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# ESTIMATING HOUSEHOLD DEMAND FOR OLIVE OIL IN GREECE

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**Abstract**
The paper estimates the monthly household demand for olive oil in Greece by econometrically analysing in a two-stage Heckman framework, cross-sectional microeconomic data solicited via the Household Budget Survey of 2011. It finds that quantity increases as (a) its price decreases, and (b) income or the quantity of seed oil, olive pomace oil, and margarine increase. Spatial, seasonal, and a couple of nationality (origin) effects are detected. Price elasticity is estimated at 1.5-1.7, which suggests that conditions are to some degree favourable towards the formation of a profit maximising monopoly exerting market power in Greece.

**JEL Classification:** C21, C24, D12
**Key Words:** Demand, Olive Oil, Substitute for Other Edible Oils and Fats, Greece, Sample Selection Correction

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## Introduction

The paper estimates the monthly household demand for olive oil in Greece by econometrically analysing cross-sectional microeconomic data collected via a Household Budget Survey (HBS) in 2011. The survey was carried out by the Hellenic Statistical Authority (ELSTAT) on a representative sample of the population involving 3,515 private households with 7,429 members;[1] and according to the report released with the data, the (weighted) average monthly household consumption of olive oil in Greece was estimated at 3.5 litres (ELSTAT, 2013): one of the highest (actually, the highest) in the world (International Olive Council, 2012).

The finding is consistent with the product's role (a) as an integral element of the Greek (and the Mediterranean) diet since antiquity, and (b) in cultural and religious activities across Greece. Hence, as we shall see momentarily, its economics has become the subject of several studies.

The rest of the paper is organised as follows: Section 2 provides a literature review of recent studies regarding the supply and demand of olive oil in Greece. Section 3 describes the data employed in the analysis. Section 4 discusses relevant methodological issues, and Sections 4 and 5, respectively, provide the empirical results and microeconomic implications of the analysis.

## Brief Literature Review of Recent Sectoral and Market Studies

Recent studies (e.g., EU Commission, 2012; Skintzi, 2012; Mylonas *et al.*, 2015) have found that Greece is the third largest producer of olive oil in the world, following Spain and Italy. However, only a quarter of the product gets labelled/branded (compared with 50% in Spain and 80% in Italy), while the remainder is either consumed by producers themselves[2] or sold in bulk, mainly to Italy (from where it is exported) and, to a lesser extent, to local consumers. Indeed, the Greek public consumption of unbranded bulk olive oil is very high (75%), as opposed to branded products, compared to Italy (32%) and Spain (50%). The domestic olive oil value chain features (a) a multitude of olive groves, mills, refineries, bottling and labelling companies which,

1. Such surveys are carried out in all 28 EU member states, as well as Norway and three additional South-eastern European states (Montenegro, the Former Yugoslav Republic of Macedonia, Turkey), in order to (a) monitor population and social conditions within and across countries, and (b) calculate weights for the consumer price index. Eurostat collates and publishes the data every five years.
2. The 2011 HBS data analysed herein after reveal a high level of consumption by producers themselves (estimated to about 13% in urban households and 42% in rural households in terms of quantity). The received wisdom is that many households that own olive groves –whether their members are professional farmers or not– keep a significant part of their production for themselves, relatives and friends.

by and large, are relatively small and not well integrated with other stages; (b) a fragmented producer cooperative structure which, on the whole, does not facilitate standardization of quality control; (c) short distribution channels, and (d) a retail sector dominated by a few large bottling and labelling companies that are said to be facing fresh competition from brands bottled by supermarket chains.

