Food Consumption within Greek Households: Further Evidence from a National Representative Sample

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Abstract: The aim of this study is to characterize the relationship between food consumption and socio-demographic characteristics in several groups of individuals. This is achieved by capturing the quantity of food purchased in categories on a microeconomic level. The empirical analysis is approached through the estimation of (a) expanded generalized linear models, (b) quantile regression models, (c) quadratic almost ideal demand system models and (d) Deaton's (1988) approach. The results reveal that the composition of a household has a significant impact on the quantity of food consumed. In addition, price and income elasticities are estimated, confirming that the majority of food items are inelastic with respect to price and income except for meat. These findings can be used as a basis for considering food policy implications while evaluating the potential gains from applying specific policies.

1. Introduction

Food consumption constitutes a main component of welfare indicators, such as food security, health and poverty (Zezza et al. 2017). In recent years, food behaviour has become a major concern due to its relationship with public health. These factors also have an impact on the well-being status of each household. As the population is increasing, households' food habits are changing (Hansen 2018) while healthcare systems are highly affected (Janssen 2018; Lemeshow et al. 2018).

Adding to the previous literature, this article combines food components within households' behaviour and their consumption decisions. More specifically, the main purpose of this study is to evaluate empirically the interrelationship between several household characteristics and food consumption. At the same time, food items' elasticities are calculated, informing researchers about how individuals make food purchasing decisions while helping policymakers to design more effective food and nutrition policies. Thus, while household data typically are not designed for providing food information, the main motivation of this study is to evaluate and find diversified policy channels for a new household analysis agenda through which policymakers may affect aspects of households' quality of food. The survey used for this research focuses on key national-scale economic indicators, such as private consumption, of primary needs that are differentially affected by a variety of socioeconomic characteristics.

The specific objectives of this analysis could lead to useful policy implications. Alternatively, they could work towards strengthening policymakers' understanding of how they can improve individuals' food quality and subsequently the sustainability of their health status. The collection of high-quality data on food consumption might be central to examining and analysing the well-being of the general population. Food consumption data are also crucial for constructing several targets for assessing the progress towards the attainment of national social goals. The estimated elasticities are in line with this scope. Primary data can help to address the necessity to eradicate malnutrition and food insecurity among several groups of people. These general issues can be captured via the following research question: What is the relationship between socioeconomic determinants and food consumption? Through this question, new evidence on the impact on the quality and the nexus of the food consumption data in the analysis of households can be achieved. It is known that household welfare is highly related to food intake. This also means that policymakers should take into account the findings that allow the identification of a set of behavioural patterns with respect to households' food status.

It is true that a vast majority of the literature has devoted substantial effort to estimating empirically the main parameters of households' consumption in several categories of goods and services. However, only a few studies have identified the necessity to survey and evaluate household food consumption based on specific quantities for each category. Following the introduction section presented above, the article is structured in six parts. A snapshot of the literature review on food is presented below. Next, the data and methodology are illustrated. Furthermore, the theoretical framework is presented. Finally, the empirical findings are described, followed by the discussion, conclusions and policy implications.

2. A Brief Literature Review on Food Behavior

Accounting for about 50 percent of a household's budget, food makes up the largest share of the total household expenditure (USDA 2011). In addition, the "nutritional footprint" as a dynamic phenomenon is an idea that is receiving increasing importance in consumers' life with regard to decreased mortality (Kinsey 1994; Tilman and Clark 2014; Westhoek et al. 2014). At the same time, food consumption might have severe externalities for the environmental and public health systems, as it requires resources such as water, land and energy while directly affecting human health (Costarelli et al. 2013; Blas et al. 2018; Damari and Kissinger 2018; Marques et al. 2018; Setti et al. 2018). An increasing population will lead to a shift in dietary habits and will be a core component of welfare indicators in the domains of nutrition and health (Zezza et al. 2017). Households' consumption will vary between age groups, as each generation behaves differently from the previous ones. Future generations may also need to adjust their consumption pattern and behaviour over their lifetime. In general, the welfare of households is often related to the level of nutrition intake and the quality of diet (Sabates et al. 2001).

Most previous researchers have demonstrated an analysis of food consumption on the macro-level (Kissinger 2012; Liu et al. 2013) or in the microeconomic environment (Slining and Popkin 2013; Moreira et al. 2015; Huybrechts et al. 2017). The majority of these have focused on household consumption by investigating food purchasing (Büchs and Schnepf 2013; Jones and Kammen 2014; Zezza et al. 2017). Particular studies have been conducted to analyse the socioeconomic determinants and demographic factors of food spending (Capps and Love 1983; Davis et al. 1983; Heien et al. 1989; Fan et al. 1994; Kinsey 1994; Nayga 1995; McDowell et al. 1997; Manrique and Jensen 1998; Jae et al. 2000; Sabates et al. 2001; Ghany et al. 2002; Gould 2002; Raper et al. 2002; Kirkpatrick and Tarasuk 2003; Ricciuto et al. 2006; Jacobson et al. 2010; Barigozzi et al. 2012; Kostakis 2014; Damari and Kissinger 2018; Hidaka et al. 2018; Janssen 2018; Marques et al. 2018).

Interestingly, a vast majority of studies have confirmed that there is a positive but not linear relationship between income and expenditure on food (Chung and Lopez 1988; Kinsey 1994; Banks et al. 1997; Vitaliano 2010; Hansen 2018). Similarly, previous research has confirmed that more educated persons tend to have a different attitude towards diet style, following a more balanced

dietary model by choosing several types of food (Capps and Love 1983; Davis et al. 1983; Heien et al. 1989; Sabates et al. 2001; Ricciuto et al. 2006; García and Grande 2010; Liu et al. 2013; Kostakis 2014). Many empirical surveys have detected differences in preferences between younger and elderly consumers, leading to different levels of spending on food (Davis et al. 1983; Heien et al. 1989; Nayga 1995; Jae et al. 2000; Mihalopoulos and Demoussis 2001; Sabates et al. 2001; Raper et al. 2002; Ricciuto et al. 2006; García and Grande 2010; Jacobson et al. 2010; Liu et al. 2013). Bernstein and Munoz (2012) suggested that nutrition is important for older adults. Employment status, gender, marital status and region of living also seem to affect the level of expenditure on food across household groups. For instance, Wardle et al. (2004) found that women eat differently from men partly for the reason that women tend to believe more that healthy eating is important. Sabates et al. (2001) compared the impact of changes in household composition on food expenditure in three Latin American countries using household-level data. They found that male household members place greater demands on household food supplies than female members. In summary, household size, employment status, marital status, gender, region of living and other several demographic characteristics also influence the level of food spending due to the differences in their roles and preferences within the household (Nayga 1995; Teklu 1996; Jae et al. 2000; Mihalopoulos and Demoussis 2001; Oygard 2000; Sabates et al. 2001; Hossain 2002; Kirkpatrick and Tarasuk 2003; Thiele and Weiss 2003; Guest et al. 2006; Ricciuto et al. 2006; Moss et al. 2007; García and Grande 2010; Jacobson et al. 2010; Neulinger and Simon 2011; Barigozzi et al. 2012; Tekguc 2012; Liu et al. 2013; Kostakis 2014; Humphries et al. 2017; Marques et al. 2018).

