«ΣΠΟΥΔΑΙ», Τόμος 43, Τεύχος 2ο, Πανεπιστήμιο Πειραιώς / «SPOUDAI», Vol. 43, No 2, University of Piraeus

HABITS AND EMPIRICAL ANALYSIS OF DEMAND FOR SIX AGGREGATE COMMODITY GROUPS IN GREECE*

By

Giannis Karagiannis
University of Saskatchewan

Kostas Velentzas
University of Macedonia

Abstract

In this paper using data form 1958 to 1989, the hypothesis of linear habit formation cannot be rejected, indicating that tastes have not been constant in Greece. Food exhibits inventory depletion effect; beverages and tobacco, footwear and clothing, settling and housing, and transportation and communication exhibit habit persistence. By accounting for habits, food becomes more sensitive to both prices and expenditure; while the opposite is true for settling and housing, and transportation and communication. On the other hand, beverages and tobacco, and clothing and footwear become more price responsive but less income sensitive when myopic formation is considered. (JEL D12)

1. Introduction

The specification and empirical estimation of complete demand systems, which are consistent with the utility maximization theory, have been proceeded within a static or a dynamic framework (Brown and Deaton, 1972; Blundell, 1988; and Phlips, 1983). In a time series context, a static modeling of consumer behavior assumes that there are no changes in tastes over time and thus, changes in quantity demanded are purely determined by changes in commodity prices and income. This assumption is, however quite unrealistic whenever the empirical analysis is dealing with long time series data. Instead, a dynamic modeling of consumer behavior may be more appropriate as long as purchases of goods are affected by changes in habits.

Two approaches are usually distinguished within a dynamic modeling of consumer behavior, (Phlips, 1983): one deals with durable goods (e.g. Tinter,

* We would like to thank the anonymous reviewers for helpful comments and suggestions and the Editorial Secretary for communication assistance.

1938; Cramer, 1957; and Diewert, 1974) and the other with the role of habits and their formation (Gorman, 1967; Pollak, 1970 and 1976; Pollak and Wales, 1992; Lluch, 1974; Spinnewyn, 1981; Pashardes, 1987; Muellbauer and Pashardes, 1982 and 1992). The former analyzes the effects of commodity durability on consumer behavior while the latter is based on the simple proposition that past and future consumption patterns have an important ifluence on present consumption patterns. In a habit formation framework, a change in commodity prices or income will cause a change in quantity demanded of the particular good which, in addition, will induce a change in tastes. Moreover, this change in tastes leads to a new change in the level of consumption (Pollak, 1970). On the other hand, changes in the demand of a commodity, in the absence of prices and/or income changes, may be attributed to changes in tastes or habits.

Habit formation underlies the consumption of most of the commodities available to consumers. The conumption of food, for example, is subject to changes in taste due to advertising (e.g. fast food versus traditional meals), diet effects (e.g. food containing less fat or in general, less food), and health-safety effects (e.g. cholesterol free food). These changes in habits with respect to food consumption result in inventory depletion effects. Similarly, advertising campaigns against smoking (e.g. warning messages in cigarettes packets) and drinking (e.g. "do not drink and drive") eventually result in inventory depletion effects with respect to the consumption of alcoholic beverages and tobacco. In contrast, changes in habits for footwear and clothing, for which people try to follow precisely today's fashion, result in habit persistence.

Habit formation has been modeled in a rational (see Spinnewyn, 1981; Pashardes, 1986; and Muellbauer and Pashardes, 1992) or a myopic (see Pollak, 1970 and 1976) fashion. Rational habit formation takes both past and future consumption patterns into account to determine present consumer preferences. Spinnewyn (1979, 1981), Phlips and Spinnewyn (1982), Pashardes (1986) and Muellbauer and Pashardes (1992) provide the theoretical and empirical frameworks for rational habit formation. Even though Phlips and Spinnewyn (1982) argued that myopic and rational habit formation are observationally equivalent in a demand system context, Pashardes (1986) developed a framework where an empirical distinction between them is feasible through the Almost Ideal (AI) demand system (Deaton and Muellbauer, 1980). In this framework, myopic habit formation is a nested and testable hypothesis.