Distinct aspects have been studied by a number of analysts: Zafeiriou *et al.* (2012) employed FAO data from 1961- 2006[3] to look into production volatility of virgin olive oil in Greece and other major producing countries of the EU. Kizos and Vakoufaris (2009) employed administrative data from 2005-06 to look into producer characteristics and geographic indications used in Greece. Matsatsinis *et al.* (2007) and Vassiliou *et al.* (2008) described the Greek olive oil value chain, and interviewed millers, bottling operators, wholesalers, retailers, consumers and other stakeholders in 1997 and 2004-06, respectively, in order to establish the importance assigned by the said groups to the methods of production as well as to the quality, price, flavor, human health and other factors. Karipidis *et al.* (2005) considered a number of natural characteristics, production conditions, packaging, quality and other features of olive oil brands sold in retail shops in and around Athens and Thessaloniki during 2004, in order to explain price variation in the supply. Blery and Kapsopoulou (2007) and Blery and Sfetsiou (2008) described the marketing practices of the country's largest olive oil bottlers, namely, Elais-Unilever and Minerva-P.Z.Cussons.[4] Krystallis and Ness (2005) interviewed consumers from Athens and its environs in 2000 in order to establish purchasing profiles and to identify consumer segments. Chaniotakis *et al.* (2010) interviewed consumers in 2008 in order to look into the attitudes of those buying supermarket-brand olive oil. Vlontzos and Duquenne (2014) employed consumer survey data from 2009-10 to look into the factors which affect people's choices to purchase olive oil from the supermarket or from a friend/relative or consume their own production, and product features that affect people's willingness to pay 10 or 20% more or 10 or 20% less for a different olive oil product than the one they usually purchased. Lazaridis (2004) and Prodromídis (2011) employed, respectively, the 1993-4 and 2004-5 HBS data, to econometrically estimate, within a two stage Heckman model framework, the domestic demand for olive oil.[5]

3. The Food and Agriculture Organization is an agency of the United Nations.

4. To the extent they are both involved in the production and/or trade of many other goods (Elais in other oils, margarines, spreads, cooking cubes, fats, spices, sauces, soups, canned tomato products, frozen fish and chicken, meats, cereals, crème caramel, jelly, jams, syrups, ice cream, drinks, cleaning and personal care products; Minerva in other oils, margarines, spreads, cooking fats, cheese, yogurt, olives and vinegar), and, much like other olive oil sellers, merge their olive oil and other business figures in their financial accounts, a proper analysis of the sector's performance may be quite challenging.

5. Tsakiridou et al. (2006) also attempted to estimate a quasi-demand function using survey data from Thessaloniki and its environs. However, the data lacked price arguments and a sufficient number of quantities observed to allow for the proper execution of the second stage.

## Data Description

Of the households surveyed in 2011, (a) 5.5% purchased olive oil, (b) 12.2% purchased seed or olive pomace oil (presumed substitutes in terms of monounsaturated fatty acids and cross price elasticities (e.g., Akbay, 2006; Serra-Majem *et al.*, 2013)), (c) 5.1% purchased both, (d) 25.8% purchased margarine, (e) 11.1% purchased olive oil and margarine, (f) 5.8% purchased all three (olive oil, seed or olive pomace oil, margarine), (g) 7.6% purchased other edible oils and fats (butter, cooking spreads, animal fats), (h) 5.0% purchased both olive oil and other edible oils and fats -slightly more than 0.6% purchased all four goods- and (i) 21.9% purchased no edible oils and fats.[6] Overall, olive oil constituted the largest item in the sample's monthly edible oils and fats food bill (averaging 5.9 litres at 4.3 euro per litre or 25.5 euro in terms of expenditure), and seed or olive pomace oil the second largest. Households that purchased olive oil generally possessed a smaller stock of olive oil in the kitchen cabinet (3.7 litres) compared to the sample surveyed (5.6 litres). They are also overrepresented in urban areas (esp. Thessaloniki, the largest city in northern Greece),[7] and are underrepresented in Peloponnese, the Ionian islands, and most of Northern Greece (the urban areas of Thessaloniki, Kastoria, Florina, Larisa and their immediate environs, excluded), and in terms of non-workforce participants and of native-born. On the other hand, these consumers' average income, household size and demographic composition are quite similar to those of the sample surveyed. In both cases, data collection was evenly distributed within the year. See Table 1.

