p}_V V + Z = Y \end{aligned} \tag{6}$$

The price of *Z*, i.e. all other goods, is one and *Z* is taken as the numéraire.

Accordingly, the demand function for the aggregate-commodity vacation is:

$$V = V(\hat{p}_V, Y) \tag{7}$$

The homogeneity of *V* (measured in quality units) and the exogeneity of $\hat{p}_V$ lead to the desired price and income elasticities with the required properties.

The Hicksian approach developed by Nelson (1991) allows writing total expenditures on vacations as follows:

$$E_V = \sum_{i \in G_V} p_i x_i = \sum_{i \in G_V} \hat{p}_V q_i x_i = \hat{p}_V \sum_{i \in G_V} q_i x_i = \hat{p}_V V \tag{8}$$

The unit value, π_V , calculated by dividing total vacation expenditure by the number of vacation days, receives the following form:

$$\pi_V = \frac{E_V}{\sum_{i \in G_V} x_i} = \frac{\hat{p}_V V}{\sum_{i \in G_V} x_i} = \hat{p}_V \sum_{i \in G_V} q_i \frac{x_i}{\sum_{i \in G_V} x_i} \tag{9}$$

The unit value can be interpreted as the weighted sum of quality units, all multiplied by the exogenous price $\hat{p}_V$.

The unit value is comprised of two parts: $\hat{p}_V$, the value of a unit of quality, which is exogenous to the consumer, and $\sum_{i \in G_V} q_i \frac{x_i}{\sum_{i \in G_V} x_i}$, the weighted average level of quality, which is endogenous to the consumer. Two households can pay a different price for the same hotel because it can be of different quality: a room over a weekend or a room with a view is a better product than a room during the week or a room without a view.

To derive the income and price elasticities, we rewrite V, E_V and π_V . Let q_V , the weighted average level of quality of a vacation, be:

$$q_V = \sum_{i \in G_V} q_i \frac{x_i}{\sum_{i \in G_V} x_i} \tag{10}$$

and v_q , the total number of vacation days, be:

$$v_q = \sum_{i \in G_V} x_i \tag{11}$$

then:

$$V = q_V v_q \tag{12}$$

$$E_V = \hat{p}_V q_V v_q \tag{13}$$

$$\pi_V = \hat{p}_V q_V \tag{14}$$

The income and price elasticities of variables X , η_X and ε_X , respectively, are derived by taking the natural logarithm of equations (12)-(14) and differentiating them with respect to Y and $\hat{p}_V$. The following elasticities are received:

$$\eta_V = \eta_{q_v} + \eta_{v_q} \tag{15}$$

$$\varepsilon_V = \varepsilon_{v_q} + \varepsilon_{q_v} \tag{16}$$

The income elasticity of demand for vacation η_V is the sum of the income elasticities of quantity and quality. A similar observation holds for the price elasticity. Deriving the elasticities for expenditure share $w = \frac{E_V}{Y}$ similarly yields the following relationships:

$$\eta_w = \eta_{E_V} - 1 = \eta_V - 1 \tag{17}$$

$$\varepsilon_w = \varepsilon_{E_V} = \varepsilon_V + 1 \tag{18}$$

These relationships allow estimation of income and demand elasticities by using *w* and π_V as the explanatory variables.

Given the relationship in equation (12), we can re-specify equation (7) as the following expenditure share function:

$$w = f(\ln \pi_V, \ln Y, A) \tag{19}$$

where *A* is a vector of household characteristics, including household size. This functional form is adapted following Dong et al. (1998) to facilitate the estimation of demand elasticities using the available expenditure share data.

Empirical Model and Estimation Methodology

The fact that only some of the households have non-zero vacation expenditures is accounted for in the empirical model by adding the following selection equation:

$$I^* = \alpha_0 + \alpha_1 \ln Y + \alpha_2 \ln FS + \alpha'_3 M_1 + \alpha'_4 S + u_1 \tag{20}$$

where *Y* is total expenditure, *FS* is family size, M_1 is a vector of a subset of household characteristics and *S* is a vector of variables accounting for seasonality. The use of household total expenditures as a proxy for permanent income is commonly found in the literature (Deaton and Muellbauer, 1980; Fish, 1996). I^* is an unobserved variable. The observed variable, *I*, equals one when the household decided to take a vacation during the period of the survey and zero otherwise. Accordingly, equation (20) takes on the following form:

$$I = \alpha_0 + \alpha_1 \ln Y + \alpha_2 \ln FS + \alpha'_3 M_1 + \alpha'_4 S + u_1 \tag{21}$$

The censored demand model is described by equations (22) and (23) if $I = 1$.