3. Study Population and Methodological Approaches

3.1. Study Population

The present research analyses data on the food choices of a nationally representative sample of Greek households by region, gender, income level, education, employment status and age. The data were retrieved from the Hellenic Statistical Authority (HSA) household expenditure survey. This survey captures not only the spending on each food item but also the total demanded quantity. It collects data on all food categories in addition to information on economic and demographic characteristics, such as employment, education, marital status and other socioeconomic variables. In the present cross-sectional analyses, the annual consumption of foods and beverages is examined with respect to food patterns. The analysis is based on the reported purchases in 2016. The final sample contains $N = 6073$ households. The average age is over 50 years, while the average household income is around 19 thousand euros. The majority of the interviewees are men (more than 60%), and around 40% of them live in cities. In the sample, 62% of the respondents are married and 1 out of 4 have completed a university degree. As far as employment status is concerned, more than 30% are employees. However, these characteristics refer only to the head of the household. It could be interesting to conduct further analyses, taking into account household composition data, but they are unobservable in households' majority. Thus, it would be more interesting to see some information comparing the general population characteristics of Greek households with those of the EU-28. The following Figures 1 and 2 present this information.

Figures 1 and 2 illustrate the main demographic structure of Greece and the EU according to the Eurostat data for 2016. As can be observed, Greece is close to the European Union mean regarding individuals' age, educational level and gender ratio. On the contrary, the population density and employment status, as expected, differ due to the current economic crisis in the country. For instance, unemployment has risen whereas the phenomenon of decentralization has been present in recent years, following the high rates of unemployment (and especially youth unemployment) in urban areas.
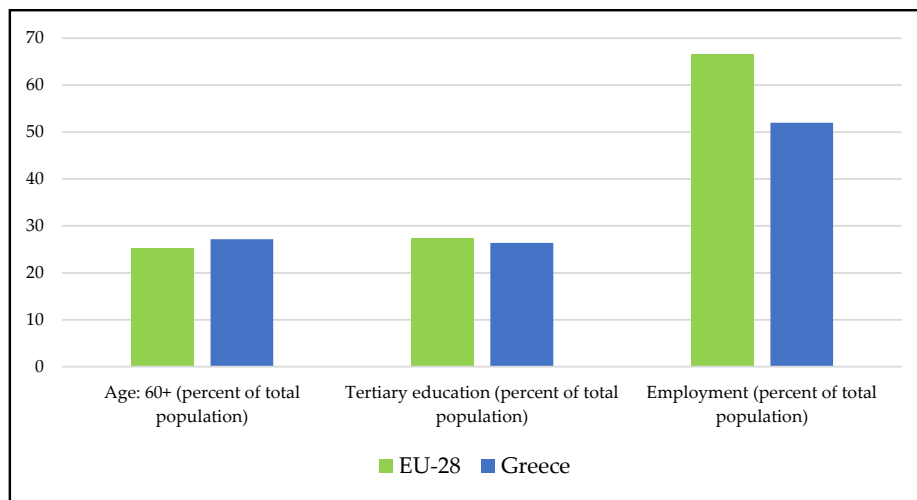
Figure 1. Share of population with respect to age, higher education and employment status.
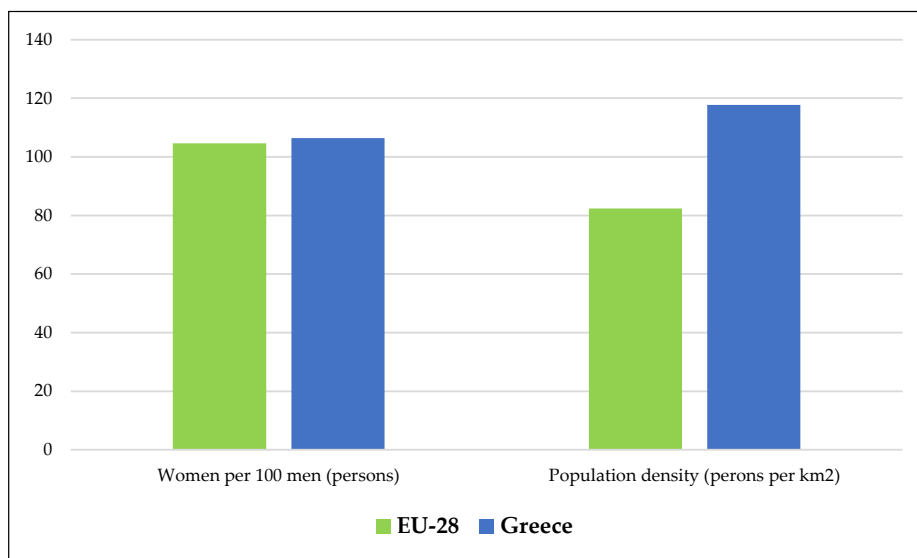

Figure 2. Gender and population density.

