What Influences Tastes? An Analysis of the Determinants of Consumers' Demand for Tastes in Food

Andreas C. Drichoutis and Panagiotis Lazaridis[*]

Abstract

This article explores the factors affecting demand for tastes in food. Following Silberberg (1985) we divide demand for food into demand for nutrition and demand for tastes. We first compute the minimum cost required to fulfil the Recommended Daily Allowances (RDAs) of households and attribute the difference of minimum cost from actual expenditures as the expenditure for tastes. Since prices are essential in deriving the minimum cost and data do not allow for the derivation of prices for food consumed away-from-home (FAFH), we also present a way to account for the FAFH expenditure. Data from the 1998/99 Greek Household Expenditure Survey are used. Results indicate a number of socioeconomic factors such as income, household size, urbanization, age and gender of the households' head as important factors explaining demand for tastes.

Keywords: *Nutrition, Tastes, Demand, Linear Programming, Tobit*

Introduction

Microeconomic theory provides the standard approach in modelling consumption. Traditional microeconomic theory investigates the relationship between the demand for goods and their prices and income under the assumption of utility maximization and rational behaviour. However, the decreasing influence of income and prices for food demand during the last decades has given rise to new approaches in consumer modeling.

In 1965 and 1966 Gary Becker and Kevin Lancaster in two different but related articles, introduced the concepts of household production functions. In these models instead of deriving utility directly from goods, utility is derived from the attributes of these goods and only when some transformation is performed. While the model of Becker and other models based on it (e.g. the demand for health model developed by Grossman in 1972) have been widely applied, empirically, "…it still remains that empirical implementation of the Lancaster model in a truly observable manner is not straightforward. Identification and measurement of "attributes" may be more difficult than measurements and predictions of market goods" (Silberberg & Suen, 2001, p. 343). The model has been more successful when applied to goods whose attributes are additive and non-conflicting, e.g. the nutrient values of foods (Silberberg, 1985).

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[*] **Andreas C. Drichoutis** is a PhD candidate in Agribusiness Management, Department of Agricultural Economics, Agricultural University of Athens, Iera Odos 75, 11855, Athens, Greece,
Tel: +302105294726, Fax: +302105294786 (e-mail: adrihout@aua.gr).
Panagiotis Lazaridis is Professor, Department of Agricultural Economics, Agricultural University of Athens, Iera Odos 75, 11855, Athens, Greece, Tel: +302105294720, Fax: +302105294786
(e-mail: t.lazaridis@aua.gr).

Silberberg (1985) divided the demand for food into two components: the demand for pure nutrition and the demand for tastes and tested the hypothesis that as income increases, the fraction of the food budget allocated to pure nutrition falls. In order to do that, he decomposed foods into nutrients and sought the minimum cost required to achieve certain nutrient levels. Silberberg extended Stigler's (1945) "diet problem" which seeks the minimum cost required to achieve the Recommended Daily Allowance (RDA) of nutrients known to be beneficial to people. In turn, Leung and Miklius (1997) extended Silberberg's analysis by using the Recommended Daily Allowances (RDAs) instead of the actually achieved nutrient levels to determine the technically efficient diets. Furthermore, they provided an alternative in estimating the minimum cost diets by optimizing over popular recipes.

However, in order to calculate the minimum cost diet these articles used optimization in a much aggregated level. The purpose of this article is to extend the analyses of the relationship between the expenditures for foods to satisfy nutritional requirements and the expenditures to satisfy tastes, moving the analyses to the household level. At this point we should make clear that throughout the article by referring to the demand for 'tastes' we do not mean the organoleptic taste, rather a bundle of attributes (e.g. convenience, ease of preparation, taste etc.) that when combined with the nutrition attribute constitute a food product. Our dual purpose is not only to find the combination of raw foods and of popular Greek recipes that would at minimum cost satisfy the nutritional requirements of households, but also to explore the factors affecting the demand for tastes and estimate the corresponding demand elasticities. In what follows we present a model in which the analysis is based on, the data for the analysis and the results and findings.

The Model

Following Silberberg (1985), we let x_i be the amount of food i actually purchased by a household and b_j the total amount of nutrient j required by the household to satisfy the Recommended Daily Allowances of its members, i.e. $b_j = \sum_k a_{jk}$ where a_{jk} is the RDA of nutrient j for the $k-th$ member of the household. The combination of foods providing households with at least those levels of the nutrients and at least cost is obtained by solving the Linear Programming Diet Problem:

$$\text{minimize } y = p'x \tag{1}$$

subject to

$$Ax \geq b \tag{2}$$

and

$$x \geq 0 \tag{3}$$

where A is the matrix of nutrient coefficients representing the amount of each nutrient that a food contains and p' is the vector of prices of foods. If we denote by x^* the food vector that solves the Linear Programming problem then $y^* = p'x^*$ is the resulting minimum expenditure on those foods that satisfy the RDAs of the household. We can then form the difference

$$Y = y - y*$$

(4)

which is the expenditure spent to satisfy the demand for tastes (e.g. convenience, taste, ease of preparation etc).