## Methodological Issues

Much like in the earlier studies carried out by Lazaridis (2004) and Prodromídis (2011), the analysis is complicated by the absence of expenditure figures pertaining to presumed substitutes (other edible oils and fats) and of reservation prices (i.e., the highest prices at which people would be willing to buy) in a good number of households (i.e., the presence of censored observations). This is common in household budget surveys considering that the emphasis is on spending, not on use.

6. Small differences between these numbers and the number of observations employed in certain probability functions considered in Table 2 arise when households with members born in Bulgaria and households located in Kastoria, Florina, Larisa or their environs are dropped, due to dependencies among the explanatory variables. Likewise, differences between the said numbers and the number of observations considered in the regressions supplied in Table 3 arise when households with Cypriot or Swedish members are dropped, due to dependencies among explanatory variables, and households with missing seed and olive pomace oil prices and missing inverse Mills ratios are dropped as well.
7. The data were provided at the local unit level, so in the analysis that follows outliers were easily singled out and the remaining observations were organised (grouped together) as per their consumption patterns, rather than the electoral or administrative division of the country (i.e., a customary sub-national partition that is probably irrelevant to the consumption issue at hand).

Understandably, the shorter the survey period and the more narrowly defined the commodity, the higher the proportion of households likely to report zero spending on the commodity.

As in the aforesaid studies, the issue is resolved via the employment of the two-stage Heckman procedure (Heckman, 1979). In our case, (a) the preparatory, first-stage (probit) equation concerning market participation takes into account household composition (by age-group and nationality), the size of the dwelling (a proxy for wealth), municipal and occupational dummies (see Table 2);[8] (b) the recovered sample selection correction variables (inverse Mills ratios) that capture the heterogeneity of uncensored observations compared to censored observations, are introduced in the second stage of the analysis, namely the estimation of demand function, alongside other explanatory variables. To deal with the restrictions posed on the size of the sample (and, hence, the degrees of freedom) by the censored (unknown) prices of other edible oils and fats purchased, we estimate two separate models: one that takes into account the impact of other oils and another that takes into account the impact of fats,[9] each in two versions: the standard one which considers the price impact of presumed substitutes (in which case many observations are censored), and another which considers the impact of their quantities (in which case observations can take the value of zero) and provides additional insights.[10]

Next, the quantity of olive oil which is demanded from the market is explained in terms of: (i) the price, (ii) the monthly income from paid work, pensions, unemployment and rent, benefits, transfers from other households, (iii) the price or quantity of other oils and fats, (iv) the available (unused) household stocks of olive oil (own production included), and (v) temporal and municipal dummies.[11] Crucially, not all explanatory variables considered in one stage are involved in the other stage.

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8. Lazaridis (2004) considered the role of (a) the overall food bill, (b) the food bill percentage assigned to food prepared away from home, (c) family size, (d) a dummy for single or multi-person household, (e) quarterly and broad regional dummies, (f) the size of the population in the area, (g) the age, gender and formal education of the family head. Prodromídis (2011) considered the role of (i) family size and composition by gender, nationality, and age-group, (ii) monthly income, (iii) broad regional and bimonthly dummies, and (iv) the inverse Mills ratio for participation in the broad oils and fats market.
9. The consideration of both oils and fats in a single equation leads to a substantial loss of observations, and the consideration of prices associated with several conceivable substitutes and complements results in micronumerosity. In our view, to the extent that olive oil may be included in nearly every other cooking recipe in Greece, and it may also be excluded at times of fasting or used in ceremonies when no other food is involved, it is hard to think of it as a complement to a specific vegetable or meat dish.
10. In a basic sense, if a higher quantity of a substitute (complement) good is used, then a lower (higher) quantity of oil ought to be demanded (e.g., Parkin, 1989: 65).
11. Lazaridis (2004) considered the role of (a) price and of the prices of other edible oils and fats, (b) total expenditure on edible oils and fats, (c) the percentage of expenditure assigned to food prepared away from home, (c) family composition by age-group, (d) the population in the area,

## Empirical Findings

The findings are supplied in Table 3. A good number of estimated coefficients is associated with positive or negative effects likely to be present (i.e., statistically different from zero) with a probability of error under or about 1%.