$$\ln \pi_V = \beta_0 + \beta_1 \ln Y + \beta_2 \ln FS + \beta_3' M_2 + \theta_1 \lambda_1 + u_2 \quad \} \ \ln \pi_V > 0 \ \text{ if } I = 1 \tag{22}$$

$$w = \gamma_0 + \gamma_1 \ln Y + \gamma_2 \ln FS + \gamma_3 ' M_3 + \gamma_4 \ln \pi_V + \theta_2 \lambda_2 + u_3 \} \; w>0 \text{ if } I = 1 \qquad (23)$$

where $M_i, i = 1,2,3$ are vectors of not necessarily identical subsets of household characteristic variables including household size, π_V is the unit value per day of vacation, *w* is the share of vacation expenditures out of all household expenditures, and $\lambda_{1,2}$ and $\theta_{1,2}$ are the selection variables and their coefficients, respectively. This functional form for demand systems has been used widely in the literature (e.g., Deaton and Muellbauer, 1980). One of the benefits of using it is that it neutralizes the impact of inflation and fluctuations in the exchange rate over the 13 months of the survey period.

Income and Demand Elasticities

Although data on *V* are not available, we can still estimate the income elasticity of the commodity vacation and its quality and quantity components using the estimations of *w* and π_V as follows:

$$\eta_V = \eta_w + 1 = \frac{1}{w}\left[\gamma_1 + \varphi_2 + \gamma_4\left(\beta_1 + \varphi_1\right)\right] + 1 \qquad (24)$$

where, $\varphi_1 = \frac{d(\theta_1 \lambda_1)}{dY}$ and $\varphi_2 = \frac{d(\theta_2 \lambda_2)}{dY}$.

The income elasticity of quality is of the following form:

$$\eta_{q_V} = \eta_{\pi_V} = \frac{d \ln \pi_V}{d \ln Y} = \beta_1 + \varphi_1 \qquad (25)$$

From equations (15), (24) and (25), receiving the income elasticity of quantity η_{V_q} becomes straightforward.

Based on Deaton (1987) and Chung (2006), price elasticity can also be derived from the unit value and quality elasticity as follows:

$$\varepsilon_{v_q} = \frac{(\gamma_4 - w)\eta_{v_q}}{w\eta_{v_q} - (\gamma_4 - w)\eta_{q_V}} \tag{26}$$

$$\varepsilon_{q_V} = \varepsilon_{v_q} \frac{\eta_{q_V}}{\eta_{v_q}} \tag{27}$$

According to equation (16), ε_V is received by adding ε_{v_q} and ε_{q_V} .

Data

The model was applied to data from the 1999 household expenditures survey of Israel. The survey was conducted over a 13-month period starting in January 1999 and ending in January 2000. Investigation of the sample was spread across the survey period so that all weeks in the investigation period would be represented. For some of the expenditure items, the households had to fill in a two-week diary while for items such as vacations and durables, they were requested to report expenditures in the three months preceding the survey. Additional and detailed information for each of the vacations and trips was provided upon special request by the Central Bureau of Statistics. This information included expenditures for each vacation and its duration. As we had information for each trip, we could obtain the number of trips taken in Israel and abroad during the three month survey period.

The fact that the households were asked about their trip expenditures during the three months preceding the survey is an advantage because they could better recall the expenditures. In the case of tourism-related expenditures, this presents a disadvantage because of the seasonality effect. Households tend to take more vacations during the summer. In view of this problem, seasonality was accounted for in our estimates by adding dummy variables for each month.

A total of 5,895 households were surveyed out of which 1,367, accounting for about a quarter of the sample, declared non-zero expenditure on vacations during the three months preceding the survey.

Results

Two models are estimated: Model 1 includes only the selection equation (21) and expenditure share equation (23), and is estimated using the Maximum-Likelihood Estimation method. Model 2 includes equations (21)-(23) which are estimated as a simultaneous equation system with selectivity using LIMDEP (2002). The selected simultaneous equations model is estimated in exactly the same way as a single equation using a form of the two-stage least squares regression (Lee, Maddala and Trost, 1980). In both models, heteroskedasticity is accounted for by using heteroskedasticity-robust standard errors. The estimated models can be seen in Tables 1-3. The marginal effects, elasticities and their standard errors were calculated based on the estimated coefficients in the tables. Estimating the two models enables a comparison of the interpretation of income elasticities when vacation quality is considered. Price elasticity cannot be compared since it can be derived only in the second model.

From Table 4, it can be seen that income elasticity η_V is of the same magnitude in both models, although it is slightly higher in Model 1. This indicates that vacations are a luxury good and that household expenditures on tourism increase faster than income. This result is similar to the aforementioned estimations of income elasticities conducted in other countries. The interpretation of the results is the crux of the estimation of income elasticities. The elasticity estimated in Model 1 is interpreted as follows: an increase (decrease) in income leads to an increase (decrease) in household expenditure on vacations; since prices are assumed constant across households, this means that households increase the quantity, i.e., number of vacation days, consumed during the year. This is the implicit assumption when unit value, and thus quality of the vacations, is not considered in the estimation.

