AT-HOME CONSUMPTION OF OLIVE-OIL IN GREECE: SOME EVIDENCE FROM SURVEY DATA

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ABSTRACT

In this paper the effects of prices, expenditure on food and a number of socio-demographic factors on the consumption of olive-oil in Greece were examined. For this purpose, the 1987/88 data of the Family Budget Survey were used and a single equation econometric model was employed.
The problem of zero-consumption was overcome with the use of Heckman's two-step procedure. The results show a high own-price and a low cross-price elasticity of olive-oil.
Combined with the other socio-demographic variables, this suggests that consumption of olive-oil in Greece is very much affected by tradition.

RÉSUMÉ

Dans cet article ont été examiné les effets de prix, la dépense pour l' alimentation et un certain nombre de facteurs socio-demographiques relatifs a la consommation de l' huile d' olive en Grece. Pour cette raison, on a utilisé les données 1987/88 de l' Enquête sur les budgets familials et un modèle économétrique à equation unique. Le problème de la consommation-zero a été surmonté en utilisant la procedure de deux pas de Heckman.
Les résultats montrent que l' elasticité de prix d' huile d' olive est elevée tandis que la cross-price elasticity est basse.
Ces résultats combines avec d' autres variables socio-démographiques indiquent que la consommation de l' huile d' olive en Grèce est très influencée par la tradition.

Olive-oil, a traditional product of the Greek agricultural sector, plays a very important role both in terms of demand and supply.
Greece ranks third in the world, after Spain and Italy, in olive-oil production. Average annual production in recent years is close to 300 thousand tons and its value represents almost 10% of the total value of agricultural production. On the other hand the total quantity consumed domestically is close to 200 thousand tons accounting for almost 3% of total expenditure on food.
At the same time the role of competitive products, especially seed-oils, is increasing. In recent years, other fats and oils represent almost 30% of the total quantity of fats and oils consumed domestically. Although the traditional character of the production as well as the consumption of this commodity is frequently stressed, the empirical evidence on which this argument is based is mostly concentrated on the production side. Empirical data on the demand for olive-oil are very limited(1). The purpose of this paper is twofold: to investigate the role of prices and income in the consumption of olive-oil using cross-section data and to examine the effect of a number of socio-demographic factors which in turn can provide some evidence of the role of tradition in the demand for olive-oil.

MODEL SPECIFICATION AND ESTIMATION

The model employed to analyse olive-oil demand behaviour is a single equation linear model which incorporates the effects of prices, expenditure and a number of socio-demographic factors which refer to household characteristics (size, urbanisation, presence of children etc.) as well as to those of heads of households (education, sex, etc.). One common problem associated with using survey data to analyse the consumption of a commodity is that many households report zero expenditures during the survey period.
The proportion of households, which are likely to report not purchasing a product during a survey, tends to increase, as the category becomes more specific and the survey period shorter.
There are two main questions associated with non-purchasers. First, do they provide any additional information, or can they simply be omitted? Second, if they are different from purchasers, what is the appropriate econometric method for estimating the demand equation? In general, a household might report zero expenditure for a commodity during a survey period for three reasons. The first reason is because of health concerns, religious beliefs etc. the household is not a member of the market. The second reason is because the household is an infrequent buyer of the specific commodity.
Finally, the third reason is because the household faces economic conditions (high price or low income) that do not allow the purchase of the specific commodity (corner solution).
The choice of econometric method should be based on which case the household with zero expenditure belongs to.
However, the typical survey does not provide this type of information and this is also true for the survey used in this study.
It remains the econometric problem, which is how do treat non-purchasers. This problem may be approached

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(1) All existing studies are based on time series data and their focus is on price and income elasticities. Demousis (1986), Andrikopoulos, Brox and Georgakopoulos (1987) and Mergos and Donatos (1989) refer to consumption of fats and oils as one commodity in a system of demand equations. The same approach is used also by Rigas (1987), where olive-oil is used explicitly. Finally, Miliakos (1980) estimates olive-oil elasticities through single-equation demand models.

as an issue of sample selection bias. Thus, we treat the sample of purchasers as a non-random sample and we try to correct the bias created in that way.