3.2. Methodological Approach

The methodology includes two crucial parts: the first describes households' food consumption, while the second surveys specific socioeconomic and spatial factors. The first step describes the per capita food consumption (with respect to expenditure and quantities in food categories). More specifically, the research provides insights into the determinants that affect consumers' attitudes towards food consumption. The empirical analysis is based on a cross-sectional data set retrieved from the Hellenic Statistical Authority. It carried out an extensive survey of 6073 persons, analysing their profile with respect to food consumption. Thereafter, to observe households' food consumption behaviour in Greece, the empirical results are based on the estimation of a number of methodological approaches. The general consumption function is as follows:

$$EXp_i = f(X_i/\beta) + \varepsilon_i, \ I = 1, 2, \dots, N \tag{1}$$

where N is the number of households, X an $(N \times K)$ matrix of K household characteristics, β a $(K \times 1)$ vector of estimated coefficients, and ε_i the $(N \times 1)$ error scalar. With respect to food consumption, quantile regression analysis was also used in estimating the income elasticity. Quantile regression can help us to obtain a more complete picture of the underlying relationship between total expenditure and

food consumption. Additionally, the presence of possible heteroskedasticity can be handily analyzed and exposed by estimating quantile regression models. Simultaneously, this methodology is not useful only for detecting heteroskedasticity; it is also possible to find the shape of the conditional distribution. This model, first introduced by Koenker and Bassett (1978), can be written as follows:

$$y_i = x_i'\beta_\theta + \varepsilon_{\theta i} \ and \ Q_\theta(y_i|x_i) = x_i'\beta_\theta \tag{2}$$

where y_i is the dependent variable, x is the vector of independent variables, β the vector of estimated parameters and $\varepsilon_{\theta i}$ is the vector of residuals. $Q_\theta(y_i|x_i)$ is the θth conditional quantile of y_i given x_i. The household variables include the geographical region where the household is located and the number of individuals in the household. The individual demographic factors include income, age, employment, marital status and highest education level achieved. As it is a spending model, it creates an empirical relationship between household spending and several parameters to work out the amount of expenses. Furthermore, taking into account the four major food types that Greek households consume (Hellenic Statistical Authority 2016), this study attempts to investigate in greater depth the at-home consumption of bread and cereals, fresh meat, milk, eggs and fats and vegetables. For that purpose, an approximate version of the Quadratic Almost Ideal Demand System is estimated. The QAIDS model has a flexible functional form consistent with household expenditure data. At the same time, it does not impose any prior restrictions on elasticities and its mostly non-linear specification. This characteristic makes it easy to estimate and test the restrictions of homogeneity and symmetry. The Quadratic AIDS model of Banks, Blundell and Lewbel (Banks et al. 1997) is based on the indirect utility function as follows:

$$lnU(p,m) = \left[\left\{ \frac{lnm - lna(p)}{b(p)} \right\}^{-1} + \lambda(p) \right]^{-1} \tag{3}$$

where $lna(p)$ is the transcendental logarithm function:

$$lna(p) = a_0 + \sum_{i=1}^{k} a_i lnp_i + \frac{\sum_{i=1}^{k} \sum_{j=1}^{k} \gamma_{ij} lnp_i lnp_l}{2} \tag{4}$$

In our case, if we denote q_i the quantity demanded of good i by a household, the expenditure share for good i as $w_i = p_i q_i / m$ and apply the Ry's identity, we obtain the expenditure share equation for good i:

$$w_i = a_i + \sum_{j=1}^{k} \gamma_{ij} lnp_j + \beta_i ln\left(\frac{m}{a(p)}\right) + \frac{\lambda_i}{b(p)} \left[\left(\frac{m}{a(p)}\right)\right]^2 \tag{5}$$

4. Results

4.1. Descriptive Statistics

Table 1 provides an overview of the annual total food consumption. More specifically, a decomposition of the socioeconomic characteristics of the sample is presented. According to this, males (heads of households) spent €7044.7 in total and €1313.2 on food. On the contrary, females on average spent more money on food than men (in total €502.9 more, of which €150 was on food). Age is also anticipated to have a solid relationship with food spending; however, which age group is expected to eat more is not clear a priori. Elderly people have different health concerns and therefore might be more inclined to eat more carefully. It can be seen that older individuals and more highly educated persons spend more money than younger ones in general, and the highest food consumption can be attributed to the ages above 60 years. The level of income is also related to food spending. Lower-income households have less flexibility to adjust their food spending patterns as economic indicators change. As far as the employment status is concerned, people working in the public sector indicated that they spend more money on food while those who are retired, as expected, spend even

more. People who live in cities having different lifestyle habits spend more money on food than those who live in rural areas. Finally, unmarried and divorced individuals spend more money than married individuals and widowers. Another kind of analysis is presented in Figure 3 and highlights the national per capita distribution of annual expenditure with respect to total and food consumption in Greece.

Table 1. Food per capita payments (in Euro) by households' head characteristics.

	Total Income	Total Consumption	Food
Gender			
Male	7056.3	7044.7	1313.2
Female	7612.6	7547.6	1463.2
Age			
15–19	3878.8	9519.5	1267.4
20–24	4481.0	8072.4	1456.8
25–29	5833.8	7240.5	1280.8
30–34	4897.8	5873.3	1107.8
35–39	5401.4	5901.7	1081.5
40–44	5446.0	5866.9	1084.5
45–49	6502.2	7150.3	1280.1
50–54	7379.1	7596.8	1334.1
55–59	8624.5	8460.4	1444.0
60–64	8964.2	8142.6	1528.2
65+	9025.9	7810.6	1647.2
Education			
Early childhood education	6055.7	5384.5	1304.1
Primary education	6624.8	6117.6	1400.2
Lower secondary education	6105.8	5981.0	1263.9
Upper secondary education	6649.4	6487.4	1263.8
Post-secondary education (non tertiary)	6508.0	6844.9	1282.6
Bachelor or equivalent	9077.0	9441.3	1477.2
Master or equivalent	9888.4	11,402.5	1408.8
Doctorate or equivalent	11,438.9	10,204.8	1357.4
Employment status			
Working in public sector	7221.7	7484.4	1271.1
Working in private sector	6265.6	6476.3	1203.9
Unemployed	3464.1	5289.4	1057.0
Retirement	8957.9	7963.5	1607.9
Urban			
Urban	7490.4	7494.8	1373.6
Rural	6987.4	6942.9	1333.4
Full-time job			
Yes	6960.8	7300.0	
No	5053.7	5818.3	
Marital status			
Unmarried	9051.8	9681.3	1629.8
Married	6711.7	6646.2	1264.8
Widower	9069.5	8242.9	1711.4
Divorce	8564.8	9737.8	1640.4