The role of determinants of demand for tastes can be investigated through an Engel type equation of the form:

$$Y_m = z'_m c$$

(5)

where z'_m is a vector of the determinants of demand for tastes and c is a vector of the unknown coefficients. The vector z'_m includes income and a series of demographic and social factors that affect consumer's preferences.

Assuming that the decision to consume food can be separated from the other items, the Engel function (5) can be estimated alone. The specific form employed is:

$$Y_m = \begin{pmatrix} c_0 + c_1 EXP_m + c_2 EXP_m^2 + c_3 SIZE_m + c_4 SIZE_m^2 + c_5 EXP_m * SIZE_m \\ + c_6 U_{2m} + c_7 U_{3m} + c_8 U_{4m} + c_9 U_{5m} + c_{10} QRT_{1m} + c_{11} QRT_{2m} \\ + c_{12} QRT_{3m} + c_{13} EDUC_{2m} + c_{14} EDUC_{3m} + c_{15} AGE_m + c_{16} GENDER_m \\ + c_{17} SINGPAR_m + c_{18} NOCHILD_m \end{pmatrix} + u_m$$

(6)

where u_m is the disturbance term. There is no theory underlying the presence of the variables in equation (6). We rather include variables that are often used in demand analysis (e.g. Cox & Wohlgenant, 1986; Drichoutis & Lazaridis, 2003; Fousekis & Lazaridis, 2005; Lazaridis, 2004; Park & Capps, 1997). That is, the demand attributed to tastes is a non-linear function of total expenditure (EXP_m), which we use as a proxy for income, a non-linear function of the household size ($SIZE_m$), and a linear function of other social and demographic characteristics. These characteristics refer to the household as a whole and to the household manager as well. These include urbanization (U_m) of households residence, the quarter of the survey (QRT_m) to capture seasonality, the education level, age and gender of the household manager ($EDUC_m$, AGE_m, $GENDER_m$), whether or not it is a single parent family ($SINGPAR_m$) and whether or not it is a household without underage children ($NOCHILD_m$). The exact definition of each variable is given in Table 1.

The Data

We use the data from the 1998/99 Household Expenditure Survey which is conducted by the National Statistical Service of Greece. Through this survey information are collected on the value of purchases and the receipts in kind of the households as well as on the different characteristics of the households and their dwellings, principally aiming to the revision of the Consumer Price Index. Information are also collected on the way the households obtain goods and services, that is pure purchases, own production, own enterprise and other ways of acquisition (e.g. for free).

The survey covers the total country's households regardless of their size or any economic and social characteristics. During the survey, the method of the multistage stratified sampling was applied with a unified general sampling fraction 2/1.000 for the

whole year. Data were collected through a diary that recorded 14 days of daily member expenditures of the members of the household. Data were also collected for expenditures on bulk quantities of products that were purchased more than 14 days before using memory recalls. Secondary information (e.g. demographic) was collected through personal interviews of each member of the household.

Table 1. Names and description of variables

Variable	Variable Description			Mean	SD
MCF	Minimum cost expenditure raw foods (€)			38.122	21.375
MCREC	Minimum cost expenditure recipes (€)			87.255	38.710
ACTEXP	Actual expenditure on food based on the 122 categories used (€)			260.215	153.656
Y	Expenditure attributed to tastes (€)	Raw foods		238.124	159.549
		Raw foods (with FAFH)		367.009	298.246
		Recipes		186.774	153.528
		Recipes (with FAFH)		314.866	293.535
EXP	Total consumption expenditure (€)			1640.591	1354.011
SIZE	Family size			2.825	1.319
SINGPAR	Single parent family=1, Otherwise=0			0.019	0.135
NOCHILD	Family with no underage children=1, Otherwise=0			0.646	0.478
AGE	Age of the head of the family			54.266	16.117
GENDER	The head of the family is male=1, Otherwise=0			0.804	0.397
Level of education of the head of the household					
EDUC$_1$[a]	Primary education=1, Otherwise=0			0.578	0.494
EDUC$_2$	Secondary education=1, Otherwise=0			0.183	0.387
EDUC$_3$	University education or higher=1, Otherwise=0			0.239	0.426
Area population Urbanization					
U$_1$[a]	The family resides in Athens=1, Otherwise=0			0.409	0.492
U$_2$	The family resides in Thessalonica=1, Otherwise=0			0.062	0.241
U$_3$	The family resides in area with population ≥10.000=1, Otherwise=0			0.200	0.400
U$_4$	The family resides in area with 2.000≤population<10.000=1, Otherwise=0			0.115	0.319
U$_5$	The family resides in area with population <2.000=1, Otherwise=0			0.213	0.410
Quarter during which the survey was conducted					
QRT$_1$	1st quarter=1, Otherwise=0			0.245	0.430
QRT$_2$	2nd quarter=1, Otherwise=0			0.248	0.432
QRT$_3$	3rd quarter=1, Otherwise=0			0.252	0.434
QRT$_4$[a]	4th quarter=1, Otherwise=0			0.255	0.436

[a] These variables were not included in estimation to avoid the problem of perfect multicollinearity.