Myopic habit formation refers to the case where past consumption influences current preferences and consequently the current demand for a good (Pollak, 1970 and 1976). Myopic habit formation may be attributed to the following two reasons: first, the consumer may have fixed commitments which do not allow him to adjust his consumption pattern according to changes in prices and income (this may be the case with goods like housing, cars, etc); and second, the consumer may be ignorant of consumption possibilities outside the range of his past consumption pattern because of lack in information (advertising, fashion and ethics) or an incomplete learning-by-doing consumption process (this may be the case, for example, with clothing, food, smoking, and recreation).

The empirical analysis of myopic habit formation has been done by using a linear specification because of its straight forward estimation procedure. Two alternative specifications have been used: the simple linear form (Pollak and Wales, 1969) and the generalized linear form (Ray, 1985). In the simple linear habit formation, certain parameters are specified to be linear function of previous consumption levels of the commodity under question and (probably) of all other commodities. It should be noted that interaction terms between previous consumption levels of different commodities are not allowed in this specification. The simple linear habit formation has been applied to the Linear Expenditure System (LES) by Pollak and Wales (1969), to the Generalized Linear Expenditure System (GLES) by Wales (1971), to the Translog utility function by Manser (1976), to the Quadratic Expenditure System (QES) by Howe, Pollak and Wales (1979) and to the AI demand system by Blanciforti and Green (1983). On the other hand, the generalized linear form allows certain paramaters to be a linear function of previous consumption levels, with the partial effect on consumption being related to the consumption of all commodities in the preceding period(s). The generalized linear habit formation, has been apllied to the Gorman Polar Form Demand System (GPFDS) by Ray (1985). Even in the more recent studies, however, the most commonly used form of habit formation is that of simple linear habit formation (see among others Haden (1990), Chen and Veeman (1991)).

The main objective of this paper is to incorporate and analyze the role of myopic habit formation into postwar changes in consumer expenditure shares for six aggregate commodity groups in Greece. The hypothesis of constant tastes is tested against aggregate consumer expenditure data for the period 1958 to 1989 using a simple linear habit specification. This is achieved by estimating a static as well as a dynamic version of the AI demand system. Moreover, a comparison between the estimated price and expenditure elasticities of the static and the dynamic model is provided.

In the postwar era, tremendous changes have occured in Greek consumptions patterns. Except of the rapid increase of total consumption expenses, the changes occured on the distribution of expenditures among commodity categories are also important. The expenditure share of food steadily declined from almost 0.45 in the 1960s to 0.20 in the 1980s. On the other hand, the expenditure shares of settling and housing and transportation and communication increased during the same period. The footwear and clothing expenditure share increased up to the middle of 1970s and decreased thereafter. Finally, the beverages and tobacco expenditure share remained almost unchanged over the whole period. It is hypothesized that some of these changes are attributed to habit formation.

The paper is organized as follows. In the next section, an illustrative derivation of the estimated expenditure share equations for the static and dynamic AI demand system is provided. The data used in the empirical analysis and the estimation procedure are discussed in the third section. The fourth and the fifth sections contain the empirical results and the elasticity measures, respectively. Summary and concluding remarks follow.

2. Model Specification

In the empirical part of this paper a static and a dynamic version of the AI demand system is used. The AI demand system is derived from a flexible consumer expenditure function known as the price-independent generalized logarithmic (PIGLOG) form. According to Muellbauer (1975), the general form of a PIGLOG consumer expenditure function is defined as:

$$\log c(u, \mathbf{p}) = (1-u) \log [\alpha(\mathbf{p})] + u\log [\beta(\mathbf{p})], \tag{1}$$

where any positive linearly homogeneous functions for $\alpha(\mathbf{p})$ and $\beta(\mathbf{p})$ can be regarded as the cost of subsistence and bliss, respectively. In the special case where the functions $\alpha(\mathbf{p})$ and $\beta(\mathbf{p})$ are specified as:

$$\alpha(\mathbf{p}) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log p_i + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma^*_{ij} \log p_i \log p_j \tag{2}$$

and

$$\beta(\mathbf{p}) = u \left(\beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \right), \tag{3}$$

(1) reduces to the AI demand system consumer expenditure function given as:

$$\log (u, \mathbf{p}) = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log p_i + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma^*_{ij} \log p_i \log p_j + u \left(\beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \right). \quad (4)$$

