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FACTORS INFLUENCING HOUSEHOLD EDIBLE OILS AND FATS IN TURKISH ECONOMY

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ABSTRACT

Study was conducted to observe the factors affecting household expenses of edible oils and fats in Turkey using a two-stage Seemingly Unrelated Regression (SUR) with data from Turkish Statistical Institute (TUIK) of 2012 household budget survey. An empirical test was conducted to show the primacy of SUR over Ordinary Least Squares (OLS) procedure. In addition, household-heads and household-related characteristics are used to determine likelihoods of household spending and levels of expenditures in oils and fats consumption. Results provide that most of these factors play key role in making consumption expenditure on edible oils and fats, while less effect were observed in the levels of expenditures. Findings revealed that due to increase in total food expenditure, the expenditures on butter, margarine and vegetable oils, olive oils and other edible fats also increase.

Keywords: Oils and fats consumption; regression models; Turkey

INTRODUCTION

Turkey has succeeded to be the 16th biggest economy with a gross domestic product (GDP) of 719,620 billion dollars among 30 OECD countries along with an economic and political stability in the last decade. In the year 2016, Turkey has become the first fastest-growing country with a growth rate of 11.7% (TUIK, 2017b) among OECD and EU countries and the second fastest-growing country after China in the world (HDTM, 2013). As a result of the growing economy, significant increases have taken placed in the per capita income. While the per capita real income in the year 2015 was $20.420, this number increased by times in 2016 and reached up to $21,146 (TUIK, 2017b). In addition to the income rise, food consumption also boosted in response to the ever-increasing population growth in the world. While the population in Turkey was around 68 million in the year 2000, this number rose to 79 million with a growth rate of 18.0 % in 2016 (TUIK, 2017a). Thus, the vital food requirements will emerge with the population growth leading to new food compositions on shelves in markets in order to the demand when the needs arise. Frankly speaking, fat is the most important food substance that meets the daily energy intake for the human body among these nutrients. This nutrition requirement is almost met by consumption of both vegetable (sunflower seed, corn, soybean and canola) oils and fats, particularly margarine and animal fats.

Socio-cultural diversities, habits and dynamic economic lives are effective factors in the formation of the consumption structure over time. Additionally, as a result of customs and traditions of nations; factors such as education, health, etc. encouraged the consumption of some fats while limiting the consumption of others (Drewnowsk and Popkin, 1997; Cankurt *et al*., 2010). In this context, the fat consumption per person in Turkey may be asserted to be quite low compared to developed countries (Cankurt *et al*., 2010). The annual total fat consumption per person including animal fats in the EU and USA is above 50 kg, whereas this amount remains at the level of 26 kg in Turkey (Cabukel *et al*., 2009).

Approximately, 67% of fats consumed in Turkey include oils (Samur, 2008). This is because oils that include polyunsaturated fatty acids cause relatively lower rates of cholesterol in body compared to fats that include saturated fatty acids in terms of cardiovascular health (Samur, 2008). The total fat consumption in Turkey was 1,416 thousand tonnes in 2011, of which 950 and 466 thousand tonnes consisted of oils and solid fats, respectively (Husin, 2012). Per capita total oil consumption level in Turkey trended upward from 19.8 kg in 2007 (Satana, 2008) to 21.5 kg in 2011 (Husin, 2012). On the other hand, the USA and EU share the first and second places in the world in terms of per capita oil consumption with 28 kg and 24.5 kg, respectively (FAPRI, 2011), while the corresponding figure in Turkey is close to the numbers in the world.

Oils are classified as vegetable oils and olive oil for which the intense consumed soybean oil is categorized within the former group, vegetable oils. The USA is ranked first with 23 kg, Taiwan the second with 18 kg and China the third with 9 kg (FAPRI, 2011) in terms of per capita per year consumption level in the world; whereas, soybean oil in Turkey constitutes only 0.4% of the total oil consumption (Husin, 2012). In terms of sunflower seed oil, Argentina is the leading country with 8.6 kg; whereas, the EU is ranked as the second with 5.8 kg (FAPRI, 2011). Surprisingly, sunflower

consumption amount in Turkey corresponds to 82.2% of the total liquid oil consumption (Husin, 2012). In this respect, the reason for this oil group to be the most-intense consumed oil among all edible oil types is that it appeals to Turkish taste and enables several different methods of usage (cosmetics, etc.) with its cheaper price as compared to other oils.