The Data for Raw Foods

In order to solve the Linear Programming Diet Problem (1) we had to construct the p', A and b matrices. To construct the p' matrix we divided expenditures with quantities consumed for each household. Consequently we excluded food categories for which no quantities were provided or measured (e.g. Food Away From Home where only expenditures are recorded) and therefore 122 food categories were used in the analysis. Food Away From Home (FAFH) accounts for 31.54% of total food expenditure while other food categories that were not included account for 3.75% of total food expenditure. By dividing expenditures with quantities the unit values are computed. However, unit values vary partly due to genuine price variation and partly due to quality variation in purchases. Different methodologies have been proposed in order to correct for quality effects (Cox & Wohlgenant, 1986; Deaton, 1988). Due to complexity issues related with these procedures, applying these methodologies to the 122 food categories would have been quite cumbersome and beyond the scope of this article.

A simpler but still rational method would be to assume that the lowest unit value observed in each food category has no quality effect induced. However, this would implicitly assume that all geographical areas in a country (in our case Greece) face the same price (for the same food category) and therefore neglect costs incurred to foods such as transportation costs etc. We therefore divided our sample in 13 geographical regions (see Table 2) and imposed the minimum unit value observed in each region and for each food category as the implicit price for the whole region that carries no quality effects. If for a region the calculated unit value for the specific food category was larger than five standard deviations of the minimum unit value observed in the food category, the unit value for the whole region was normalized to the mean of all other regions.[1] This way a 1 x 122 matrix of prices was calculated for each of the 6258 households.

Table 2. Regions

1. East Macedonia and Thrace	8. Central Greece
2. Central Macedonia	9. Attica
3. Western Macedonia	10. Peloponnesus
4. Epirus	11. North Aegean Islands
5. Thessaly	12. South Aegean Islands
6. Ionian Islands	13. Crete
7. Western Greece	

To construct the A matrix we used food composition tables (Trichopoulou, 1992) to transform foods into nutrients. For food categories not included in the above tables the USDA's National Nutrient Database for Standard Reference Release 17 was used. Each of the 122 food categories was therefore analyzed into 17 nutrients, the most commonly listed in RDA tables. Ideally we would have wanted to break down foods in all possible nutrients but unfortunately those 17 nutrients are the only ones for which RDAs exist.

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[1] Cox and Wohlgenant (1986) proceed in a similar manner. They've deleted observations with prices more than five standard deviations from the average observed price. Following the exact same methodology for the 122 columns of prices would have resulted in deleting a great number of observations due to non-overlapping of observations greater than five standard deviations from the mean.

Therefore, the nutrients used were: Energy, Proteins, Fat, Carbohydrates, Fiber, Thiamin, Riboflavin, Vitamin C, Vitamin B6, Sodium, Vitamin K, Calcium, Magnesium, Phosphorous, Iron, Zinc and Vitamin A. This way a 17 x 122 matrix of nutrients coefficients was created.

The b matrix was calculated separately for each household based on its member's composition. This way, different nutritional requirements were calculated for each household based on the number of members of the household, their gender and their age. The RDAs per member (based on individual characteristics) were first calculated using Dietary Reference Intakes tables (Institute of Medicine of the National Academies, 2004) and then were summed over the household. This way a 17 x 1 matrix for each of the 6258 households was constructed.

The Data for Popular Greek Recipes

Optimizing over raw food items is not technically 'feasible' because the technologies transforming these foods into meals are not specified (Leung & Miklius, 1997). Therefore and for comparative purposes we use Linear Programming to optimize over popular Greek recipes. The recipes were taken from the 'Composition tables of foodstuffs and Greek foods' (Trichopoulou, 1992). In this book 105 recipes are decomposed into nutrients. In addition the quantities of raw foods required to produce these recipes are listed.

We used the quantities of ingredients required to produce these recipes along with the p' matrix that we constructed before to derive a new matrix of prices p_r' for the recipes. This new matrix reflects the prices of the recipes based on the cost required to purchase the ingredients. It therefore biases downwards the real cost required to produce these recipes since costs like electricity for cooking or transportation costs (to travel to the grocery) etc. are neglected. However, these additional costs that would produce more accurate estimates of completed meal prices are not available. This way a new 1 x 105 matrix of prices of meals is constructed.

Furthermore, a new 17 x 105 matrix of nutrient coefficients (A_r) was constructed for the meals. Nutrient amounts for the meals were provided by composition tables (Trichopoulou, 1992). The *b* matrix remains as is.

Results and Findings

Solution of the LP problem (1) is presented in Tables 3 and 4. The solution provides the optimum combination of foods (Table 3) and recipes (Table 4) that satisfy nutritional requirements of households at minimum cost. We use the minimum costs from the two methods on equation (4) to derive the expenditures attributed to tastes. However, equation (4) does not ensure positive tastes expenditure. In the case of raw foods 62 households were found to have negative expenditure for tastes and 309 in the case of recipes. Negative values for expenditure on tastes means that these households spend less than the minimum cost that the LP solution suggests as satisfying the RDAs. This does not necessarily mean that these households suffer from malnutrition since 35.29% of total food expenditure, as mentioned before, was not included in the analysis.