Using Shephard's lemma in logarithmic form, the resulting demand functions in expenditure share form are derived through equation (4) as:

$$\frac{\partial \log (u, \mathbf{p})}{\partial \log p_i} = \frac{p_i q_i}{c (u, \mathbf{p})} = S_i(\mathbf{p}, c) = \alpha_i + \sum_{i=1}^{n} \gamma_{ij} \log p_j + \beta_i u \left(\beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \right), \quad (5)$$

where $S_i(\mathbf{p}, c)$ is the i^{th} good's expenditure share and $\gamma_{ij} = 0.5 (\gamma^*_{ij} + \gamma_{ji}^*)$. For a utility-maximizing consumer, total expenditure c is equal to $c(u, \mathbf{p})$ and this equality can be inverted to give the indirect utility function, $u(\mathbf{p}, c)$, as function of prices and total expenditure (Deaton and Muellbauer, 1980b and Varian, 1984). By doing so in (5) the AI demand system's indirect utility function may be yield as:

$$u (\mathbf{p}, c) = \frac{\log c - \alpha_0 - \sum_{i=1}^{n} \alpha_i \log p_i - 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma^*_{ij} \log p_i \log p_j}{\beta_0 \prod_{i=1}^{n} p_i^{\beta_i}} \quad (6)$$

Substituting (6) into (5) results in:

$$S_i (\mathbf{p}, \mathbf{c}) = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log \left(\frac{c}{P}\right), \quad (7)$$

where P is an aggregate price index defined as:

$$\log P = \alpha_0 + \sum_{i=1}^{n} \alpha_i \log p_i + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \log p_i \log p_j, \quad (8)$$

which is usually approximated by the Stone's (1953) index:

$$\log P = \sum_{i=1}^{n} S_i \log p_i. \quad (9)$$

For the demand system consisting of equations (7) to be consistent with the underlying consumer theory the following conditions should hold: first, the condition of linear homogeneity in prices which implies the following set of restrictions:

$$\sum_{j=1}^{n} \gamma_{ij} = 0 \; ; \tag{10}$$

second, the adding-up condition is satisfied if

$$\sum_{i=1}^{n} \alpha_i = 1, \qquad \sum_{i=1}^{n} \beta_i = 0, \qquad \text{and} \sum_{i=1}^{n} \gamma_{ij} = 0; \tag{11}$$

and finally, symmetry requires that

$$\gamma_{ij} = \gamma_{ji} \, . \tag{12}$$

The habit persistence version of the AI demand system model, based on the simple linear habit formation, may be obtained by specifying an *ad hoc* dynamic cost function through the introduction of one-period lagged consumption levels, q_{it-1}, to the AI demand system consumer expenditure function:

$$\log c(u, \mathbf{p}; \mathbf{q}_{it-1}) = \alpha_0 + \sum_{i=1}^{n} (\alpha_i + \delta_i q_{it-1}) \log p_i + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma^*_{ij} \log p_i \log p_j + u \left(\beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \right) \tag{13}$$

By using Shephard's lemma:

$$S_i\,(c, \mathbf{p}; \mathbf{q}_{it-1}) = \alpha_i + \delta_i q_{it-1} + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i\, u \left(\beta_0 \prod_{i=1}^{n} p_i^{\beta_i} \right) \tag{14}$$

Based on duality theory (Deaton and Muellbauer, 1980b and Varian, 1984), the dynamic version of the AI demand system's consumer expenditure function (13) can be inverted and solved for u. By substituting consumer expenditure function into (14) yields the expenditure share function which incorporates linear habit formation. The form has been proposed by Blanciforti and Green (1983):

$$S_i\,(c, \mathbf{p}; \mathbf{q}_{it-1}) = \alpha_i + \delta_i q_{it-1} + \sum_{j=1}^{n} \gamma_{ij} \log p_j + \beta_i \log \left(\frac{c}{P}\right) \tag{15}$$

It should be mentioned that under the above dynamic specification of the AI demand system, the price index, P, is given as:

$$\log P = \alpha_0 + \sum_{i=1}^{n} (\alpha_i + \delta_i q_{it-1}) \log p_i + 0.5 \sum_{i=1}^{n} \sum_{i=1}^{n} \gamma^*_{ij} \log p_i \log p_j \qquad (16)$$