Note: The total number of the sample is 6073. In some cases, the number of observations is lower as the main categories are presented.
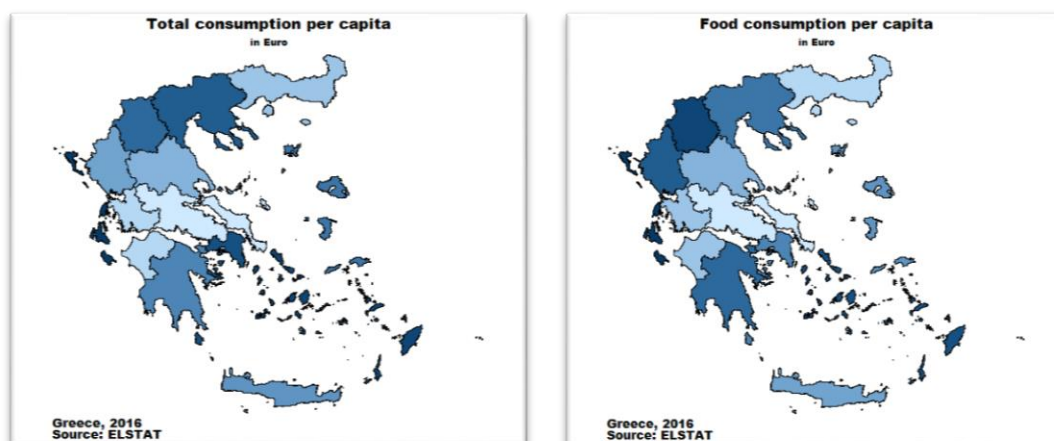
Figure 3. Total and food consumption per capita.

As can be seen, the situation seems to be very similar for all kinds of expenditure across all regions. The northern regions of Greece—West and Central Macedonia, the Ionian Islands, Athens and South Aegean—have higher levels of total and food consumption. The level of income also seems to be related to food, as mentioned above. The following Tables 1 and 2 present the food per capita payments (in euros and in purchased quantities) by heads of households' characteristics.

Regarding the quantitative analysis, Table 2 presents the food consumption per capita in quantities by each food category. Females (as heads of households) consume higher quantities of all items apart from tobacco, as expected. Older individuals consume more bread, meat, oils and fats, fruits and vegetables. On the contrary, younger individuals consume more milk, cheese, eggs and sugar while they also drink more alcohol and smoke more tobacco. It is worth noting that individuals under 30 years old spend more than €263/year on smoking, representing a high level of their annual consumption expenditure. As already mentioned above, elderly people have different concerns about their health status from younger ones and thus tend to eat more carefully. However, older persons might also find that lifelong eating habits are difficult to change. One notable exception is the consumption of oil and fats. It seems reasonable to assume that more educated people have better knowledge and information on health and nutrition issues. Therefore, discrepancies in spending patterns for people with different levels of education could be expected. Indeed, more educated people seem to have healthier nutrition, as they consume less meat, bread, oils and fats, while they also drink and smoke less. In general, households with lower incomes also have a lower educational level, so they are not as informed about health issues. Regarding employment status, retired members consume higher quantities themselves, apart from spirits and tobacco. Of particular interest is the higher level of expenditure on tobacco by unemployed individuals. The area of living and the kind of job (full- or part-time) do not appear to lead to different consumption quantities with the exception that part-time workers seem to smoke more. Finally, with respect to marital status, widowers consume more food items than unmarried, married and divorced people but smoke less; a divorce may lead to more smoking. Last but not least, it is highly interesting to see the food consumption patterns of Greek society compared with those of other European economies. The following Table 3 presents this information.

Table 2. Food consumption (quantities) per capita by household head characteristics.

	Bread and Cereals	Meat	Fish and Seafood	Milk, Cheese and Eggs	Oils and Fats	Fruit	Vegetables	Sugar, Jam, Honey, Chocolate and Confectionary	Coffee, Tea and Cocoa	Wine	Beer	Tobacco
Gender												
Male	75.7	48.6	16.2	68.9	23.1	75.6	119.4	13.3	2.5	16.9	17.4	165.9
Female	81.9	53.1	17.7	80.8	27.6	88.6	142.2	17.0	3.2	18.2	21.2	150.6
Age												
15–19	66.5	27.5	15.1	106.8	18.9	65.4	89.7	18.9	3.2	38.1	59.7	62.0
20–24	84.7	50.3	15.6	104.3	30.5	90.5	134.8	20.5	3.6	15.9	38.0	263.5
25–29	73.1	50.9	15.9	69.7	22.3	77.5	114.8	15.6	2.7	17.9	24.7	233.3
30–34	69.4	40.7	14.1	67.9	20.0	65.6	103.1	11.8	2.2	12.3	19.5	163.0
35–39	61.3	38.4	11.2	60.2	18.6	66.6	90.7	10.7	2.1	12.9	15.2	169.7
40–44	65.8	39.3	12.1	65.7	17.6	61.7	90.0	10.6	1.9	15.8	14.1	158.8
45–49	74.6	45.4	14.9	73.3	21.0	70.3	109.0	13.0	2.4	15.9	17.2	158.2
50–54	81.2	48.4	16.1	67.7	22.8	77.5	120.8	13.0	2.6	17.6	20.2	153.3
55–59	82.9	51.9	16.7	66.6	26.6	81.1	135.8	15.1	2.8	16.5	21.5	200.7
60–64	81.7	59.0	19.4	73.5	26.5	86.0	145.7	15.8	2.9	24.1	19.9	211.6
65+	89.6	62.7	21.9	83.8	32.4	99.7	167.0	19.3	3.6		23.3	124.4
Education												
Early childhood education	87.6	52.8	18.1	68.9	26.0	77.3	137.2	15.3	2.9	17.2	13.4	121.4
Primary education	83.7	57.3	18.0	71.0	28.0	80.7	145.2	15.9	2.8	19.0	19.5	161.5
Lower secondary education	76.4	50.9	16.3	66.0	24.3	67.5	118.3	13.2	2.5	17.0	18.5	186.5
Upper secondary education	75.0	47.1	15.0	69.7	23.4	76.2	118.4	13.3	2.5	15.4	16.5	176.5
Post-secondary education (non-tertiary)	72.0	44.8	15.6	68.3	20.9	75.3	114.1	12.8	2.5	15.9	16.2	169.8
Bachelor or equivalent	74.7	48.5	17.1	77.2	22.5	85.2	120.3	14.8	2.9	18.1	19.9	150.5
Master or equivalent	68.4	39.1	16.1	76.6	20.0	85.8	114.9	11.3	2.7	15.9	21.3	122.0
Doctorate or equivalent	58.8	33.9	20.0	78.1	22.7	80.3	104.3	12.6	2.2	13.3	24.9	101.0