In order to estimate equation (6) we normalized negative values of expenditure on tastes to zeros. Equation (6) was estimated with a Tobit model because of the censored

nature of the dependent variable and Limdep ver 8.0 served as the econometric software. The OLS interpretation is not valid for Tobit coefficients because the Tobit coefficient represents the effect of an independent variable on the latent dependent variable. We therefore computed marginal effects and we base our discussion on these computations.[2] Note, that by letting Limdep automatically calculate marginal effects would have produced one marginal effect for each term that appears in equation (6). However, this does not accurately report marginal effects for terms that appear in several (nonlinear) forms in equation (6) (i.e. *EXP* and *SIZE*). We therefore calculate only one marginal effect for the income variable (*EXP*) and the size variable (*SIZE*) respectively by accounting for the fact that these variables appear in different forms in equation (6).

In explain, the marginal effect for a continuous variable that appears only once in (6) is calculated as (Greene, 2002, p. 21-7):

$$\frac{\partial E\left[y/x_i\right]}{\partial x_i} = \Phi\left(c'x/\sigma\right)c_i \tag{7}$$

The marginal effects for income and size are calculated as:

$$\frac{\partial E\left[y/EXP\right]}{\partial EXP} = \Phi\left(c'x/\sigma\right)\left(c_1 + 2c_2 EXP + c_5 SIZE\right) \tag{8}$$

and

$$\frac{\partial E\left[y/SIZE\right]}{\partial SIZE} = \Phi\left(c'x/\sigma\right)\left(c_3 + 2c_4 SIZE + c_5 EXP\right) \tag{9}$$

where Φ is the standard normal cumulative distribution function. Finally, the marginal effects for the dummy variables of (6) are computed as (Greene, 2002, p. 21-9):

$$\text{Impact} = E\left[y/x^1\right] - E\left[y/x^0\right] \tag{10}$$

where the superscripts '1' and '0' indicate that in the computation, the dummy variable *x* takes values 1 and 0 respectively. Standard errors for the estimates of the marginal effects are computed using the delta method. Tables 5 and 7 also present the *ANOVA* and *DECOMPOSTION* fit measures (Greene, 2002, p. 21-12) and the standard trio of Neyman-Pearson tests for the joint significance of all the variables of the model (Greene, 2002, p. 21-6).

Equations (8) and (9) are also used to derive the appropriate income and size elasticities:

$$\varepsilon_I = \frac{\partial E\left[y/EXP\right]}{\partial EXP}\frac{EXP}{Y} = \Phi\left(c'x/\sigma\right)\left(c_1 + 2c_2 EXP + c_5 SIZE\right)\frac{EXP}{Y} \tag{11}$$

$$\varepsilon_S = \frac{\partial E\left[y/SIZE\right]}{\partial SIZE}\frac{SIZE}{Y} = \Phi\left(c'x/\sigma\right)\left(c_3 + 2c_4 SIZE + c_5 EXP\right)\frac{SIZE}{Y} \tag{12}$$

Income and size elasticities from equations (11) and (12) were calculated at the means of all other variables.

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2   Parameter estimates are available upon request.

Results and Findings from Minimum Cost Diet

To solve the Linear Programming (LP) problems we used Excel Premium Solver Platform V5.5. Table 3 and Table 4 present summaries from the solutions of the two cases. In the case of raw foods (see Table 3) approximately 54% of the sample can achieve the minimum cost diet by consuming six different types of foods the most popular of which are flour and cereals, fresh fish and lemons. In addition, almost 31.1% of the sample can achieve the minimum cost diet by consuming flour and cereals, fresh fish and spinach. Therefore, it appears that flour and cereals and fresh fish are essential in achieving a diet capable of fulfilling basic nutrients needs at minimum expense.

Table 3. Raw foods for minimum cost diet

Number of raw foods for minimum cost diet	Percentage in total sample %	Percentage in specific category %	Flours and cereals	Fresh fish C class	Fresh milk	Milk canned	Milk powder	Spinach	Lemons	Carrots	Pickles	Olives canned
6	54.04	38.79	✓	✓			✓	✓	✓			✓
		16.29	✓	✓		✓		✓	✓		✓	
		15.41	✓	✓			✓	✓	✓		✓	
		9.49	✓	✓			✓		✓	✓	✓	
		8.63	✓	✓		✓			✓	✓	✓	
5	31.14	73.32	✓	✓			✓	✓				✓
		16.32	✓	✓		✓		✓			✓	
7	5.54	49.86	✓	✓	✓		✓	✓	✓		✓	

When it comes to the LP problem of recipes, Table 4 illustrates that cream cheese pie, baked potatoes and lentil soup fulfil the basic nutrient needs of most diets of Greek households. More specifically about 56% of households can achieve the RDAs by consuming four different kinds of meals, three of which are mentioned above. Almost 27% of the sample can use three kinds of meals to satisfy the RDAs. Cream cheese pie, baked potatoes and lentil soup are the principal recipes.