The properties of homogeneity and symmetry place the same restrictions on the parameters of (15) as those of (7). The adding-up restriction further requires that:

$$\sum_{i=1}^{n} \delta_i q_{it-1} = 0 \qquad (17)$$

3. Data and Estimation Procedure

For the econometric estimation of (7) and (15), annual observations from 1958 to 1989 for six aggregate commodity groups in Greece are used. The six aggregate commodity groups are: food; beverages and tobacco; footwear and clothing; settling and housing, which includes heating, lighting, furniture and house equipment; transportation and communication; and finally, the category of others includes recreation, entertainment, education, health care and other services.

The data required for the study are provide by the National Account of Greece published by the National Statistical Services. The expenditures to each aggregate commodity group, both in current and in constant (1970) prices, are used. The price index corresponding to each commodity group is derived by dividing the current to constant expenditures. The expenditures for the category of others is calculated by subtracting from the total personal expenditure on consumer goods and services the sum of the expenditures on the goods for the first five categories. Then, its price index was measured similarly to the other categories. The expenditure share for each commodity group is given by dividing the expenditures for that group by the total expenditure on consumer goods and services. Finally, the total personal expenditure on consumer goods and services is used as the total consumer expenditures.

The systems of equations (7) and (15) are estimated with a seemingly unrelated regression (SUR) method (Zellner, 1962), which adjusts for cross-equation contemporaneous correlation. The efficiency of estimation can be increased by imposing theoretically proposed restrictions on the coefficients of the equations. The restrictions *a priori* imposed on the model include: linear homogeneity of the consumer expenditure function in prices, symmetry, and the adding-up restriction of expenditure shares. Under these restrictions anyone equation from the set of expenditure shares equations can be arbitrarily excluded, which in this case was the expenditure share of beverages and tobacco. Since Zellner's method is sensitive to which equation is excluded, the procedure must be iterated and for this reason an iterative seemingly unrelated regression method is used (Oberhofer and Kmenta, 1974). This estimation method ensures that the estimates assymptotically approach those obtained by the maximum likelihood method and they do not depend on the choice of the excluded equation. However, this estimation procedure is appropriate only when there is no serial correlation of error terms within equations.

In the case where the disturbances exhibit not only contemporaneous correlation across equations but an autocorrelation pattern in each equation as well, Parks (1967) proposed the following two-stage estimation procedure. Each of the system's equation is initially estimated using OLS and then corrected autocorrelation. With respect to equations of systems (7) and (15), first-order autocorrelation was found in the expenditure share of settling and housing. Autocorrelation was corrected through a Cochrane-Orcutt procedure. In the second stage, the systems of equations (7) and/or (15), corrected for autocorrelation, are estimated with an iterative SUR procedure. This two-stage estimation procedure is similar to that outlined by Judge et al. (1980: 260-267) when the first observation from each equation is missed because of the first-order autocorrelation process. Parks (1967) prosedure was also used by Kmenta and Gilbert (1970).

4. Empirical Results

Estimates of the structural parameters for both the static and the dynamic versions of AI demand system are reported in Tables 1 and 2, respectively. Twenty six out of the thirty five coefficients are statistically different from zero for the dynamic AI demand system while twenty three out of thirty coefficients are statistically significant for the static model. Monotonicity of the consumer expenditure function can be cheked by computing the predicted values of the expenditure shares. Given the estimated parameters, it can be shown that monotonicity is satisfied since the predicted expenditure shares are positive for all observation and each commodity group. Moreover, given that all own-price Marshallian elasticities are negative and income elasticities are positive, the corresponding own-price Hicksian elasticities are also negative. The concavity of the expenditure function is ensured by the fact that the corresponding Slutksy matrix will be negative semi-definite.

The hypothesis of linear habit formation cannot be rejected indicating that consumer tastes have not been constant during the period 1958 to 1989. The calculated value of X^2-statistic is 77.94 while the critical values, for five degrees of freedom, are 11.07 and 15.09 at 5% and 1% level of significance, respectively. The null hypothesis of constant tastes consists of all δ; being equal to zero across expenditure share equations. Thus, the statistical significance of the habit persistence coefficients suggests that habit formation had some influence on the allocation of consumer's expenditures among the six aggregated commodity groups. In other words, past consumption had significantly influenced present demand for all aggregate commodity groups and hence, it has affected consumer behavior.