Table 2. *Cont.*

	Bread and Cereals	Meat	Fish and Seafood	Milk, Cheese and Eggs	Oils and Fats	Fruit	Vegetables	Sugar, Jam, Honey, Chocolate and Confectionary	Coffee, Tea and Cocoa	Wine	Beer	Tobacco
Employment status												
Working at public sector	70.6	43.1	14.1	72.8	20.3	69.9	105.9	11.8	2.4	16.7	15.9	149.0
Working at private sector	71.1	45.0	13.6	66.7	21.3	71.6	107.5	12.3	2.2	14.3	18.3	167.3
Unemployed	67.7	41.6	15.6	69.7	21.0	60.1	107.4	11.8	2.5	11.6	18.2	178.5
Retired	87.1	59.9	21.1	79.0	30.2	96.8	158.6	17.7	3.2	22.3	21.9	136.9
Urban												
Urban	78.3	49.0	16.4	76.4	24.4	85.6	131.7	14.8	2.8	17.2	18.8	158.3
Rural	76.5	50.2	16.6	68.5	24.0	74.0	120.2	13.8	2.6	17.1	17.8	164.8
Full time job												
Yes	71.4	45.0	14.4	68.4	21.1	71.2	106.2	12.6	2.4	15.1	17.5	170.9
No	74.6	45.2	14.5	60.8	21.1	71.3	116.9	12.3	2.6	15.4	18.2	196.1
Marital status												
Unmarried	86.9	60.2	20.3	84.4	33.1	105.0	159.5	21.9	4.0	29.5	38.1	242.8
Married	73.6	46.4	15.5	67.4	21.9	71.7	113.8	12.5	2.3	15.2	15.4	151.3
Widower	97.6	66.5	22.2	94.1	34.6	109.8	181.5	22.1	4.3	27.1	27.5	137.5
Divorce	82.5	59.6	20.9	83.6	29.0	98.2	151.0	18.7	4.1	27.5	27.2	259.2

Note: Bread and cereals, Meat, Fish and seafood, Milk, cheese and eggs, Oils and fats, Fruit, Vegetables, Sugar, jam, honey, chocolate and confectionary, Coffee, tea and cocoa are measured in kg. Wine and beer are measured in liters. Tobacco is measured in euros.

Table 3. Food consumption (in quantities, kg) per capita in the EU.

Country	Cereals	Meat	Fish and Seafood	Milk-Egg	Fruits	Vegetables	Sugar
Austria	116.73	88.01	14.05	248.77	74.58	95.77	49.98
Belgium	138.2	63.35	23.75	255.42	119.56	139.65	73.94
Bulgaria	136.52	58.01	7.18	172.32	49.76	92.16	34.37
Croatia	128.82	71.27	17.02	247.57	65.62	258.3	53.52
Cyprus	101.03	71.37	23.55	118.66	80.53	97.05	58.36
Czechia	107.71	81.26	8.94	204.52	54.81	77.67	63.95
Denmark	122.58	69.98	22.78	324.59	59.71	96.66	54.93
Estonia	128.31	66.04	14.2	358.64	69	100.75	51.23
Finland	114.26	75.2	31.8	467.14	70.46	85.71	40.26
France	130.5	85.27	33.59	269.76	88.73	98.31	47.62
Germany	114.04	88.53	13.75	281.81	74.61	92.21	48.07
Greece	**137.89**	**68.78**	**20.53**	**237.27**	**101.96**	**159.55**	**29.17**
Hungary	116.11	77.68	5.73	203.45	52.18	91.99	39.55
Ireland	125.02	78.54	21.21	272.55	65.03	97.54	86.75
Italy	162.01	76.68	29.81	237.06	118.5	134.99	32.38
Latvia	126.11	65.72	24.57	208.29	42.26	133.36	48.49
Lithuania	145.12	78.7	32.58	341.04	53.35	96.33	95.36
Luxembourg	99.71	81.96	34.5	161.94	90.58	98.95	161.65
Malta	136.23	77.78	32.03	119.56	78.55	201.86	83.82
The Netherlands	86.24	76.21	21.82	351.56	107.54	63.13	45.42
Poland	140.44	86.3	10.68	181.14	67.09	121.23	44.89
Portugal	129.05	92.86	57.36	225.88	119.81	157.94	40.27
Romania	165.01	65.86	5.92	261.04	90	178.93	29.19
Slovakia	94.58	57.67	9.13	177.59	46.24	68.32	70.96
Slovenia	146.47	76.01	11.36	228.41	108.68	93.05	41.62
Spain	119.81	97.93	42.45	184.05	88.49	138.83	33.94
Sweden	101.34	78.49	32.2	328.07	68.93	89.55	47.25
United Kingdom	120.32	80.79	19.85	230.98	87.63	83.45	43.48
EU (28)	124.6486	76.29464	22.22643	246.3957	78.36393	115.83	55.37214

Source: FAOSTAT (2016).

Table 3 illustrates food consumption in quantities per capita in all the EU countries. As can be seen, Greece seems to have one of the highest consumption levels of healthy foods, such as vegetables, cereals and fruits. The country also occupies the fourth position out of the 28 member states in the consumption of vegetables and the seventh place out of the 28 countries in the consumption of cereals. Additionally, Greece has the lowest consumption of sugar and sweeteners in the EU. Karagiannis and Velentzas (1997) found that Greek consumers have tended to reduce their consumption of bread and cereals over time but have increased their consumption of all other food items, with the most striking changes occurring in the consumption of meat and livestock products, such as milk, cheese and eggs. However, we can see that Greek consumers tend to consume less meat and livestock products. For instance, it is apparent that the consumption of meat (twenty-third out of 28), seafood (seventeenth out of 28) and milk and eggs (fifteenth out of 28) in Greece are below the EU 28 average. The disparity in per capita food consumption between Greece and the EU 28 average in those categories might be explained by the economic crisis, low income or different lifestyle.

4.2. Econometric Analysis

In Table 4, we present the results from the GLM (Generalized Linear Models) regression analysis based on expenditure and consumption in quantities per household. For the food and tobacco regressions, the annual household income is used, since quantity and price data are unavailable.

Table 4. GLM Regression analysis based on expenditures (food and tobacco) and consumption in quantities (the rest) per household.