In Model 2, the change in expenditures can be broken down into its components: number of vacation days and their price. The income elasticity of 1.4 is comprised of two parts: 0.67 is due to a change in the quality of the vacation and 0.73 to a change in the number of vacation days. For example, a household enjoying a 10 percent increase in income will increase its expenditures on tourism by 14 percent; 6.7 percent of the increase in expenditure will be allocated to improving the quality of the vacation and 7.3 percent to more vacation days (see illustration in Table 5).

Price elasticity (ε_V), i.e. the sensitivity of tourism demand to an increase in the price of a unit of quality, is negative, as expected, and inelastic (see Table 4). This means that tourism expenditure will increase (decrease) more slowly than a decrease (increase) in price. The ratio between price-quality elasticity (ε_{q_V}) and price-quantity elasticity (ε_{v_q}) is the same as in the income elasticities. This means that if, for example, price decreases by 10 percent, demand (*V*) will increase by 6.3 percent. The quality (q_V) component will increase by 3 percent while the quantity (v_q) will increase by 3.3 percent (see illustration in Table 5).

Total household expenditure rose in Israel by about 10 percent annually between 1999 and 2004. Changes in $\hat{p}_V$, or as it is defined here, price of a unit of quality, are difficult to evaluate, thus for illustration purposes, a 10 percent decrease is assumed. It is shown in Table 5 that when income and price change at the same rate but in different directions, the demand for tourism increases much faster than total expenditures (20.3 percent vs. 10.3 percent). The shift to higher-quality holidays is responsible for about half of the increase in demand, while the rest is due to an increase in vacation days. This result explains the aforementioned growing demand for luxury-tourism facilities.

CONCLUSION

Income elasticities estimated over the years in different countries have established the fact that vacations are a luxury good and that an increase in income, as seen in the tourism-generating countries, will lead to a faster increase in tourism expenditure. However, these elasticities cannot explain the emergence of boutique hotels, luxury Bed & Breakfast, spas and other high-quality tourism services. The decomposition of the tourism elasticities into their components and the ability to estimate them as done in this paper give tourism researchers and decision-makers insight into this increase. Two important factors dominate tourism demand: income and price, and these have been changing in recent years. Income in the tourism-generating countries has been constantly increasing along with a constant improvement in technology, which has led to a decrease in price per unit of quality. Flights and other forms of transportation are cheaper, information is readily available on the internet, and access to exotic resorts is improving. These two trends, i.e. increase in income and decrease in price, have affected the demand for tourism and its components. By using these findings, we can gain insight into the adjustments needed in the tourism industry to meet the growing demand. The capacity of the different facilities should rise more slowly than the growth in demand. However, there is a need to adjust existing or new facilities to the shift from low- to high-quality accommodations, resorts, etc.

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Table 1: Maximum-Likelihood Estimation of Model 1

	Coeff.	Std.Err.
Selection Equation		
Constant	-11.180*	0.389
Age of HH head	-0.003*	0.001
=1 if HH head has academic education	0.191*	0.042
=1 if HH head is male	-0.050	0.040
=1 if HH head works	0.006	0.053
=1 if HH has internet	0.111*	0.058
No. of electrical instruments	0.034*	0.008
ln (total expenditures)	1.164*	0.047
ln (number of family members)	-0.368*	0.037
=1 if HH was surveyed in January	-0.355*	0.086
=1 if HH was surveyed in February	-0.316*	0.087
=1 if HH was surveyed in March	-0.268*	0.084
=1 if HH was surveyed in April	-0.155	0.088
=1 if HH was surveyed in May	-0.095	0.084
=1 if HH was surveyed in June	-0.017	0.085
=1 if HH was surveyed in July	0.111	0.085
=1 if HH was surveyed in August	0.182*	0.082
=1 if HH was surveyed in September	0.374*	0.083
=1 if HH was surveyed in October	0.492*	0.086
=1 if HH was surveyed in November	0.122	0.083
Vacation expenditure share equation		
Constant	5.638	15.263
Age of HH head	-0.128	0.133
Age of HH head squared	0.002*	0.001
ln (total expenditures)	-4.231*	0.837
ln (number of family members)	1.625	1.524
No. of school years of HH head	-0.078	0.091
=1 if HH head is male	1.724*	0.734
=1 if HH head immigrated from Europe	2.271*	0.743
sigma(1)*	11.479*	0.437
rho(1,2)*	-0.334*	0.113

HH: household.