According to the sign of habit formation coefficients, δ,, food and the category of others exhibited inventory depletion effects. The habit formation coefficient for the latter is, however, statistically insignificant which suggests that this commodity group may exhibited constant tastes. Inasmuch as food, its habit formation coefficient indicates a strong inventory depletion effect. That is, given constant prices and income, consumers were willing to reduce its contribution to total expenditures by an average rate of 8.7%. This may be due to (1) stronger needs or preferences for allocating income to other commodity groups; (2) diet methods and (3) changes on food consumption patterns (more fast food which actually is relatively cheaper).

In contrast, beverages and tobacco; footwear and clothing; settling and housing; and transportation and communication exhibited habit persistence. From these commodity groups, footwear and clothing exhibited relatively stronger habit persistence compared to beverages and tobacco. According to our findings, habits may contributed, *ceteris paribus,* around 6% to the increase in the expenditure share of footwear and clothing. This is mainly explained by the nature of this commodity group where fashion (e.g. use of unisex clothes and blue jeans) and advertising (e.g. athletic shoes and T-shirts, firm-specific clothes like Lacoste, Adidas etc) play an important role in its demand function.

The relatively strong habit persistence nature of the commodity group labeled settling and housing is primarily caused by the furniture and house equipments. During the postwar period, the modernization of Greek households has expanded and the extensive use of electrical house equipment like television, refrigerator, electric iron, and washing machines has been established. Consequently, expenditures for electrical and water utilities have also increased. The habit persistence with respect to transportation and communication may be explained by the every-day use of buses and taxi-cubs mainly in the urban areas and the revolutionary expansion of telephone services even in the smallest villages in Greece.

5. Elasticity Estimates

In Table 3, the average values (over the period 1958 to 1989) of the Marshallian and the expenditure elasticities corresponding to the static and the dynamic versions of the AI demand system are reported. These elasticities have be calculated by using the following formulas:

$$\varepsilon_{ij}^{M} = \frac{\gamma_{ij} + \beta_i \beta_j \log(c/P)}{w_i} - \delta_{ij} + w_j - w_j n_i \quad (18)$$

$$n_i = \frac{\beta_i}{w_i} + 1 \quad (19)$$

$$\varepsilon_{ij}^{M} = \frac{\gamma_{ij} - \beta_i (\alpha_j + \delta_j q_{it-1} + \sum \gamma_{jk} \ln P_k)}{w_i} - \delta_{ij} \quad (20)$$

where δy is the Kronecker delta and ni is the expenditure elasticity and (18) and (20) give the Marshallian elasticities for the static and dynamic versions of AI demand system.

Given that the own-price elasticities for all six aggregate groups are negarive in both the static and the dynamic AI demand system, the Marshallian demand functions are downward sloping. This indicates that all aggregate commodities found to be normal goods. Moreover, in the static model, only food and transportation and communication are found to have an inelastic demand while in the dynamic model, settling and housing is also found to be price inelastic. The rest of the aggregate commodity groups have an elastic demand in both models. Finally, the sign of the cross-price Marshallian elasticities remain unchanged in both models except for that between settling and housing and others.

Even though the sign of either own-price or cross-price elasticities does not change across the static and dynamic model, the magnitude of the elasticities changes a lot. In particular, food, beverages and tobacco, and clothing and footwear have a relatively more elastic demand in the dynamic version of AI demand system; while the opposite is true for settling and housing and transportation and communication, and others. Therefore, it can be argued that the demand for commodities which are more sensitive to habit formation is more elastic when habits are taken into consideration than otherwise. This has considerable policy implications with respect to commodity taxation and thus, with the revenue generated by governmental authorities. In contrast, demand for settling and housing, and transportation and communication, is less elastic when habit formation is considered. This, of course, is of equal importance for policy and welfare questions.

The income (expenditure) elasticities are also presented in Table 3. For both models, the income elasticities are positive; thus, the possibility of inferior goods is eliminated. In addition, according to their magnitudes, food and beverages and tobacco behave as necessities in both models; while clothing and footwear, transportation and communication, and the others behave as luxuries. Settling and housing is sensitive to the demand specification; this commodity group seems to be a luxury under a static model while it is a necessity under a dynamic specification. Given, though, that the hypothesis of habit formation cannot be rejected, settling and housing is more likely to be a necessity.