At a first glance the solutions of the LP problem of raw foods offered here are quite different from those of Silberg (1985) and Stigler (1945). However, there are several similarities like milk, spinach and flour and cereals. One should also have in mind that dietetic habits of Americans (where the above studies refer to) and Greeks (where the Mediterranean diet is still consumed, even though it is increasingly supplemented with ready made foods) are normally expected to differ. Fish, vegetables, fruits and cereals are basic components of the traditional Mediterranean diet and it is not a surprise that these appear as part of the solution of the LP problem.

Table 4. Recipes for Minimum Cost Diet

Number of foods for minimum cost diet	Percentage in total sample %	Percentage in specific category %	Marzipan almond paste Amigdalota	Stuffed tomatoes, marrow, peppers Gemista	Cream cheese pie Mizithropita	Cabbage boiled with rice Lahanorizo	Cookies	Potatoes baked	Spinach boiled with rice Spanakorizo	Custard cream Krema	Lentil soup
4	56.04	22.78			✓			✓	✓		✓
		12.03		✓	✓				✓		✓
		10.80	✓		✓			✓			✓
3	26.94	39.92			✓			✓			✓
		14.47				✓		✓			✓
		13.52	✓		✓			✓			
		12.69			✓	✓		✓			
		11.86					✓		✓	✓	
5	16.32	55.63		✓	✓			✓	✓		✓
		10.38	✓		✓	✓	✓	✓			
		9.60	✓		✓		✓	✓	✓		

Results and Findings from Tobit

The results from the censored regression are presented in Table 5. Because the optimum solutions of the LP problem were computed for two scenarios (the case of raw foods and the case of recipes), tastes expenditure based on equation (4) was created both for raw foods and recipes. Table 5 therefore includes estimates from two equations, one for raw foods and one for recipes. Results show that as income increases (*EXP*) expenditure on tastes will increase. The income elasticity (see Table 6) is inelastic in both scenarios. According to these elasticities a 10% increase in total consumer expenditure will have as a result a 4.1% (5.1%) rise in the expenditure for tastes.

Ditto, Table 5 shows that an increase in household members (*SIZE*) will increase expenditure on tastes. The size elasticity from Table 6 shows that a 10% increase in household size will have as a result a 5.2% (4.6%) rise in spending for tastes. That is the difference between a three-member household and a two-member household is 25.9% (22.9%) in spending for tastes. One explanation for this is the existence of strong economies of scale in the consumption of basic nutrients. In other words larger households require less per capita spending in order to satisfy basic nutrient requirements and consequently larger amounts on tastes spending. It may also be that larger households reallocate their total consumption expenditure in order to have more available expenditure for tastes.

Another major difference is in the urbanization of households'. There are differences depending on the scenario we follow. Households residing in Thessalonica (U_2) or in areas with more than 10.000 people (U_3) spend less on tastes than Athens residents in the case of raw foods. In the case of recipes, households in rural areas (U_5) spend more

Table 5. Results from Tobit

	Tastes expenditure (raw foods)		Tastes expenditure (recipes foods)	
	Coefficients	*p*	*Coefficients*	*p*
EXP	**0.060***	**0.000**	**0.058***	**0.000**
SIZE	**43.605***	**0.000**	**30.321***	**0.000**
U_2	**-40.088***	**0.000**	**-35.337***	**0.000**
U_3	**-20.368***	**0.000**	**-12.398***	**0.003**
U_4	0.954	0.857	8.098	0.127
U_5	2.595	0.567	**12.150***	**0.007**
QRT_1	**-17.422***	**0.000**	**-17.304***	**0.000**
QRT_2	-1.039	0.811	-1.015	0.814
QRT_3	1.050	0.808	0.286	0.947
$EDUC_2$	1.672	0.713	1.800	0.690
$EDUC_3$	-6.479	0.149	-4.982	0.262
AGE	**1.072***	**0.000**	**1.018***	**0.000**
GENDER	**9.401****	**0.052**	7.734	0.107
SINGPAR	-0.423	0.972	-4.578	0.705
NOCHILD	6.955	0.153	4.798	0.320
ANOVA fit measure	0.348		0.263	
DECOMPOSITION fit measure	0.363		0.280	
Neyman-Pearson tests — *LM stat*	3070.549		2440.939	
Neyman-Pearson tests — *Likelihood ratio test*	3135.196	0.000	2474.149	0.000
Neyman-Pearson tests — *Wald statistic*	4056.586	0.000	3012.579	0.000

*(**) Statistically significant at 5%(10%) level

for tastes for food than households residing in Athens. In all, it seems that households at the edges of the urban-rural scale spend more on tastes.