An increasing demand has been observed in the consumption of olive oil in the world in the last 10 years. Oils are considered to be an opportunity for healthy nutrition and natural food intake due to its rich unsaturated fat acid content and recommended to be consumed by several sources (Ozturk *et al*., 2009). While annual per capita olive oil consumption in EU countries is 5-6 kg interval, this number is unfortunately around 1 kg in Turkey. The most important reason for the low consumption amount in the country is that its prices are approximately 2.5-3 times higher than the prices of substitute products (vegetable oils). Such a high price difference between products directs the oil demands of middle and low income families to other vegetable oils (Ozturk *et al.*, 2009).

In terms of butter which constitute a small amount of fat consumption and may change consumption patterns depending on consumption habits, Switzerland is ranked first with a per capita consumption of 7 kg followed by New Zealand with an amount of 4.6 kg and EU countries with 3.7 kg (FAPRI, 2011), while the amount in Turkey is approximately 2 kg. Since home-made butter is not taken into account when the butter consumption amount per person in Turkey is calculated, it can be asserted that the butter consumption amount per person is more than 2 kg. Especially in parallel with the increasing population and life standard levels of developed countries and developing countries like Turkey, oil or fat cannot be produced in the same amounts they are consumed, therefore many countries try to meet the oil and fat consumption gap. Similarly, although it is significantly important to reveal the fat consumption habits of households in Turkey in order for retailers, wholesalers, manufacturers and farmers to create more effective strategic planning and marketing structures, unfortunately sufficient number of studies have not been conducted in this area (Cankurt *et al*., 2010; Bilgic and Yen, 2013, 2014).

In this study, the effects of socio-demographic and economic factors of households on their butter, margarine, vegetable oil, olive oil and edible oil expenditure amounts were analysed using a two-step generalized Heckman sample selection model (Shonkwiler and Yen methods) by using data emanating from the Turkish Statistical Institute (TUIK) of 2012 household consumption survey. Each food's expenditure probabilities were separately modelled through a binary probit model in the first step, while the corresponding expenditure levels (e.g., butter, margarine-vegetable oil, olive oil and edible oil consumption expenditures) were analysed in a system using Seemingly Unrelated Regression (SUR) model in the second step[1]. Unlike the ordinary SUR model, the system where independent variable sets of the second step are multiplied by (cumulative distribution function, cdf) and a variable (probability density function, pdf) added as the control variable all derived (e.g., both cdf and pdf) from the first step is called as Generalized SUR model[2] proposed first by Shonkwiler and Yen, (1999). In addition, unit (marginal) effects of the factors that both affect the probability and unconditional expenditure levels were calculated with their associative standard errors. These unitary effects have a significant importance in terms of revealing how the recent changes in socio-demographic and economic factors in Turkey have shaped oil and fat consumption expenditures and in what level they have shed light on different dimensions for local and national policymakers and stakeholders such as retailers, wholesalers, manufacturers, importers-exporters and consequently farmers.

Included in the subsequent sections are Data and Method followed by Results and Discussion section. Recommendations are drawn and highlighted in the Conclusion section.

MATERIALS AND METHODS

Materials: The data were obtained from the Household Consumption Expenditures Surveys collected by the Turkish Statistical Institute (TUIK) in 2012.In order to minimise the seasonal effects on consumption, monthly surveys were conducted between 1 January 2012 and31 December2012,on families with similar socio-demographic characteristics. The sample size was specified as 8789 people after excluding missing and contradictory (e.g., outliers) observations.

Table 1 illustrates socio-demographic characteristics of households and household heads[3]. While socio-demographic characteristics of household heads are gender, marital status, employment status, age group, education year and compulsory health insurance,

[1]In cases where the dependent variables forming the SUR model are related to error terms and there is no significant relationship between the independent variables and different dependent variables, it has been indicated by Zellner (1962) that SUR estimators are more effective than the estimators in Ordinary Least Squares Method (OLS).

[2]Generalized SUR model will be explained in detail in the section Data and Method.