The income sensitivity of the commodity groups also changes according to the modeling of the demand system. Food, beverages and tobacco, and others become more sensitive to changes in expenditures under a dynamic modeling; while the opposite is true for the rest of the commodity groups, i.e. they are more income responsive under a static modeling. Nevertheless, it must be noted that there are no changes from necessities to luxuries and vice versa under the two alternative models used in this paper.

6. Summary and Concluding Remarks

The hypothesis of linear habit formation cannot be rejected by the data indicating that tastes have not been consant in Greece during the period 1958 to 1989. According to the sign of habit formation coefficient, food exhibited inventory depletion effects because of habits. In contrast, beverages and tobacco; footwear and clothing; settling and housing; and transportation and communication exhibited habit persistence.

By taking habits into consideration, food become more price as well as income sensitive than otherwise. In contrast, under habit formation, settling and housing; and transportation and communication become less elastic with respect to both price and expenditures. On the other hand, beverages and tobacco as well as clothing and footwear are more price responsive and less income sensitive when habits are taken into account.

Given the habit formation is found to be a maintained hypothesis, these differences in the price and income responsed of the different commodity groups should be taken into consideration when alternative policy and marketing questions are analyzed. Further research is needed to analyze the behavior and the nature of habit formation of less aggregated commodity groups. Such an analysis will offer more detail and precise results than the present paper does.

Appendix

Table 1

Iterative SUR Estimates of the Structural Parameters of a Static AI Demand System for Six Commodity Groups, Greece, 1958-1989.[a]

Parameters[b]	Estimates	t-statistics	Parameters	Estimates	t-statistics
α_1	0.3548	228.19	γ_{33}	-0.1341	-26.46
α_2	0.0614[c]		γ_{34}	-0.0031	-0.33
α_3	0.1148	136.69	γ_{35}	0.0428	5.90
α_4	0.2291	98.03	γ_{36}	0.0547	8.66
α_5	0.0906	65.80	γ_{44}	-0.0024	-0.11
α_6	0.1493	153.72	γ_{45}	-0.0292	-2.80
γ_{11}	0.0477	2.31	γ_{46}	0.0045	0.34
γ_{12}	0.0137	1.66	γ_{55}	-0.0082	-0.52
γ_{13}	-0.0291	-3.95	γ_{56}	0.0799	7.59
γ_{14}	0.0795	5.87	γ_{66}	-0.1034	-7.21
γ_{15}	-0.0584	-3.74	β_1	-0.1263	-25.94
γ_{16}	-0.0534	-4.11	β_2	-0.0044	
γ_{22}	-0.0241		β_3	0.0161	6.49
γ_{23}	0.0688	12.13	β_4	0.0108	1.46
γ_{24}	-0.0493	-4.53	β_5	0.0572	13.56
γ_{25}	-0.0268	-4.12	β_6	0.0466	13.62
γ_{26}	0.0177	2.53			

a The parametric restrictions of homogeneity and symmetry are imposed.

b The subscripts of the parameters represent the commodity groups as follows: (1) refers to Food, (2) to Beverages and Tobacco, (3) to Footwear and Clothing, (4) to Settling and Housing, (5) to Transportation and Communication and (6) to Others.

c The estimates of the parameters without a t-statistics value are calculated though the homogeneity restrictions.

Table 2

Iterative SUR Estimates of the Structural Parameters of a Dynamic AI Demand System for Six Commodity Groups, Greece, 1958-1989.[a]