More specifically, the general form of the equation to be estimated is written as

$y_i = \mathbf{X'b} + \varepsilon_i \quad if \quad y_i > 0 \qquad (1)$

$= 0$ *otherwise*

where **yi** is the quantity of olive-oil consumed by the i[th] household, **X** is a $1 \times k$ vector of explanatory variables, **b** is a $k \times 1$ vector of unknown coefficients and ε's are independently, identically, normally distributed random variables with mean zero and variance(2).

If we restrict the sample size to the number of observations for which the quantity consumed was greater than zero, we introduce selectivity bias(3) since

$E(y_i|\mathbf{X}, y_i > 0) = \mathbf{X'b} + E(\varepsilon_i|y_i > 0) = \mathbf{X'b} + \sigma\lambda_i \qquad (2)$

where:

$$\lambda_i = \frac{f(\varphi_i)}{1 - F(\varphi_i)} \quad \text{and} \quad \varphi_i = -\frac{X'b}{\sigma}$$

while f and F are the density and cumulative distribution functions of a standard normal random variable. The ratio λ_i is also known as the inverse Mills' ratio.

To avoid the problem of bias instead of equation (1) one should estimate the equation

$y_i = \mathbf{X'b} + \sigma\lambda_i + u_i \qquad (3)$

From this estimation we get consistent estimates of **b** and σ. This approach, however, requires that λ_i be known and since this is not known it should be estimated.

It has been proved that if we estimate a probit model using the total number of observations, all the regressors of equation (1) and the values 1 or 0, depending on whether y' is greater than zero or not as a dependent variable, we get consistent estimates of φ_i and λ_i. This is the first step in the two-step procedure proposed by Heckman(4). With these estimates, we can proceed to the second step which is the application of ordinary least squares to equation (3) only for those cases where $y_i > 0$.

The exact form of the equation is given by

$$\ln Q_{OIL} = b_0 + b_1 \ln P_{OIL} + b_2 \ln P_{SUB} + b_3 \ln EXP + b_4 \ln AGE + b_5 \ln FSIZE + b_6 EDUC_1 + b_7 URBAN_1 + b_8 URBAN_2 + b_9 URBAN_3 + b_{10} URBAN_4 + b_{11} URBAN_5 + b_{12} QUART_1 + b_{13} QUART_2 + b_{14} QUART_3 + b_{15} SEXM + b_{16} EMPL_1 + b_{17} EMPL_2 + b_{18} OCCUP_1 + b_{19} OCCUP_2 + b_{20} OCCUP_3 + b_{21} OCCUP_4 + b_{22} OCCUP_5 + b_{23} OCCUP_6 + b_{24} OCCUP_7 + b_{25} CHILD + b_{26} \lambda$$

and the descriptions of the variables used are given in

(2) Blaylock J.R and Blisard (1992).
(3) See G.S. Maddala (1985) and Green H.W. (1993).
(4) Heckman J. J.(1976,1979) and Olsen J.R. (1980).

DATA

The data source for this study is the 1987/88 Family Budget Survey. This survey is contacted by the National Statistical Service of Greece and its main purpose is to compile data on the level and the composition of household expenditure pattern which would be further used for revising and expanding the consumer price index. The survey covered all the households of the country and 6489 of them selected on the basis of random sample. The main body of the data collected refers to quantities and expenditures for a great number of goods and services. However, there is also information on a number of socio-demograhic characteristics.