[3]By taking the journal's page limitation into account, the descriptive statistics of variables will not be discussed here in detail.

socio-demographic characteristics of households are the number of technological devices (number of computers, cell phones, internet, satellite and TV, etc. used at home), possession of properties, revenue group, houses owned, and the number of children according to age groups. Expenditures on butter, margarine and vegetable oils, olive oil, and edible oils were shown on a monthly basis. We also checked for multicollinearity among independent variables for the first and second step estimations by calculating the variance inflation factors (VIFs). All VIFs were very small, suggesting multicollinearity was not an issue among explanatory variables in both step estimations (Chatterjee and Hadi, 2006).

Methods: After a long derivation, Shonkwiler and Yen (1999), henceforth SY, has come up the two-step of Heckman multivariate sample selection model (MSSM) as:

$$\begin{aligned} E\left(y_{it}\right) &= E\left(y_{it} \mid \mathbf{x}_{it}, \mathbf{z}_{it}; v_{it} > -\mathbf{z}'_{it}\boldsymbol{\alpha}_i\right) * P\left(d_{it}=1\right) + E\left(y_{it} \mid \mathbf{x}_{it}, \mathbf{z}_{it}; v_{it} \le -\mathbf{z}'_{it}\boldsymbol{\alpha}_i\right) * P\left(d_{it}=0\right) \\ &= \left[f\left(\mathbf{x}_{it}, \boldsymbol{\beta}_i\right) + \delta_i \frac{\phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)}{\Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)} \right] * \Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right) + 0 * \left(1 - \Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)\right) \\ &= \left[f\left(\mathbf{x}_{it}, \boldsymbol{\beta}_i\right) + \delta_i \frac{\phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)}{\Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)} \right] * \Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right) \\ &= \Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right) * \mathbf{x}'_{it}\boldsymbol{\beta}_i + \delta_i \phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right) \end{aligned} \tag{1}$$

where, i and t stand for the equation and observations, respectively, whilst y_{it} and d_{it} represent the observed dependent variables, whilst y^*_{it} ve d^*_{it} represent their latent unobserved equivalents, respectively. Similarly, $\mathbf{z}_{it}$ and $\mathbf{x}_{it}$ form the independent variables vector affecting the first and second steps respectively and $\boldsymbol{\alpha}_i$and $\boldsymbol{\beta}_i$ represent the parameter vector sets to be estimated according to their corresponding independent variable sets, respectively. On the other hand, υ_{it} and ε_{it} represent the random error residuals of the system of equations in the first and second steps, respectively (Shonkwiler and Yen, 1999). This type of system of equations is the generalized censored system of equations of Amemiya (1974);

$$\begin{aligned} y_{it} &= \Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right) * \mathbf{x}'_{it}\boldsymbol{\beta}_i + \delta_i \phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right) + \xi_{it}, \qquad (i = 1, 2, \ldots, m; t = 1, 2, \ldots, T) \\ \xi_{it} &= y_{it} - E\left(y_{it}\right) = \varepsilon_{it} + \left[\Phi\left(\mathbf{z}'_{it}\boldsymbol{\alpha}_i\right) - \Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)\right]\mathbf{x}'_{it}\boldsymbol{\beta}_i + \delta_i\left[\phi\left(\mathbf{z}'_{it}\boldsymbol{\alpha}_i\right) - \phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)\right] \end{aligned} \tag{2}$$

Where represents the error residuals of the system and the error residual also clearly shows that the observations do not have equal variances. In a similar vein with the HW method, the SY method also makes parameter estimations through a two-step approach: depending on the binary variable of the first step (where d_{it}=1 and d_{it}=0 in the probit model), each i equation's $\hat{\boldsymbol{\alpha}}_i$ values are obtained. Thereafter, by using SUR model or the Maximum Likelihood Function (MLE), all parameter sets of the system are consistently estimated. However, as the variance-covariance matrix of parameters in the second step varies according to the observation (heteroskedasticity), the corrected and relatively more efficient new variance-covariance matrix of parameters are achieved followed by the literature (Shonkwiler and Yen, 1999).

whereas, the deterministic part may not be linear for $\boldsymbol{\beta}_i$ values and the censoring of every dependent variable is determined by a separate stochastic process (Shonkwiler and Yen, 1999; Vermeulen, 2001; Chen and Yen, 2005).