Variables	Bread and Cereals	Meat	Sea and Seafood	Milk, Cheese and Eggs	Oils and Fats	Fruit	Vegetables	Sugar, Jam, Honey, Chocolate and Confectionary	Coffee, Tea and Cocoa	Wine	Beer	Food	Tobacco *
own price (Euro)	−0.539 ***	−0.777 ***	−0.326 ***	−1.100 ***	−0.385 ***	−0.688 ***	−0.667 ***	−0.338 ***	−0.715 ***	−0.439 ***	−0.489 ***	–	–
	(−19.89)	(−24.49)	(−12.30)	(−63.52)	(−11.60)	(−29.53)	(−17.85)	(−24.09)	(−34.16)	(−24.07)	(−9.59)		
food expenditure (Euro)	0.733 ***	1.073 ***	0.786 ***	0.877 ***	0.499 ***	0.864 ***	0.906 ***	0.903 ***	0.427 ***	0.248 ***	0.271 ***	0.237 ***	0.131 ***
	(48.86)	(67.78)	(30.81)	(59.54)	(26.69)	(46.18)	(54.61)	(30.77)	(18.35)	(6.88)	(7.73)	(16.36)	(3.59)
gender (male)	−0.023	0.050 ***	0.046 *	−0.044 ***	0.015	0.026	−0.042 **	0.008	0.067 ***	0.092 **	0.090 ***	−0.047 ***	0.079 *
	(−1.57)	(3.02)	(1.84)	(−2.67)	(0.71)	(1.30)	(−2.41)	(0.28)	(2.91)	(2.28)	(2.70)	(−2.98)	(1.89)
marital status (married)	0.080 ***	−0.029	0.020	0.026	0.043 *	−0.014	0.025	−1.519 *	−0.079 ***	0.003	−0.059	0.230 ***	−0.159 ***
	(4.53)	(−1.55)	(0.71)	(1.30)	(1.69)	(−0.58)	(1.25)	(−1.95)	(−2.75)	(0.07)	(−1.37)	(12.69)	(−3.44)
age (years)	0.975 ***	1.187 **	0.982	−1.491 ***	2.097 ***	−0.162	2.014 ***	0.191 *	0.810	−1.035	0.363	2.453 ***	1.633
	(2.62)	(2.37)	(1.29)	(−3.14)	(3.32)	(−0.30)	(3.87)	(1.89)	(1.30)	(−0.78)	(0.32)	(5.12)	(1.31)
age_square (years)	−0.140 ***	−0.141 **	−0.092	0.193 ***	−0.261 ***	0.022	−0.231 ***	0.014	−0.121	0.115	−0.049	−0.330 ***	−0.169
	(−2.91)	(−2.22)	(−0.95)	(3.15)	(−3.21)	(0.32)	(−3.47)	(0.52)	(−1.50)	(0.67)	(−0.33)	(−5.37)	(−1.04)
educational level (bachelor an above)	−0.112 ***	−0.119 ***	0.073 ***	0.019	−0.113 **	0.103 ***	−0.081 ***	0.035	0.122 ***	0.108 ***	0.139 ***	0.035 **	−0.094 **
	(−7.80)	(−7.99)	(3.19)	(1.33)	(−5.44)	(5.59)	(−5.05)	(1.20)	(5.43)	(3.14)	(4.93)	(2.44)	(−2.48)
employment status (public)	−0.027 *	−0.017	0.008	0.016	−0.027	0.045 **	−0.065 ***	0.111 ***	0.048 *	0.007	0.047	−0.005	−0.027
	(−1.79)	(−1.13)	(0.31)	(1.03)	(−1.26)	(2.25)	(−3.85)	(4.69)	(1.95)	(0.18)	(1.50)	(−0.37)	(−0.66)
north Greece (dummy)	0.098 ***	−0.139 ***	−0.111 ***	0.075 ***	−0.060 ***	0.029 *	0.063 ***	0.021	−0.062 ***	−0.089 **	−0.084 ***	0.055 ***	0.164 ***
	(8.69)	(−10.62)	(−5.71)	(5.81)	(−3.10)	(1.77)	(4.68)	(0.92)	(−3.00)	(−2.50)	(−2.70)	(4.54)	(4.74)
urban areas (dummy)	0.038 ***	−0.069 ***	−0.068 ***	0.069 ***	−0.080 ***	0.130 ***	0.050 ***	0.236 **	0.022	−0.029	−0.059 **	−0.004	−0.042
	(3.44)	(−5.63)	(−3.60)	(5.61)	(−4.59)	(8.40)	(3.86)	(2.52)	(1316)	(−0.91)	(−2.16)	(−0.34)	(−1.26)
number of persons aged from 0 to 13 (persons)	0.304 ***	−0.033	−0.029	0.270 ***	−0.035	−0.059	−0.222 ***	−0.331 ***	−0.062	−0.009	−0.086	0.422 ***	−0.025
	(6.08)	(−0.69)	(−0.35)	(5.59)	(−0.45)	(−0.79)	(−3.11)	(−2.60)	(−0.60)	(−0.06)	(−0.96)	(9.29)	(−0.20)
number of persons aged from 14 to 64 (persons)	0.617 ***	0.034	0.046	0.080	0.275 ***	−0.31 *	0.104 *	0.236 **	−0.020	−0.310**	−0.207 *	0.586 ***	0.287
	(10.51)	(0.60)	(1.65)	(1.22)	(2.92)	(−1.67)	(1.77)	(2.52)	(−0.21)	(−2.13)	(−1.93)	(10.65)	(1.51)
number of persons aged more than or equal to 65 (persons)	0.300 ***	0.113 ***	0.078 *	0.040	0.311 ***	−0.107 *	0.072 **	−0.331 ***	−0.049	−0.261 ***	−0.171 **	0.448 ***	0.176 **
	(10.85)	(3.81)	(1.65)	(1.27)	(7.17)	(−2.65)	(2.09)	(−2.60)	(−0.95)	(−3.37)	(−2.41)	(14.69)	(1.97)
const	−2.929 ***	−5.047 ***	−4.744 ***	1.798 **	−4.134 ***	−1.301	−5.778 ***	−0.304 ***	−0.954	4.875 *	1.752	−0.045	1.321
	(−4.22)	(−5.25)	(−3.23)	(2.00)	(−3.44)	(−1.23)	(−5.76)	(−5.18)	(−0.82)	(1.92)	(0.83)	(−0.05)	(0.57)
Obs.	6042	5880	4365	5975	5726	5820	5969	4772	4317	2510	2068	6071	2292
Scale parameter	0.172	0.203	0.351	0.206	0.376	0.317	0.228	0.561	0.355	0.581	0.356	0.194	0.595
Log psuedolikelihood	−3256.52	−3651.26	−3901.41	−3753.47	−5319.41	−4906.98	−4045.77	−5384.87	−3884.16	−2872.82	−1860.84	−3630.08	−2650.34
Deviance	1039.58	1191.97	1527.31	1228.87	2149.26	1839.83	1355.67	2669.12	1528.30	1449.91	732.24	1175.30	1355.59
AIC	1.082	1.247	1.79	1.261	1.863	1.691	1.360	2.263	1.806	2.300	1.813	1.20	2.32
BIC	−51,443.14	−49,720.88	−34,930.66	−50,604.04	−47,275.38	−78,492.71	−50,419.09	−37,633.61	−34,489.17	−18,088.87	−14,948.69	−51,588.91	−16,269.71

Note: ***, ** and * denote significance at 1%, 5% and 10% level, respectively. t-statistics are presented in the parentheses. Food and tobacco are measured in euros.