According to the results of the two typical demand functions and of the two variant expressions, the quantity demanded increases as price decreases, and is lower in the Athenian suburbs of Agios Dimitrios, Alimos, and Elliniko compared to Athens. (See columns 1-4, variables 21 and 13, respectively.) In addition, according to the results of the two variant expressions, quantity increases with family income[12] (as expected in the case of a normal good) and with the purchase of seed oil, olive pomace oil,[13] and margarine.[14] These oils and fats are goods for which someone might have expected olive oil to be a substitute, but then an increment in the amount of seed oil or margarine bought ought to bring about a reduction (rather than an increment) in the quantity of olive oil demanded. At the same time, demand appears to be lower during the vacation months of July and August compared to the rest of the year, and higher in the rest of continental Attica, Central Greece-Euboea, the Aegean islands (the islands of the Saronic Gulf and Crete included), and in households with members of Cypriot or Swedish origin.

## Two Microeconomic Implications

The recovery of margarine and seed and olive pomace oil price coefficients statistically indistinguishable from zero (in Table 3, columns 3 and 1, variable 22), and, hence, the estimation of horizontal demands with respect to the prices of these goods (that is, a zero percent change in the quantity of olive oil in response to a change in each of these prices or zero cross elasticities of demand) is inconsistent with the role of

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(e) quarterly dummies, (e) the age, gender and formal education of the family head. Prodromidis (2011) considered the role of (i) price, (ii) the quantities of other oils and fats purchased at the time or acquired by other means (own production included), (iii) the household stocks of olive oil and other edible oils and fats, (iv) family size and composition by gender, nationality, and age-group, (v) monthly income, (vi) broad regional and bimonthly dummies.

12. The recovered estimates associated with monthly income suggest so up to the rather high level of 3,370-3,532 euro per month. This is the result of the twice differentiated function with respect to monthly income. See columns 2 and 4, variables 19-20.
13. Up to the rather high level of 15.3 kg per month. As in the previous footnote, this is the result of the twice differentiated function with respect to the purchase of seed and olive pomace oil. See column 2, variables 22-23.
14. Up to the rather high level of 2.5 kg per month. As in the two previous footnotes, this is the result of the twice differentiated function with respect to the purchase of margarine. See column 4, variables 22-23. It seems that unlike the prices of the two goods, the quantities of the two goods have a non-linear effect on the quantity of olive oil demanded.

olive oil as their substitute. (The opposite cross elasticity, i.e., whether the said goods are substitutes for olive oil, is not studied here.) Interestingly, Lazaridis (2004) also reached a similar conclusion.

At the same time, the four olive oil (own) price elasticities of demand, E, at the average price and quantity are estimated to|-1.8|,|-1.5|,|-1.6|, and|-1.5|, respectively. All exceed the value of one. It follows that (a) a marginal reduction in price would increase sales, and (b) Lerner's index, equivalent to the inverse of *E*, is slightly or modestly above one half. As a result, conditions are to some degree favourable to collusion and the formation of a profit maximising monopoly exerting market power in Greece; so attention is drawn to the prospect of a bottleneck at the end of the olive oil value chain. It is noted that the range of price elasticities estimated here is close to the value of 1.3 estimated by Lazaridis (2004) on the basis of the 1993-4 data (collected, coincidently, at a time of a brief economic contraction) and much lower than the values of 2.9-3.1 estimated by Prodromídis (2011) on the basis of the 2004-5 data.

Finding an elastic demand and failing to classify olive oil as a substitute for certain goods is not necessarily inconsistent for two reasons: It does not mean that the said goods are not substitutes for olive oil. In a country with a long tradition of olive oil consumption by producers themselves, the true substitute for olive oil bought at the marketplace may well be olive oil made from one's own olives.