This method was first derived by Maddala (1991), however it was used in empirical studies for the first time by Shonkwiler and Yen (1999) (it is also known as the SY method) (Su and Yen, 2000; Vermeulen, 2001; Yen *et al*., 2002; Chen and Yen, 2005; Pan *et al*., 2008; Bilgic and Yen, 2013). In the parameter estimation of the second step, the system is reconstructed as follows for each i^{th} equation:

On the other hand, the unitary (marginal) effects of independent variables in the second step in terms of the unconditional expected values could be derived as follows:

(1) If the independent variable is used in both steps, its marginal effect is:

$$m_{ik} = \frac{\partial}{\partial x_{ik}} E\left(y_{it}\right) = \left[\Phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)\right]\hat{\beta}_{ik} + \left[\phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)\left(\mathbf{x}'_{it}\boldsymbol{\beta}_i\right) - \phi\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)\left(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i\right)\right]\hat{\alpha}_{ik} \tag{3a}$$

(2) If the exogenous variable is used only in the first step, then its unitary effect is:

$$m_{ik} = \frac{\partial}{\partial x_{ik}} E(y_{it}) = \left[\phi(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i)(\mathbf{x}'_{it}\boldsymbol{\beta}_i) - \phi(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i)(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i) \right] \hat{\alpha}_{ik} \quad (3b)$$

(3) If the independent variable is used only in the second step, its marginal effect is:

$$m_{ik} = \frac{\partial}{\partial x_{ik}} E(y_{it}) = \left[\Phi(\mathbf{z}'_{it}\hat{\boldsymbol{\alpha}}_i) \right] \hat{\beta}_{ik} \quad (3c)$$

These unitary effects could be calculated according to the mean values of independent variables as well as the mean values of observations. We preferred the latter. In addition, standard errors of marginal effects were calculated by using delta method.

RESULTS AND DISCUSSION

Before discussing the results obtained from the system of equations, it is required to first determine if the equations in the second step are to be estimated separately through Ordinary Least Estimation (OLS method), or with a system via the seemingly unrelated regression (SUR) method that considers the synchronous correlations among the dependent variables. With this objective, the assumption which suggests that the cross covariance between the dependent variables of the SUR model are zero and therefore the OLS method is valid should be tested. The test statistic suggests that the null hypothesis suggesting that the synchronous cross correlations are null was rejected (λ=278.207, df = 6 and p=0.000). The finding shows that the SUR model estimators are superior to OLS method in terms of unbiasedness, consistency, and efficiency.

When the cross correlation between the oil and fat type expenditure levels are analysed after controlling all exogenous variables within the system, the uncontrollable factors which affect the system have a negative correlation coefficient between butter expenditure level and margarine-vegetable oils expenditure level (ρ = -0.014). Therefore, the unobservable factors within the system increase butter expenditure amounts while limiting margarine-vegetable oil expenditure amounts, vice versa. On the other hand, a positive correlation is observed between butter and olive oil expenditure amounts (ρ = 0.031) and butter and other edible animal fat expenditure amounts (ρ = 0.026) and a negative correlation is observed between margarine-vegetable oil expenditure levels and olive oil expenditure amounts (ρ = -0.012), whereas there is a positive correlation between margarine- vegetable oils and other edible animal fats (ρ = 0.088). Consequently, a negative correlation is interestingly observed between olive oil expenditure levels and other edible animal fats (ρ = -0.040). All these cross correlation coefficients show us that after independent variables are taken under control within the system, impacts of uncontrollable factors within the system remain limited between dependent variables in terms of absolute value.

Table 2 illustrates parameter estimations of the first and second steps and Table 3 illustrates the unitary (marginal) impacts of the independent variables on the dependent variables. We discuss only statistically significant unitary effects of both the binary probabilistic models and the expenditure levels.

When the unitary impacts of exogenous variables in the probit model in the first step were examined[4]; the margarine and vegetable oil and other edible oil consumption probabilities in families whose household head is married are higher than those of the families whose household head is not married. Butter, olive oil and other edible oil consumption probabilities of the families whose household head is employed was higher than those families whose household head were unemployed. While butter and other edible fat consumption probabilities increased in families where the household head has a compulsory health insurance, olive oil and other edible oil consumption probabilities decrease as expected in families where the household head had a “green card” (healthcare card for uninsured people in Turkey).