Table 5 also shows a seasonality effect. Households surveyed in winter appear to spend less on tastes than households surveyed in autumn. Quite interesting is the lack of any educational effect. Traditionally education effects are present in food demand analysis (e.g. Drichoutis & Lazaridis, 2003; Fousekis & Lazaridis, 2005; Lazaridis, 2004). The absence of educational effects may be an indication that when it comes to tastes, it is not education that matters since the demand to fulfil it, remains constant re-

Table 6. Income and Size Elasticities for Tastes

	Tastes	
	Raw foods	**Recipes**
Income elasticity	0.410	0.506
Size elasticity	0.517	0.459

gardless of educational level. Finally, results indicate that as households' head age increases so is expenditure on tastes and that households with male heads spend more on tastes.

One should also have in mind that tastes is a composite attribute (convenience, ease of preparation etc.) and this makes hard the explanation of results that may be the combined effect of the specific components of tastes.

Accounting for the Neglected FAFH Expenditure

One possible caveat of the above analysis is the neglect of the FAFH expenditure which accounts for over 31.5% of total food expenditure. If quantities purchased were recorded in the Household Expenditure Survey, then we would be able to derive prices following the aforementioned methodology and therefore include this food category in the Linear Programming problem (1). However, FAFH has one very special and widely accepted characteristic. Away-from-home foods generally contain more of the nutrients overconsumed and less of the nutrients underconsumed (Lin, Guthrie, & Frazao, 1999) and therefore are not cost efficient from a nutrition intake perspective. That is, FAFH is less nutritious than home made foods and is offered at a higher price, mostly because one does not pay for the nutrients he/she buys rather he/she pays for taste, convenience and other attributes that make FAFH so attractive.

Having said that it would be reasonable to assume that even if we had included FAFH in the LP problem (1) it probably would not have been selected as an optimum solution. Therefore, it is quite plausible to assume that all of the expenditure on FAFH can be attributed to expenditure on tastes. In order to address the issue of neglected FAFH expenditure we include it in the total food expenditure figure. We recalculate tastes expenditures based on (4) by including the FAFH expenditure on the y variable of equation (4).

It is quite interesting to note that negative values of tastes expenditure remain even when we add the FAFH expenditure figure. Eleven households were found to have negative expenditures on tastes in the case of raw foods and 114 households in the case of recipes. Negative expenditures were normalized to zero and tobit was used for the estimation.

Table 7 shows that there are some differences when accounting for the FAFH expenditures. The income effect (*EXP*) remains the same (as expected) even though the calculated income elasticities shift upwards. Elasticities in Table 8 show that not accounting for the FAFH expenditure may lead to inaccurate conclusions. A 10% increase in total consumer expenditure will have as a result a 6.4%(7.3%) rise in the expenditure for tastes rather the 4.1%(5.1%) figure calculated before.

In contrast, size elasticities (see table 8) shift downwards when we include the FAFH expenditure. In this case, the difference between a three-member household and a two-member household is 18.3% (15.4%) compared with the 25.9% (22.9%) figures calculated before.

In addition households with no under age children (*NOCHILD*) spend more on tastes probably due to the fact that these households may be less interested on providing an adequate diet for the members of their household and therefore spend more on FAFH. This is why when accounting for the FAFH expenditure this variable becomes statistically significant.

Education variables show that households with highly educated heads ($EDUC_3$) spend less on tastes than lower educated household heads. This could be the overall effect of the different attributes of tastes. For example, more educated people might have a higher willingness to pay for more healthy alternatives of food (one component of tastes) but a lower willingness to pay for convenience (another attribute of tastes).

Table 7. Results from Tobit (FAFH included)

	Tastes expenditure (raw foods with FAFH)		Tastes expenditure (recipes with FAFH)	
	Coefficients	*p*	*Coefficients*	*p*
EXP	**0.143***	**0.000**	**0.140***	**0.000**
SIZE	**47.399***	**0.000**	**34.494***	**0.000**
U_2	**-49.691***	**0.000**	**-45.049***	**0.000**
U_3	**-17.820***	**0.015**	-11.002	0.129
U_4	1.845	0.840	8.363	0.354
U_5	**14.509****	**0.063**	**23.042***	**0.003**
QRT_1	**-40.107***	**0.000**	**-39.421***	**0.000**
QRT_2	-5.158	0.489	-5.057	0.491
QRT_3	-0.593	0.936	-0.739	0.920
$EDUC_2$	-2.792	0.721	-2.417	0.753
$EDUC_3$	**-18.778***	**0.015**	**-17.179***	**0.023**
AGE	**-0.846***	**0.000**	**-0.890***	**0.000**
GENDER	**26.884***	**0.001**	**25.717***	**0.002**
SINGPAR	-2.687	0.898	-6.118	0.767
NOCHILD	**60.463***	**0.000**	**57.754***	**0.000**
ANOVA fit measure	0.394		0.348	
DECOMPOSITION fit measure	0.419		0.377	
Neyman-Pearson tests	*LM stat*	3756.998		3471.294	
	Likelihood ratio test	3876.508	0.000	3563.475	0.000
	Wald statistic	5365.911	0.000	4781.120	0.000

*(**) Statistically significant at 5%(10%) level

Table 8. Income and Size Elasticities for Tastes (FAFH included)

	Tastes (FAFH included)	
	Raw foods	**Recipes**
Income elasticity	0.641	0.729
Size elasticity	0.365	0.309

In addition, households with male heads appear to spend more on tastes. This may be a result of the fact that typically men are less interested in nutrition (Drichoutis,

Lazaridis, & Nayga, 2005a, 2005b) and therefore spend more on non-nutritious foods (i.e. FAFH).