Each household in the sample was visited for seven consecutive days and was asked to complete special questionnaires. In the case of goods and services frequently used such as foodstuffs, beverages etc. individual expenses of the household members were recorded for each day of the survey. In the case of other more durable goods or services of restricted frequency such as furniture, hospitalisation expenses etc., the data were recorded for longer periods of time varied between one month and one year. In the final stage quantities and expenditures with a reference period other than one month were transformed to quantities and expenditures of a monthly duration. According to the survey data consumption of olive-oil represents 83% of the total value of consumption of fats and oils which accounts for 5.89% of the total consumption of foods and beverages. From the total number of 6489 households 4433 reported non-zero consumption and 2003 of them reported that some or all the quantities consumed were obtained without payment mainly from own farm. The total quantity obtained without payment represents almost half of the quantity purchased and its value for each household was estimated by the interviewers on the basis of the retail prices prevailing in the local or the nearest market. The price of olive-oil was computed from the quantity and expenditure data. The total quantity of seed-oil and margarine was used as the competitive product and its price was computed as a weighted average. Whenever the computation of prices was not possible the average price paid by households in the neighbourhood was used. It is also assumed that the consumption follows a two-step decision process. In the first step is decided the amount of income devoted to food and in the second step the quantity of olive-oil to be purchased. Thus, the expenditure on food is used as one more explanatory variable. The socio-demographic variables refer to age, level of education, employment status and occupation of the head of the family as well as to size of the family, presence of children (less than 13 years), population density and quarter during which the survey took place. Descriptive statistics for these variables are given in **table 2**. It is obvious

that the nature of the data do not allow the investigation of total consumption and that is why only the at-home consumption is taken in to account.

Empirical Results

The results obtained in the second stage of Heckman's procedure are presented in **table 3**. According to these results, all the economic variables have the right sign and they are all significantly different from zero. The own-price elasticity (–0.777) is very close to most of the respective elasticities of the studies mentioned at the beginning. However, this comparison should be made with care since on the one hand this study concentrates on at-home consumption and on the other hand differences in prices may represent, up to a point, differences in quality. The value of cross-price elasticity (0.080) is very low(5). Combined with the own-price elasticity this shows that the relative prices do not play an important role as long as the own price remains unchanged.

The size of the expenditure on food elasticity (0.315) is very much as expected and so is the elasticity with respect to the size of the family (0.213). Thus, olive-oil is not a luxury good in Greece and its consumption is characterised by economies of scale.

Concerning the characteristics of the head of the family, we notice that age and education level have also an effect, which is significantly different from zero. More specifically, families with older or less educated heads tend to consume more than those with younger and more educated heads. With respect to employment status, there is evidence that those families with heads who are employed or housewives tend to spend more on olive-oil than the others. The same evidence is found for pensioners, although here it is not very strong since the zero hypothesis can not be rejected. The employment status in this case reflects to some extend the income effect. Finally, sex and occupation status do not seem to have a significant effects.

There is strong evidence that the population density plays a significant role. Households in areas with higher population density spend less compared to those in less populated areas.

It is very difficult to identify a time pattern of olive-oil consumption from the data referring to quarter during which the survey took pla[illegible]. Even though most of the parameters are significantly [illegible]ferent from zero, the differences between them are very small. If we were to risk tracing a pattern we would say that the consumption is higher during the summer and autumn months.

Conclusion

The main purpose of this study is to examine, besides the effect of prices and income, the effects of a number of socio-demographic factors on the consumption of olive-oil. For this reason, Family Budget Survey data (1987/88) were used. To overcome the problem of zero consumption reported by a number of families the Heckman two-step procedure was employed.

The results show that the consumption of olive-oil is affected by tradition. More specifically, families that live in less populated areas and have older and less educated family heads, i.e. families that overall would be expected to behave more traditionally, tend to consume more olive-oil than others. The almost negligible cross-price elasticity provides additional evidence in the same direction. However, the own-price elasticity shows that consumers are very sensitive to price changes. As a result, during periods when great price increases take place consumers tend to replace olive-oil with other substitutes, especially seed-oils.

The question is how many of them do that and to what extent they return to their previous consumption patterns. The answer is given to some extent by the decreasing share of olive-oil in the total consumption of fats and oils in recent years. However, this could be also attributed to other factors not considered in this study e.g. advertising.

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(5) The only available cross-price elasticity (Miliakos 1980) has a value of 0.89.