Parameters[b]	Estimates	t-statistics	Parameters	Estimates	t-statistics
α_1	0.3536	214.29	γ_{36}	0.0537	9.77
α_2	0.0881[c]		γ_{44}	0.0086	0.34
α_3	0.1144	88.03	γ_{45}	-0.0334	-3.41
α_4	0.2065	30.16	γ_{46}	0.0011	0.09
α_5	0.0766	29.16	γ_{55}	0.0103	0.77
α_6	0.1608	22.29	γ_{56}	0.0660	7.15
γ_{11}	0.0387	1.81	γ_{66}	-0.1068	-8.16
γ_{12}	0.0035	0.43	β_1	-0.0864	-4.89
γ_{13}	-0.0190	-2.76	β_2	-0.0095	
γ_{14}	0.0714	5.45	β_3	0.0114	2.41
γ_{15}	-0.0480	-3.37	β_4	-0.0107	-1.13
γ_{16}	-0.0466	-3.64	β_5	0.0377	6.29
γ_{22}	-0.0717		β_6	0.0615	8.27
γ_{23}	0.0889	14.10	δ_1	-0.0870	-2.59
γ_{24}	-0.0447	-4.40	δ_2	0.0064	
γ_{25}	-0.0096	-1.36	δ_3	0.0583	2.52
γ_{26}	0.0326	4.58	δ_4	0.0207	3.23
γ_{33}	-0.1363	-27.50	δ_5	0.0128	5.89
γ_{34}	-0.0031	-0.33	δ_6	-0.0112	-1.43
γ_{35}	0.0148	1.91			

a The parametric restrictions of homogeneity and symmetry are imposed.

b The subscripts of the parameters represent the commodity groups as follows: (1) refers to Food, (2) to Beverages and Tobacco, (3) to Footwear and Clothing, (4) to Settling and Housing, (5) to Transportation and Communication and (6) to Others.

c The estimates of the parameters without a t-statistics value are calculated though the homogeneity restrictions.

Table 4

Average Values of the Estimated Marshallian and Expenditures Elasticities for the Static and Dynamic AI Demand System, Six Commodity Groups, Greece: 1958-1989.

	(F)	(B-T)	(F-C)	(S-H)	(T-C)	(O)
			Static AI Demand System			
(F)	-0.46	0.08	-0.08	0.32	-0.26	-0.21
(B-T)	0.25	-1.32	0.94	-0.66	-0.38	0.24
(F-C)	-0.47	0.70	-2.39	-0.06	0.48	0.59
(S-H)	0.28	-0.21	-0.01	-1.02	-0.11	0.02
(T-C)	-1.27	-0.35	0.45	-0.43	-0.96	0.93
(O)	-0.72	0.09	0.39	-0.03	0.64	-1.70
n_i	0.61	0.94	1.17	1.04	1.62	1.33
			Dynamic AI Demand System			
(F)	-0.67	0.05	-0.05	0.30	-0.17	-0.19
(B-T)	0.15	-1.96	1.23	-0.57	-0.14	0.42
(F-C)	-0.29	0.92	-2.42	-0.07	0.16	0.58
(S-H)	0.33	-0.18	-0.01	-0.95	-0.14	-0.00
(T-C)	-0.82	-0.15	0.15	-0.47	-0.86	0.78
(O)	-0.69	0.18	0.39	-0.13	0.51	-1.68
n_i	0.73	0.87	1.12	0.96	1.37	1.44

where (F) refers to Food, (B-T) to Beverages and Tobacco, (F-C) to Footwear and Clothing, (S-H) to Settling and Housing, (T-C) to Transportation and Communication and (O) to Others; and n_i is the income elasticity.

References

Blanciforti, L. and *Green, R.* (1983). "An Almost Ideal Demand System Incorporating Habits: An Analysis of Expenditures on Food and Aggregate Commodity Groups", Review of Economics and Statistics, 65, pp. 511-515.

Brundell, R. (1988), "Consumer Behavior, Theory and Empirical Evidence: A Survey", Economic Journal, 98, pp. 16-65.

Brown, J. and *Deaton, A.S.* (1972), "Surveys in Applied Economics: Models of Consumer Behavior", Economic Journal, 82, pp. 1145-1236.

Chen, P.Y. and *Veeman, M.M.* (1991), "An Almost Ideal Demand System for Meats with Habit Formation and Structural Change", Canadian Journal of Agricultural Economics, 39, pp. 223-235.

Cramer, J.S. (1957), "A Dynamic Approach to the Theory of Consumer Demand", Review of Economic Studies, 24, pp. 73-86.

Deaton, A.S. and *Muellbauer, J.* (1980a), "An Almost Ideal Demand System", American Economic Review, 70, pp. 312-326.

Deaton, A.S. and *Muellbauer, J.* (1980b), Economics and Consumer Behavior, Cambridge University Press, New York.