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**Table 1.** Description of the 2011 HBS sample and of the subsample of households that purchased olive oil (the figures concerning the subsample are supplied in parentheses)

3,515 (1,355) households involving 7,429 (2,950) members

| | | | quantity (litres (L) /month) | | | price per L | | |
|---|---|---|---|---|---|---|---|---|
| *Households that purchased* | | | mean | min | max | mean | min | max |
| Olive oil | 1,355 | | 5.89 | 1.09 | 36.95 | 4.32 | 2.19 | 7.30 |
| Seed and olive pomace oil | 810 | (382) | 4.57 | 2.17 | 43.47 | 2.20 | 1.06 | 6.00 |
| Margarine | 1,501 | (593) | 0.94 | 0.27 | 7.61 | 5.63 | 0.85 | 15.41 |
| Butter | 281 | (118) | 0.75 | 0.27 | 3.26 | 11.18 | 5.20 | 22.10 |
| Cooking spread | 166 | (65) | 1.02 | 0.33 | 2.61 | 5.21 | 2.17 | 12.01 |
| Animal fats | 8 | (5) | 0.92 | 0.54 | 1.74 | 9.58 | 4.71 | 13.54 |

| *Household features* | | | mean | min | max | mean | min | max |
|---|---|---|---|---|---|---|---|---|
| Available stock of olive oil (in L) | 1,813 | (96) | 5.64 | 0.25 | 451.39 | (3.74) | (0.42) | (25) |
| Non zero monthly income (in €) | 3,507 | (1,353) | 1,334.75 | 1 | 13,268 | (1,301.34) | (1) | (9,823) |
| Size of domicile (in $m^2$) | 3,515 | (1,355) | 84.74 | 12 | 450 | (83.00) | (20) | (300) |

| *Membership composition* [a] | | | *Members' residence (municipalities)* [a] | | |
|---|---|---|---|---|---|
| Males aged 0-11 years old | 441 | (190) | Athens | 292 | (131) |
| Females aged 0-11 years old | 459 | (218) | A.Dimitrios, Alimos, Ellinikon | 34 | (12) |
| Males aged 12-17 years old | 277 | (128) | Rest of Attica, C. Greece, Aegean Isl. | 1,747 | (699) |
| Females aged 12-17 years old | 262 | (116) | Thessaloniki and its environs | 249 | (174) |
| Males aged 18-81 years old | 3,210 | (1,290) | Kastoria, Florina and their environs | 29 | (21) |
| Females aged 18-84 year old | 3,620 | (1,432) | Larisa and its environs | 52 | (41) |
| Older folk | 324 | (104) | Rest of Greece | 1,112 | (277) |
| *Members' origin (born in)* [a] | | | *Members by occupation (aged 15 years or older)* [c] | | |
| Greece | 7,801 | (2,932) | Farmer (cultivator) | 46 | (20) |
| Cyprus | 10 | (1) | Business professional [b] | 125 | (26) |
| Bulgaria | 41 | (30) | Other profession | 3,016 | (1,311) |
| Other neighbouring countries | 101 | (63) | Homemaker | 1,193 | (504) |
| Sweden | 3 | (3) | Unemployed | 652 | (319) |
| Elsewhere in the EU | 44 | (27) | Non workforce participant | 2,397 | (770) |
| Elsewhere in Europe | 483 | (353) | | | |
| Other places | 110 | (69) | | | |

*Households surveyed:* April-June: 895 (359), July-August 620 (257), other months 2,000 (739).

*Notes:*

a The information is organized so as to describe elements featured in Tables 2 and 3.

b In finance, sales, management, market research, information technologies.