The most important result from this analysis is that all price elasticities and all income elasticities, as expected, are negatively and positively related to the food categories of households. Regarding the other independent variables, the results are mixed. More importantly, it is obvious that married people consume less sugar and coffee but more from the other food categories. Individuals' educational level and age composition are related to healthier nutritional habits. Regarding income elasticities, Engel's Law indicates that there is hierarchical consumption in the economy. Lower living standards usually lead to more spending to meet basic needs, such as food. As households become wealthier, their spending moves to other goods, covering more luxury needs (transport, recreation, culture, tourism, etc.). This means that the share of food consumption evolves in an inverse relationship with income. Table 5 illustrates the empirical results after implementing quantile regression models.

Table 5. Food elasticity with respect to total household income.

	$\theta = 0.10$	$\theta = 0.25$	$\theta = 0.50$	$\theta = 0.75$	$\theta = 0.90$
Income	0.251 ***	0.272 ***	0.266 ***	0.256 ***	0.247 ***

Note: ***, denotes significance at 1% level.

Taking into account the tenth, twenty-fifth, fiftieth, seventy-fifth and ninetieth percentiles, the results reveal a statistically significant (at the 1% level of significance) inverse U-shaped relationship (positive asymmetry) between the annual total expenditure and the annual food consumption per household, confirming Engel's Law in the sample. However, for future research, a more specific analysis of the composition of food consumed by weight might be crucial. At the same time, it would be highly interesting to show the composition of consumption per food type. The following Figure 4 illustrates this budget share with respect to food categories.
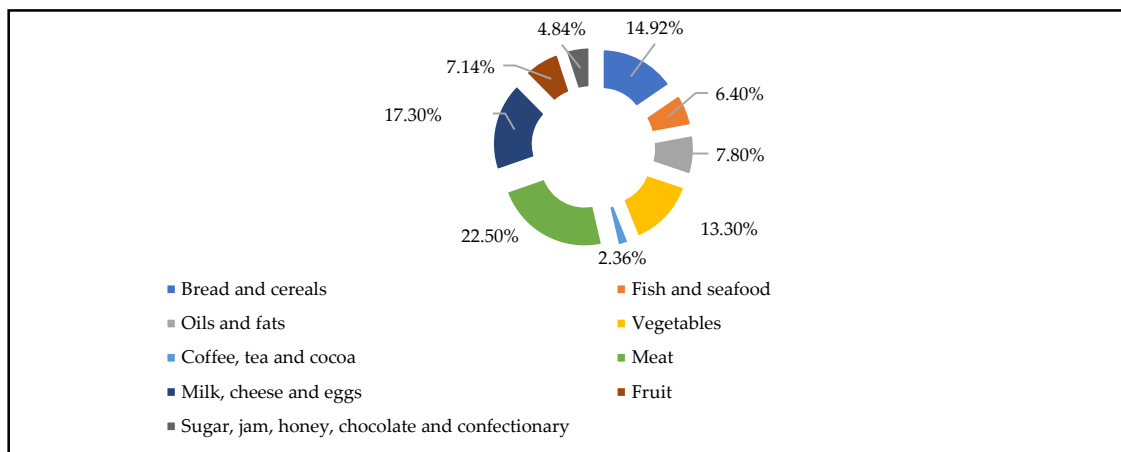

Figure 4. Share of food expenditure by product categories (%). Source: ELSTAT; Authors' calculations.

As can be seen, the share of meat in the total food expenditure is generally the largest (22.5%) and is immediately followed by the shares of milk (cheese and eggs), bread and cereals and vegetables, which recorded 17.3%, 14.9% and 13.3%, respectively. Finally, the shares of (1) coffee, tea, cocoa and sugar and (2) jam, honey, chocolate and confectionary are the lowest, recording 2.36% and 4.84%, respectively.

Moreover, taking into account the four food types—(a) bread and cereals, (b) meat, (c) milk, cheese and eggs and (d) vegetables—with the largest budget shares with respect to food expenditure, a QUAIDS model is estimated, presenting the matrix of own- and cross-price Marshallian and expenditure elasticities (Table 6).

Table 6. Matrix of Marshallian price and expenditure elasticities (evaluated at sample means).

Food Type	Prices of				Expenditure
	Bread and Cereals	Meat	Milk, Cheese and Eggs	Vegetables	
Bread and cereals	−0.402	−0.267	−0.032	−0.267	0.789
Meat	−0.266	−0.802	0.034	−0.206	1.240
Milk, cheese and eggs	−0.052	0.163	−1.070	0.061	0.898
Vegetables	−0.138	−0.271	0.073	−0.596	0.931

An alternative and recently proposed way to estimate own-price and expenditure elasticities is the Marshallian demand system. This method has several advantages over traditional demand systems. For example, it is not necessary to have closed functional forms for Marshallian demand curves. Thus, based on this approach, the results show that all the expenditure elasticities are positive, indicating that food is a normal good. Only for meat products is the expenditure elasticity greater than one ($\varepsilon = 1.240$), allowing such products to be classified as luxury goods. In contrast, the increase in spending on goods such as bread and cereals, milk, cheese and eggs and vegetables are smaller. Nearly all of the own-price elasticities are negative, as expected. Generally, Greek consumers are found to be not very sensitive to most of the examined food prices, except milk, cheese and eggs (−1.070). The own-price estimations for bread and cereals, meat and vegetables are less elastic than those for milk, cheese and eggs. Finally, the cross-price elasticities that we can obtain from the table above for milk, cheese and eggs are complementary to bread, and vegetables are complementary goods to bread, cereals and meat, while meat is complementary to bread, cereals and vegetables. For comparison reasons, Table A1 in Appendix A presents the own- and cross-price and expenditure elasticities based on Deaton (1988) approach.