Table 2: Maximum-Likelihood Estimation of Unit Value Equation in Model 2

	Coeff.	Std.Err.
Selection equation		
Constant	-11.082*	0.390
Age of HH head	-0.003*	0.001
=1 HH head has academic education	0.193*	0.042
=1 if HH head is male	-0.076*	0.039
=1 if HH head works	0.015	0.054
=1 if HH has internet	0.126*	0.058
No. of electrical instruments	0.040*	0.008
ln (total expenditures)	1.151*	0.047
ln (number of family members)	-0.371*	0.037
=1 if HH was surveyed in January	-0.351*	0.086
=1 if HH was surveyed in February	-0.328*	0.088
=1 if HH was surveyed in March	-0.261*	0.085
=1 if HH was surveyed in April	-0.116	0.086
=1 if HH was surveyed in May	-0.082	0.084
=1 if HH was surveyed in June	-0.012	0.086
=1 if HH was surveyed in July	0.109	0.087
=1 if HH was surveyed in August	0.161*	0.084
=1 if HH was surveyed in September	0.326*	0.085
=1 if HH was surveyed in October	0.465*	0.087
=1 if HH was surveyed in November	0.120	0.084
Unit value equation		
Constant	-3.466	1.885
ln (number of family members)	-0.129*	0.065
ln (total expenditures)	0.984*	0.177
=1 if HH has internet	-0.118*	0.053
No. of electrical instruments	0.025*	0.011
No. of school years of HH head	-0.005	0.007
=1 if HH was surveyed in January	-0.340*	0.117
=1 if HH was surveyed in February	-0.064	0.141
=1 if HH was surveyed in March	-0.161	0.118
=1 if HH was surveyed in April	-0.134	0.120
=1 if HH was surveyed in May	-0.050	0.101
=1 if HH was surveyed in June	-0.066	0.105
=1 if HH was surveyed in July	-0.003	0.101
=1 if HH was surveyed in August	0.136	0.105
=1 if HH was surveyed in September	0.213	0.110
=1 if HH was surveyed in October	0.141	0.117
=1 if HH was surveyed in November	-0.023	0.100
sigma(1)	0.800*	0.058
rho(1,2)	0.414*	0.221

HH: household.

Table 3: Maximum-Likelihood Estimation of the Expenditure Share on Vacation

	Coeff.	Std.Err.
Selection equation		
Constant	-11.151*	0.388
Age of HH head	-0.003*	0.001
=1 if HH head has academic education	0.193*	0.042
=1 if HH head is male	-0.051	0.039
=1 if HH head works	0.007	0.053
=1 if HH has internet	0.124*	0.058
No. of electrical instruments	0.034*	0.008
ln (total expenditures)	1.160*	0.047
ln (number of family members)	-0.367*	0.037
=1 if HH was surveyed in January	-0.343*	0.086
=1 if HH was surveyed in February	-0.319*	0.088
=1 if HH was surveyed in March	-0.262*	0.085
=1 if HH was surveyed in April	-0.142	0.087
=1 if HH was surveyed in May	-0.092	0.084
=1 if HH was surveyed in June	-0.012	0.085
=1 if HH was surveyed in July	0.113	0.085
=1 if HH was surveyed in August	0.174*	0.083
=1 if HH was surveyed in September	0.361*	0.084
=1 if HH was surveyed in October	0.489*	0.086
=1 if HH was surveyed in November	0.126	0.083
Vacation expenditure share equation		
Constant	-1.433	13.356
Age of HH head	-0.182	0.120
Age of HH head squared	0.003*	0.001
ln (total expenditures)	-4.350*	0.740
ln (number of family members)	-1.903	1.354
No. of school years of HH head	-0.005	0.079
=1 if HH head is male	0.919	0.651
=1 if HH head immigrated from Europe	2.228*	0.683
Unit value	6.571*	0.392
sigma(1)	10.082*	0.319
rho(1,2)	-0.258*	0.120

HH: household.

Table 4: Income and Price Elasticities

Income Elasticities	Model 1 (w/o unit price)	Model 2 (with unit price)
η_V	1.43*	1.40*
η_{q_V}	N.A.	0.67*
η_{v_q}	N.A.	0.73*
Price Elasticities		
ε_V	N.A.	-0.63*
ε_{q_V}	N.A.	-0.3*
ε_{v_q}	N.A.	-.33*

*Significant at 5%. Standard errors of elasticities are derived using the Delta Method.

Elasticities are calculated at mean value.

N.A.: not applicable

Table 5: An Illustration: Changes in the Demand Variables Resulting from a 10% increase in Income (*Y*) and 10% Decrease in Price ($\hat{p}_V$)

Change	Expenditures E_V	Demand V	Quality q_V	Quantity v_q
10% increase in *Y*	14%	14%	6.7%	7.3%
10% decrease in $\hat{p}_V$	-3.7%	6.3%	3%	3.3%
Total change	10.3%	20.3%	9.7%	10.6%

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