In childless families, butter consumption probabilities increase; whereas, margarine and vegetable oil consumption tendencies decreased. Families living in detached houses, margarine, vegetable oil and olive oil consumption probabilities decreased compared to other family types; whereas, in families living in apartments, olive oil consumption probabilities similarly decrease. In families that are tenants, butter, margarine-vegetable oil

[4] If the literature is reviewed in detail, frankly speaking the HW and SY methods are mostly adapted to demand analyses, while the analysis; however, to the food expenditures are scant. This preference generally arises when demand equations are more significant than expenditure equations if the demanded amounts and prices of foods are in question. Similarly, if demand equations are estimated in the two-step model in the literature, there is a common tendency that unitary effects are only reported or only the results of the second step are reported. Therefore, this attitude unfortunately limits our opportunity to compare our study’s results with national (unfortunately no studies have been conducted until today in this field) or international findings.

and olive oil consumption likelihoods decreased as expected and only olive oil consumption probabilities have been found to be statistically significant. Maybe, the economic burden that the rent creates in the family budget accelerates the consumption tendency of other edible oils which are more abundant and relatively cheaper. In a study conducted in the USA, the consumption probabilities of margarine-vegetable oils that are used for baking and cooking were found to be higher in families that own houses than other family types (Yen *et al*., 2002).

Consumption probabilities of margarine-vegetable oils, olive oil and other edible oils have been found to be higher among families residing in cities than families residing in the rural areas. In a study conducted by Pan *et al*. (2008), households residing in the rural areas of India were found to be consuming less butter, however consuming more palm oil. On the other hand, in a study conducted by Yen *et al*. (2002) in USA, the consumption probabilities of vegetable oils used for cooking and solid fats used for baking have been found to be lower among those living in cities than those living in the rural areas.

As household head gets older and household head's educational level increases, families likelihood of spending on butter, olive oil and other edible oils increases, whilst their margarine-vegetable oil consumption tendencies decreases. The positive impacts of olive oils on human health are better understood with the increasing educational level, leading to increased intake of this food type. Results of our study echo other international results (Pan *et al*., 2008; Yen *et al*., 2002).

The number of children in different age categories in families has distinct effects on their oils and fats consumption probabilities. For instance, as households with the number of children within 0-5 years of age increases, families' tendencies for margarine-vegetable oil and olive oil consumption significantly drops, while the number of children within the 6-14 and 15-19 years age ranges in the household increases, families' consumption probabilities on margarine-vegetable oils rise. However, as the number of children within the age range of 15-19 years increases, families tend to consume less olive oil. The increase in the number of adult children in families brings along the habit of more frequently consumed margarine-vegetable oils. Considering that in Turkish cuisine, foods are generally cooked with margarine and liquid vegetable oils, both the increasing number of adults and children in the age groups of 6-14 years and 15-19 years in the family are expected to increase the consumption probabilities as shown in the food content. As the number of employed family members increases, households tend to consume more butter but less margarine-vegetable oils. This result triggers the probability of consuming animal fats rather than vegetable oils due to the increasing physical activity.

As the number of communication devices used within the family rises, families' probabilities of consuming both butter and margarine-vegetable oils also increase. The easy correspondences provided by communication devices among family members, especially between the individual who is in charge of the family (generally the household head) and the individuals reporting the family's food needs (particularly the lady of the house) cannot be denied. On the other hand, increasing number of automobiles only decreases the consumption probabilities of other edible oils. Furthermore when easy access provision to district bazaars or big shopping centres is considered, increasing number of personal vehicles may be thought to be increasing food consumption probabilities. The increasing number of durable goods purchased to protect their shelf lives as a support to family revenue decrease the consumption probabilities of margarine-vegetable oils and other edible oils in families while it increase olive oil consumption probability.

Before discussing the unit effects of the second step, we emphasized on beneficial points First of all, some variables, which are used in probit models as a solution to problem identification (variables related to the number of technologies, automobiles, durable house goods and real estate properties), were not used in the SUR equation system in the second step. Similarly, variables of the total food expenditures used in the SUR equation system in the second step but was ignored in the probit models in the first step. This approach brings an exact solution to problem identification in parameter estimation (Bilgic and Yen, 2013). Although there is no certain suggestion regarding which variables should be used in which step in literature (Pudney, 1989; Yen, 2005), we preferred to use most of demographic factors in the first step and economic and some demographic factors in the second step. The second important point is that the variance-common variance matrixes of the second step's parameters were recalculated by using equation 4a. On the other hand, the marginal effects of the independent variables were calculated using equations 4a, 4b, and 4c.