Finally, the effect of age reverts when we add FAFH in the analysis. Households with older heads spend less on tastes which probably can be attributed exclusively to FAFH spending, since in general older individuals spend less in FAFH (Mihalopoulos & Demoussis, 2001).

In conclusion, adding FAFH expenditures in equation (4) as an expenditure on tastes does not alter results with the exception of some demographic variables.

Conclusion

In this study the demand for tastes in food was investigated using data from the 1998/99 Households Expenditure Survey conducted in Greece. In order to do that we divided demand for food into two components, that is demand for nutrition and demand for tastes. Therefore, we first calculated the minimum cost that a household requires to satisfy the RDAs of its members and attributed the rest of the expenditure as the expenditure on tastes. We also provided a way to account for the neglected FAFH expenditure attributing it as a pure expenditure on tastes.

Findings show that most households could satisfy their basic nutritional requirements by consuming a specific mix of foods or meals. Deviations from this optimum mix of foods are considered as providing the tastes in their food consumption. A number of variables, which are usually used in demand analysis, were hypothesized to affect the tastes expenditure. Results indicate that variables like income, household size, age of the family's head and urbanization are significantly affecting the demand for tastes. Ideally we would have wanted to test the effect of other variables (e.g. attitudinal) which unfortunately are not available in Household Expenditure surveys. This remains a caveat for our analysis.

Furthermore, results have important implications for marketers and the food sector in general. Consumers, their diets, preferences and tastes differ. The complexity of the modern food choice process, influenced mainly by the demand for product characteristics has put more weight on food sector's shoulders. The vast majority of new food products (72%-88%) continue to fail mainly because of low consumer satisfaction. Therefore, it is important to understand which factors drive the demand for tastes. The aim of this study was to attempt to shed some light on these complex issues.

References

Becker, G. (1965). A theory of the allocation of time. *The Economic Journal, 75*(299), 493-517.
Cox, T. L., & Wohlgenant, M. K. (1986). Prices and quality effects in cross-sectional demand analysis. *American Journal of Agricultural Economics,* 68(4), 908-919.
Deaton, A. (1988). Quality, quantity and spatial variation in prices. *The American Economic Review,* 783, 418-430.
Drichoutis, A. C., & Lazaridis, P. (2003). Determinants of demand for food in Greece: A microeconometric approach. *Global Business & Economics Review,* 52, 333-349.
Drichoutis, A. C., Lazaridis, P., & Nayga, R. M., Jr. (2005a). Nutrition knowledge and consumer use of nutritional food labels. *European Review of Agricultural Economics,* 32(1), 93-118.

Drichoutis, A. C., Lazaridis, P., & Nayga, R. M., Jr. (2005b). Who is looking for nutritional food labels? *Eurochoices,* 4(1), 18-23.

Fousekis, P., & Lazaridis, P. (2005). The demand for selected nutrients by Greek households: an empirical analysis with quantile regression. *Agricultural Economics,* 32(267-279).

Greene, W. H. (2002). *LIMDEP version 8.0, Econometric modelling guide* (Vol. 2). NY, USA: Econometric Software Inc.

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy,* 802, 223-255.

Institute of Medicine of the National Academies. (2004). Dietary Reference Intakes tables. The complete set: Institute of Medicine of the National Academies.

Lancaster, K. (1966). A new approach to consumer theory. *The Journal of Political Economy,* 742, 132-157.

Lazaridis, P. (2004). Olive oil consumption in Greece: A microeconometric analysis. *Journal of Family and Economic Issues,* 253, 411-430.

Leung, P., & Miklius, W. (1997). Demand for nutrition vs. demand for tastes. *Applied Economics Letters,* 4, 291-295.

Lin, B.-H., Guthrie, J. F., & Frazao, E. (1999). Nutrient contribution of food away from home. In E. Frazao (Ed.), *America's eating habits: Changes and consequences*: USDA, Economic Research Service.

Mihalopoulos, V. G., & Demoussis, M. P. (2001). Greek household consumption of food away from home: a microeconometric approach. *European Review of Agricultural Economics,* 28(4), 421-432.

Park, J. L., & Capps, O., Jr. (1997). Demand for prepared meals by U.S. households. *American Journal of Agricultural Economics,* 79, 814-824.

Silberberg, E. (1985). Nutrition and the demand for tastes. *The Journal of Political Economy,* 935, 881-900.

Silberberg, E., & Suen, W. (2001). *The Structure of Economics, A Mathematical Approach* (3rd ed.). New York: McGraw-hill.