Diewert, E. (1974). "Intertemporal Consumer Theory and the Demand for Durables", Econometrica,42, pp. 497-516.

Gorman, W.M. (1967), "Tastes, Habits and Choices", International Economic Review,8,pp. 218-222.

Haden, K. (1990), "The Demand for Cigarettes in Japan", American Journal of Agricultural Economics, 72, pp. 446-450.

Howe, H, Pollak, R.A. and *Wales, T.J.* (1979), "Theory and Time Series Estimation of the Quadratic Expenditure System", Econometrica, 47, pp. 1231-1247.

Judge, G., Griffiths, W., Cartel Hill, R., Lutkepohl, H and *Lee T.* (1980), The Theory and Practice of Econometrics, John Wiley and sons, New York.

Kmenta, J. and *Gilbert, R.F.* (1970), "Estimation of Seemingly Unrelated Regressions with Autoregressive Disturbances", Journal of American Statistical Association, 65, pp. 1986-1996.

Lluch, C. (1974), "Expenditures, Saving and Habit Formation", International Economic Review, 15, pp. 786-797.

Manser, M. (1976), "Elasticities of Demand for Food: An Analysis Using Non-Additive Utility Functions Allowing for Habit Formation", Southern Economic Journal, 43, pp. 879-891.

Muellbauer, J. (1975), "Aggregation, Income Distribution and Consumer Demand", Review of Economic Studies, 62, pp. 525-543.

Muellbauer, J. and *Pashardes, P.* (1992), "Tests of Dynamic Specification and Homogeneity in Demand Systems", in Aggregation, Consumption and Trade, edited,by L. Phlips and L.D. Taylor, Klumer Academic Publishers.

Muellbauer, J. and *Pashardes, P.* (1982), "Tests of Dynamic Specification and Homogeneity in Demand Systems", Discussion Paper, No 125, Birkbeck College.

National Statistical Services of Greece (various years), National Accounts of Greece, Athens.

Oberhofer, W. and *Kmenta, J.* (1974), "A General Procedure for Obtaining Maximum Likelihood Estimates in Generalized Regression Models", Econometrica, 42, pp. 579-590.

Parks, R. W. (1967), "Efficient Estimation of Regression Equations when Disturbances are both Serially and Contemporaneously Correlated", Journal of American Statistical Association, 62, pp. 500-509.

Pashardes, P. (1986), "Myopic and Forward Looking Behavior in a Dynamic Demand System", International Economic Review, 27, pp. 387-397.

Phlips, L. (1983), Applied Consumption Analysis, Revised and Enlarged Edition, North-Holland, Elsevier Science Publishers, New York.

Pollak, R.A. (1976), "Habit Formation and Long-Run Utility Functions", Journal of Economic Theory, 13, pp. 272-297.

Pollak, R.A. (1970), "Habit Formation and Dynamic Demand Functions", Journal of Political Economy, 78, pp. 745-763.

Pollak, R.A. and *Wales, T.J.* (1992), "Specification and Estimation of Dynamic Demand Systems", in Aggregation, Consumption and Trade, edited, by L. Phlips and L.D. Taylor, Klumer Academic Publishers.

Pollak, R.A. and *Wales, T.J.* (1969), "Estimation of the Linear Expenditure System", Econometrica, 37, pp. 629-750.

Ray, R. (1985), "Specification and Time Series Estimation of Dynamic Gorman Polar from Demand Systems", European Economic Review, 27, pp. 357-374.

Spinnewyn, F. (1981), "Rational Habit Formation", European Economic Review, 15, pp. 91-109.

Tinter, G. (1938), "The Theoretical Derivation of Dynamic Demand Curves", Econometrica, 6, pp. 375-380.

Varian, H.R. (1984), Microeconomic Analysis, Second Edition, W. W. Norton and Co. Inc, New York.

Wales, T.J. (1971), "A Generalized Linear Expenditure Model of the Demand for Non-Durable Goods in Canada", Canadian Journal of Economics, 4, pp. 471-484.

Zellner, A. (1962), "An Efficient Method of Estimating Seemingly Unrelated Regressions and Test for Aggregation Bias", Journal of the American Statistical Association, 57, pp. 348-368.