**Table 2.** Probability of participation in the edible oils & fats market based on the 2011 HBS

| | Independent variables | Olive oil | | Seed and olive pomace oil | | Margarine | |
|---|---|---|---|---|---|---|---|
| 1 | Constant | -0.460 | * | -1.005 | * | -0.738 | * |
| | *Household membership* | | | | | | |
| 2 | Members aged 0-17 years old | 0.651 | o | 0.056 | o | 0.162 | * |
| 3 | Members age 18 years or older | 0.024 | | 0.134 | * | 0.156 | * |
| 4 | Members born in Greece (ref.) | | | | | | |
| 5 | Members born in Bulgaria | 0.484 | * | 0.389 | * | 0.061 | |
| 6 | Members born in Europe, non EU | 0.308 | * | 0.125 | * | 0.095 | * |
| 7 | Members born elsewhere | 0.353 | * | 0.323 | * | 0.036 | |
| 8 | Members occupied as homemakers | 0.119 | * | 0.144 | * | 0.100 | o |
| 9 | Members occupied as farmers | -0.380 | * | -0.090 | | -0.206 | |
| 10 | Members occupied as business prof. | 0.114 | | 0.079 | | -0.033 | |
| 11 | Unemployed members | 0.101 | o | 0.051 | | -0.056 | |
| 12 | Others (ref.) | | | | | | |
| | *Residence* | | | | | | |
| 13 | Mun. of Kastoria, Florina environs | 1.062 | * | -0.177 | | 0.063 | |
| 14 | Mun. of Thessaloniki, environs | 0.925 | * | 0.214 | o | 0.070 | |
| 15 | Municipality of Larisa, environs | 1.191 | * | 0.128 | | 0.774 | * |
| 16 | Rest of Greece (ref.) | | | | | | |
| 17 | Size of domicile (in $m^2$) | -0.001 | o | -0.002 | o | 0.001 | o |
| | Pseudo $R^2$ | 7.25% | | 3.25% | | 3.02% | |
| | Observations (households) | 3,515 | | 3,515 | | 3,515 | |

*Note:* Asterisks (circles) denote p-values ≤ 1% (between 1 and 5%).

**Table 2 (continued)**

| | Independent variables | Butter | | Cooking spread | | Animal fats | |
|---|---|---|---|---|---|---|---|
| 1 | Constant | -1.834 | * | -1.917 | * | -3.271 | * |
| | *Household membership* | | | | | | |
| 2 | Members aged 0-17 years old | 0.007 | | 0.023 | | -0.105 | |
| 3 | Members aged 18 years or older | 0.131 | * | 0.116 | º | -0.077 | |
| 4 | Members born in Greece (ref.) | | | | | | |
| 5 | Members born in Bulgaria | | | 0.008 | | | |
| 6 | Members born in Europe, non EU | -0.153 | º | 0.070 | | 0.325 | * |
| 7 | Members born elsewhere | 0.024 | | -0.082 | | 0.204 | |
| 8 | Members occupied as homemakers | 0.072 | | 0.038 | | 0.029 | |
| 9 | Members occupied as farmers | -0.022 | | -0.089 | | | |
| 10 | Members occupied as business prof. | 0.698 | * | 0.271 | | | |
| 11 | Unemployed members | -0.158 | | 0.051 | | -0.232 | º |
| 12 | Others (ref.) | | | | | | |
| | *Residence* | | | | | | |
| 13 | Mun. of Kastoria, Florina environs | -0.501 | | 0.169 | | | |
| 14 | Mun. of Thessaloniki, environs | 0.172 | | 0.146 | | 0.250 | |
| 15 | Municipality of Larisa, environs | 0.239 | | 0.248 | | | |
| 16 | Rest of Greece (ref.) | | | | | | |
| 17 | Size of domicile (in $m^2$) | 0.002 | | -0.001 | | 0.006 | * |
| | Pseudo $R^2$ | 2.37% | | 1.44% | | 10.19% | |
| | Observations (households) | 3,490 | | 3,515 | | 3,258 | |

*Note:* Asterisks (circles) denote p-values ≤ 1% (between 1 and 5%).