Stigler, G. (1945). The cost of substistence. *Journal of Farm Economics,* 27(303-314).

Trichopoulou, A. (1992). *Composition tables of foodstuffs and Greek meals*. Athens: Parisianos (In Greek).

APPENDIX

A. The following foods were utilized in the survey:

1. <u>Flour, bread and cereals</u>: Rice, bread (all types), crisp breads, crackers, cookies, biscuits, pasta, tarts, small honey cakes, sugar bun, flour, cereals.

2. <u>Meat</u>: beef, veal, pork, lamb, goat, turkey, chicken, duck, cooked meat (sausages), salted preserves, ham, bacon, rabbit, hare, pigeons,

3. <u>Fish</u>: A class fish (flounder, sole, swordfish, grouper, scup), B class fish (mullet, cod, tope, saddled bream), C class fish (mackerel, anchovy, bonito, sardine, horse mackerel), lobster, shrimps, crayfish, octopus, snails, sardine salted, herring kippered, cod dried and salted, salted tuna, salted anchovy, caviar, fish roe, brick.

4. <u>Dairy products and eggs</u>: fresh milk, skim milk, evaporated milk, condensed and sweetened milk, powder milk, yogurt, soft cheese, hard cheese, chocolate milk, whipping cream, eggs.

5. <u>Fats and oils</u>: butter, margarine, vegetable cooking oil, olive oil, seed oil, lard.

6.   Fruits: lemons, tangerines, oranges, grapefruit, bananas, apples, pears, peaches, apricots, cherries, plum, avocados, loquats, figs, grapes, strawberries, kiwi, watermelon, melon, pineapple and quinces, plums dried, figs dried, raisins, coconut, chestnut, walnut, hazelnut, almonds, baby food based on fruits.

7.   Vegetables: chicory, turnip, dandelion, lettuce, spinach, parsley, celery, spearmint, cauliflower and broccoli, cabbage, cucumber, peas, zucchini, broad beans, eggplant, okra, peppers, tomatoes, beans, artichokes, carrots, onions fresh, beet, leeks, garlic, scallions, other (radishes, asparagus, mushrooms), beans, lentils, chickpeas, other (peas, fava, lupine), frozen vegetables (okra, peas, beans), olives, pickles, tomatoes (canned), potatoes, sweet potatoes.

8.   Sugars and sweets: sugar, honey, glucose, marmalade, fruit jell, preserves, chocolates, ice-cream, water ice.

9.   Beverages: coffee, tea, sagebrush, chamomile, chocolate, cocoa, carbonated beverages (cola, soda, orange, lemonade), wine, beer, whisky.

10. Juice: fruit juice, concentrated fruit juice, vegetable juice.

B. The following recipes were utilized in the survey:

Tomato and cucumber salad, artichokes ala polita, marzipan almond paste, peas with tomatoes in sauce, lamb in tomato sauce, lamb with artichokes, lamb with lettuce frikase, eggs with tomato and cheese, eggs fried, galaktoboureko, galatopita, gardoubes, shrimps in tomato sauce, stuffed vegetables (tomatoes, peppers, marrow), stuffed vegetables with minced meat, cake made with yogurt, minced meat and rice with sauce, diples, squid fried, walnut cake, cake, meat balls fried, minced meat in tomato sauce, kokoretsi, marrows stuffed in casserole, marrow fried, marrow balls fried, marrow pie, chicken in tomato sauce, chicken with okra in tomato sauce, chicken based soup, roasted chicken, cookies, cookies made with oil, rabbit stifado, sugar buns, custard, cream caramel, croissants, stuffed cabbage leaves, cabbage boiled with rice, magiritsa, macaroni boiled, eggplants (imam), eggplants in tomato sauce, papoutsakia (eggplant based dish), eggplant fried, eggplant salad, small honey cakes, apple pie, mille-feuille, beef with vegetables, beef based soup, beef in tomato sauce, beef with marrows in tomato sauce, beef stifado, beef roasted in casserole, moussakas, cod dried salted with tomato sauce, baklavas, okra in tomato sauce, mince meat roasted, baked vegetables (briam), cream cheese pie (mizithropita), stuffed vine leaves with rice, tomato soup, ice cream dairy, ice cream chocolate, pastitsio, potatoes in tomato sauce, potatoes mashed, potatoes baked, fried potatoes, potato balls fried, ravani (cake with almonds and syrup), chick pea soup, rice boiled, rice pudding, Russian salad, tomato sauce, skordalia, rice based soup, meat balls in tomato sauce, spinach pie, spinach boiled with rice, tzatziki, frumenty soup, tsoureki (bun), cheese pie, lentil soup, beans french in tomato sauce, beans baked in tomato sauce, dried beans soup, halva, pork and celery, chicory boiled, vegetables soup, octopus in tomato sauce, octopus with macaroni, octopus in vinegar sauce, chilopites cooked, horiatiki salad, fish and potatoes baked in tomato sauce, fish grilled, fish based soup