5. Discussion

Theories on food expenditures have been investigated in previous economics studies. Many researchers have tried to explain the characteristics of demand for food expenditures. The dominant factors, determinants of the demand, are demographic, psychological, social and cultural. The increasing interest in research is based on the gradual differentiation of the expenditures on food across household groups. Furthermore, it is of high interest that contemporary consumers' attitude is linked to a healthy lifestyle. Our empirical results indicate that age has a solid relationship with food spending and elderly people have different concerns about their health status from younger ones and thus tend to eat more carefully. Those results are in accordance with many surveys that have detected differences in the preferences between younger and elderly consumers leading to different levels of expenditures on food (Davis et al. 1983; Heien et al. 1989; Jae et al. 2000; Mihalopoulos and Demoussis 2001). As far as the employment status is concerned, people working in the public sector indicated that they spend more money on food while those who are retired, as expected, spend even more. We have found also that people who live in cities spend more money on food and consumers who live in rural places. An obvious reason is that they can produce their own primary goods whereas consumers in urban areas have more food consumption choices leading them to have higher food expenditures. These results confirm several previous surveys (see for example Heien et al. 1989; Kirkpatrick and Tarasuk 2003; Mihalopoulos and Demoussis 2001). Although consumers who live in urban places used to consume a lot of money on food, nowadays this trend seems to be changing (Hossain 2002). Additionally, our findings show that unmarried and divorced individuals spend more money than married individuals and widowers. Furthermore, as expected, the household behaviour of expenditures on food is directly related to the household size. Previous studies have estimated that there exists a positive relationship between the number of members in a household and the level of its expenditures on food (García and Grande 2010; Heien et al. 1989; Jacobson et al. 2010; Jae et al. 2000; Manrique and Jensen 1998). The previous study of Karagiannis and

Velentzas (1997) found that Greek consumers have tended to reduce their consumption of bread and cereals over time but have increased their consumption of all other food items, with the most striking changes occurring in the consumption of meat and livestock products, such as milk, cheese and eggs. We confirmed these results, as meat was found elastic with respect to expenditures, even if Greeks seem to consume less meat than many other European consumers. It could be explained due to the alteration of lifestyle and the differentiation of households' budget structure.

Generally, in this paper, we have presented the relationship between headed-reported households' demographic parameters and their food consumption patterns. Our results indicate that these characteristics matter for household food consumption. Furthermore, the income and price elasticities were estimated to be statistically significant, with the expected sign and magnitude. Age, marital status, educational level, region of living and employment status also affect food consumption significantly. The empirical analysis showed that richer households, elderly people and more highly educated persons might consume more on food, as expected. It seems that these categories of consumers select food items of higher quality (healthier), which are also more expensive. Household structure and living region also affect food item selections, as they involve different lifestyles. Regarding tobacco use, unmarried and unemployed persons smoke more. This result could have an even greater psychological interpretation; however, that is beyond the scope of this survey.

6. Concluding Remarks and Policy Analysis

Several issues might arise from the foregoing that should be taken into consideration for future research. First, data reliability can be a serious issue, as consumers are prone to tax evasion, typically refusing to declare their real income and consumption (Grigorakis et al. 2017). Second, a more detailed analysis using time periods will show the dynamic relationship between the variables of interest. However, despite these limitations, this study seems to have important policy implications. First, it improves the policy recommendations that address the issues of food insecurity and malnutrition. For example, the findings might lead to new policy implementation throughout several establishments, such as public schools or nursing homes. Food knowledge creates better food behaviour, which produces healthier societies. Education strategies could be applied to several sub-groups of individuals. Similarly, this survey might give new knowledge to food researchers to take into consideration households' expectations in terms of food and nutritional values based on their behavioural and physiological features. Eating choices are complicated and can be affected by a number of factors. According to Pomeranz et al. (2018), there is increasing evidence that many factors other than personal decisions affect households' dietary choices. Individuals' food habits are defined by their own preferences and several demographic characteristics, such as age, gender, level of education, personal income, health status and nutritional knowledge. Hence, there is a need for evidence-based policy. This whole strong relationship between food knowledge and food quality recommends a new significant role in food education efforts. Significantly, while increased food knowledge is an essential condition to advance food intake patterns, other factors also need to be considered. Consumer consciousness and inspiration need to be targeted additionally as important factors in shifting the taste preferences of households. A potential trade-off exists between food and health status among poor families.

Future research should approach food policies in this broader way. Non-food policies, including those that subsidize housing, healthcare or transportation, might also have a meaningful and unintended impact on reducing food insecurity. Except for education and information, governments and policymakers can use fiscal measures with either incentives or disincentives that are mainly focused on consumers and producers. For instance, the implementation of extra taxes on the production or sale of unhealthy items, such as sweets and tobacco, could work in this direction. This type of taxes can be financially regressive for those with a low income but progressive due to the benefits of health. According to Olsho et al. (2016), to decrease monetary regressivity and increase the positive effect on health, tax profits can be deployed for alternative health promotion strategies, such as producing incentives to decrease the price of healthier food goods. Paradoxically, the healthcare system has not

been used very often by government authorities to encourage better diets. Both public and private providers of food services experience numerous obstacles to food promotion. One of the problems that policymakers face is that they do not have relevant data that show the relationship between nutrition and health, spending on healthcare and economic problems that are needed for policy action. Governments must have the support from the whole society to sustain appropriate policies. However, it should be mentioned that, even if a dietary shift can have great effects on health, the insight that dietary interferences need a long time to show gains may not concur with economic or political cycles. Last but not least, future research should take into account the already-existing dynamic issue of population aging. European economies are facing very low fertility levels, and elderly people will make up the largest proportion of the population in future years. This means that policy interventions are required to correct market failures in new food quality and healthcare systems that will be observed in the near future.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Deaton (1988) approach.

	Bread and Cereals	Meat	Fish and Seafood	Milk, Cheese and Eggs	Oils and Fats	Fruit	Vegetables	Sugar, Jam, Honey, Chocolate and Confectionary	Coffee, Tea and Cocoa	Wine	Beer
Own price elasticity	−0.902	−0.905	−0.267	−1.478	−0.475	−0.508	−0.678	−0.407	−0.872	−0.567	−0.622
Expenditure elasticity	0.657	1.107	0.971	0.892	0.581	0.812	0.879	1.090	0.662	0.434	0.401
F-stat R^2	20.26 *** 3.9%	8.59 *** 1.8%	25.56 *** 6.6%	10.34 *** 2.0%	12.75 *** 2.6%	14.39 *** 2.9%	17.67 *** 3.4%	10.56 *** 2.6%	10.23 *** 2.8%	14.38 *** 6.5%	3.38 *** 1.9%

Note: *** denotes significance at 1% level.

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