**Table 3.** Estimated OLS monthly demand for olive oil in Greece run with robust standard errors and based on the 2011 HBS (in milliliters)

| | Independent variables | A: Considers the impact of seed & olive pomace oils, esp. | | B: Considers the impact of margarine, esp. | |
|---|---|---|---|---|---|
| | | the price | quantity | the price | quantity |
| 1 | Constant | 12,941.84 | 13,176.09 * | 17,095.11 º | 12,324.08 * |
| | *Household composition* | | | | |
| 2 | Males aged 0-11 y.o. | -715.86 | -1,926.60 º | -2,206.34 | -2,119,79 º |
| 3 | Males aged 12-81 y.o. | -437.42 | -1,306.34 | -1,336.18 | -1,460.34 |
| 4 | Females aged 0-84 y.o. | -1,288.01 | -1,345.64 | -2,106.30 | -1,560.03 |
| 5 | Others | -629.58 | -1,278.66 | -1,401.47 | -1,439.32 |
| 6 | Born in Greece (ref.) | | | | |
| 7 | Born in Cyprus | | 11,169.19 * | 9,430.53 º | 10,236,47 * |
| 8 | Born in Sweden | | 13,384.06 * | 11,745.83 º | 13,295,48 * |
| 9 | Born elsewhere in EU | 2,150.09 | 4,101.53 º | 2,975.18 | 4,202,19 º |
| 10 | Born in other neighboring countries (incl. Bulgaria, rest of Europe) | 3,076.77 | 3,204.00 | 2,182.62 | 3,477.09 º |
| 11 | Born elsewhere | 2,963,39 | 3.321,31 | 2,591.98 | 3,646.09 º |
| | *Residence* | | | | |
| 12 | Munic. Athens (ref.) | | | | |
| 13 | Munic. of Ag. Dimitrios, Alimos, Ellinikon | -2,890.45 * | -1,567.84 * | -2,378.83 * | -1,621,50 * |
| 14 | Rest of Attica, C. Greece –Euboea, Aegean Isl. | 37.59 | 1,176.20 * | 1,475.00 * | 1,122,47 * |
| 15 | Rest of Greece | -224.24 | 366.79 | -87.78 | 349,91 |
| | *Months* | | | | |
| 16 | April-June | -444.74 | -399.02 | -978.98 * | -388,16 |
| 17 | July-August | -548.01 | -629.56 □ | -765.40 | -629,84 * |
| 18 | Other months (ref.) | | | | |
| 19 | Monthly income (in €) | 0.02 | 0.66 * | 0.98 * | 0,70 * |
| 20 | Monthly income squared | -0.00 | -0.00 □ | -0.00 * | -0.00 * |
| 21 | Price (in €) | -2,446,08 * | -2,023,96 * | -2,160,39 * | -2,023,84 * |
| 22 | Column variable | 803,94 º | 0.14 * | -53,717.57 | 1,15 * |
| 23 | Variable 22 squared | | -0.00 * | | -0,00 º |
| 24 | Available stock of olive oil | -0.13 | -0.04 | -0.12 | -0,03 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | *Sample selection correction* | | | | | |
| 25 | Olive oil | -2,539.68 | -3,031.91 | -2,127.76 | -3,212.76 | |
| 26 | Butter | -8,021.67 | -8,848.15 | -4,823.37 | -9,421,68 | *o* |
| 27 | Margarine | -8,479.95 | -14,084.92 | -16,997.17 | -15,187.86 | *o* |
| 28 | Cooking spread | -4,336.56 | -4,236.49 * | -3,819.32 | -4,335,20 | * |
| 29 | Seed, olive pomace oil | 13,971.03 | 14,664.50 *o* | 11,186.07 | 15,543.24 | *o* |
| 30 | Edible animal fats | 6,126.44 | 7,722.18 | 6,764.64 | 8,459.54 | *o* |
| $R^2$ | | 24.77% | 28.08% | 30.11% | 28.81% | |
| Observations (households) | | 354 | 1,236 | 524 | 1,236 | |

*Regressions are estimated with robust standard errors to address issues of heterogeneity and lack of normality. Asterisks denote p-values ≤ 1.0%. Squares denote p-values between 1.0 and 1.1% and are used here in order to show that at a marginally higher p-value thereshold the findings of columns (2) and (4) are almost identical. Circles denote p-values between 1.1 and 5%.*