ANNEX

Table 1 ***Description of the variables in the model.***

Q_{OIL}	Quantity of olive-oil consumed
P_{OIL}	Price of olive-oil
P_{SUB}	Price of substitute (seed-oils and margarine)
EXP	Expenditure on food
FSIZE	Family size
CHILD	Presence of children
AGE	Age of the head of the family
SEXM	Head of the family Male
SEXF	Head of the family Female
Level of education of the head of the family	
$EDUC_1$	Diploma of higher education or certificate of intermediate schools or higher or intermediate school student
$EDUC_2$*	Primary or secondary education only
Area population (urbanisation)	
$URBAN_1$	Greater Athens
$URBAN_2$	Greater Thessaloniki
$URBAN_3$	Population > 100,000
$URBAN_4$	10,000<population<100,000
$URBAN_5$	2,000<population<10,000
$URBAN_6$*	population<2,000
Quarter during which the survey took place	
$QUART_1$	November 1987 - January 1988
$QUART_2$	February 1988 - April 1988
$QUART_3$	March 1988 - July 1988
$QUART_4$*	August 1988 - October 1988
Employment status of the head of household	
$EMPL_1$	Employed or housewife
$EMPL_2$	Pensioner
$EMPL_3$*	Student, seeking work or other
Occupation of the head of household	
$OCCUP_1$	Professional, technical and related workers
$OCCUP_2$	Administrative, executive or managerial
$OCCUP_3$	Clerical
$OCCUP_4$	Tradesman or sales person
$OCCUP_5$	Working in the service sector
$OCCUP_6$	Working in the agricultural sector
$OCCUP_7$	Technician, worker and transport equipment operator
$OCCUP_8$*	Not working or seeking work for first time

* The dummy variable omitted.

Table 2 ***Descriptive statistics of the variables used.***

Variable	Mean	Std.Dev.	Variable	Mean	Std.Dev.
Q_{OIL}	6525.5	8219.6	$QUART_1$	0.2500	0.4330
P_{OIL}	342.89	39.13	$QUART_2$	0.2500	0.4330
P_{SUB}	263.26	98.03	$QUART_3$	0.2500	0.4330
EXP	44838.9	28591.7	$QUART_4$	0.2500	0.4330
FSIZE	3.087	1.409	$EMPL_1$	0.6795	0.4667
CHILD	0.3234	0.4678	$EMPL_2$	0.2761	0.4471
AGE	52.102	15.842	$EMPL_3$	0.0438	0.2046
SEXM	0.8270	0.3782	$OCCUP_1$	0.0747	0.2630
SEXF	0.1730	0.3782	$OCCUP_2$	0.0174	0.1308
$EDUC_1$	0.1513	0.3584	$OCCUP_3$	0.0653	0.2471
$EDUC_2$	0.8487	0.3584	$OCCUP_4$	0.0686	0.2527
$URBAN_1$	0.3563	0.4789	$OCCUP_5$	0.0644	0.2455
$URBAN_2$	0.0892	0.2850	$OCCUP_6$	0.1248	0.3305
$URBAN_3$	0.0516	0.2213	$OCCUP_7$	0.2250	0.4176
$URBAN_4$	0.1493	0.3564	$OCCUP_8$	0.3597	0.4799
$URBAN_5$	0.1006	0.3008			
$URBAN_6$	0.2529	0.4347			

Table 3 ***Parameter estimates from the second step of Heckman's two-step procedure.***

	Estimate	t-statistic		Estimate	t-statistic
b_0	8.345	7.559	$QUART_3$	–0.058	–1.905
P_{OIL}	–0.777	–6.787	*SEXM*	–0.049	–1.181
P_{SUB}	0.080	2.062	$EMPL_1$	0.132	1.995
EXP	0.315	4.378	$EMPL_2$	0.091	1.167
AGE	0.285	2.878	$OCCUP_1$	–0.063	–0.796
FSIZE	0.213	6.456	$OCCUP_2$	–0.044	–0.443
$EDUC_1$	–0.089	–1.958	$OCCUP_3$	–0.023	–0.303
$URBAN_1$	–0.233	–4.726	$OCCUP_4$	–0.061	–0.894
$URBAN_2$	–0.296	–3.318	$OCCUP_5$	0.003	0.044
$URBAN_3$	–0.076	–1.036	$OCCUP_6$	0.131	1.826
$URBAN_4$	–0.100	–1.811	$OCCUP_7$	0.029	0.450
$URBAN_5$	–0.106	–2.470	*CHILD*	0.006	0.149
$QUART_1$	–0.072	–1.769		–0.178	–0.759
$QUART_2$	–0.082	–2.324			
LLF	*–4654.2*				
R^2	*.230*				