When the variables with statistically significant, unitary effects were analysed; families whose household head is married spend more on margarines-vegetable oils than families whose household head is not married. While childless families spend less on margarines-vegetable oils, families owning their own houses and tenant families have been observed to display a similar attitude.

Families living in cities spend less on butter compared to families living in rural areas. As the household head gets older and the educational level of the household head increases, the expenditures spent by

families on butter also increases. As the number of children between 0-5 year age group increases in households, families spend less on margarine-vegetable oils, but more on margarine-vegetable oils as the number of children within the age range of 6-14 years and the number of adult individuals in households rise. Butter consumption increases with a rise in the number of employed individuals in households. One extra employed individual in a household spends 0.41 TL piastres and more is spent butter. One extra unit of technological device in a household causes more spending on both butter (0.03 piastres) and margarine-vegetable oils (0.10 piastres) within families. While the increasing number of durable white goods used in homes decreases, spending on margarine-vegetable oils and other edible oils (0.12 piastres and 0.92 piastres, respectively), it causes more expenses to be made on olive oil (0.14 piastres).

A one ¨lira increases in monthly food expenses in a family boost food spending in four types of oils and fats (0.004 piastres, 0.002 piastres, 0.003 piastres, and 0.010 piastres, respectively). Spending levels of these four main food items will rise as the share allocated to food expenses increases.

Table 1- Variable Definitions and Sample Statistics.

Variable	Definition	Mean	Std. Dev.
Dependent variables	**Expenditure (**TL/**month)**		
Butter Consumption	All observation (¨)	3.55	7.88
	Among to consuming (¨)	13.63	10.06
Margarine-Vegetable Oil Consumption	All observation (¨)	2.02	3.82
	Among to consuming (¨)	4.93	4.62
Olive Oil Consumption	All observation (¨)	2.16	7.68
	Among to consuming (¨)	21.80	12.90
Edible Oil Consumption	All observation (¨)	11.02	12.76
	Among to consuming (¨)	20.82	10.18
Continuous explanatory variables			
Age	Age of the household head in years	47.09	(12.82)
Education	Educational level of the household in years	7.56	(4.44)
Age 0-5	Kid(s) age 0–5 present	0.32	(0.61)
Age 6-14	Kid(s) age 6–14 present	0.59	(0.88)
Age 15-19	Kid(s) age 15–19 present	0.31	(0.61)
Adults children	Kid(s) age is 20 or older (reference)	2.35	(0.92)
Income earners	Number of family members employed	1.15	(0.78)
Technology	Number of communication devices	4.85	(2.26)
Automobile	Has an automobile	0.44	(0.55)
Durables	Number of kitchen appliances (TV, refrigerator, dish- washer, washing machines, dryers, ovens, etc.) owned	3.13	(1.36)
Equities	Number of properties (shops, grocery stores, lands, apartments, vineyards, orchards, and etc.) owned	0.98	(1.18)
Total food expenditure	Monthly total food expenditures inTL	412.90	(246.51)
Binary explanatory variables (yes = 1; no = 0)			
Household head and household characteristics			
Male	Gender is male	0.87	(0.33)
Married	Married	0.85	(0.35)
Employed	Employed	0.71	(0.45)
Compulsory	Has a compulsory health insurance	0.86	(0.33)
Green card	Has a green card for the family	0.07	(0.25)
Couple with kids	Couple with kids	0.55	(0.49)
Childless	Childless adult couple	0.16	(0.36)
Separate home	Resides in a separate home	0.41	(0.49)
State apartment	Resides in the state apartment	0.58	(0.49)
Homeowner	Resides in own house	0.56	(0.49)
Renter	Resides in rental house	0.28	(0.44)
Urban	Resides in urban	0.71	(0.45)
	Number of samples	8789	

Table 2-Expected Parameters of Probit and SUR models

Variables	1st step = Probit Model				2st step =SUR Model			
	Butter	Margarine-vegetable Oil	Olive oil	Edible Oil	Butter	Margarine-vegetable oil	Olive oil	Edible Oil
Constant	-1.707**	-0.106	-0.172	-1.324*	-40.069**	4.564	24.575	32.697
	(0.738)	(0.637)	(0.670)	(0.701)	(17.472)	(4.237)	(15.149)	(25.502)
Male	-0.095	-0.031	-0.088	0.002	1.623	0.746	1.474	1.334
	(0.069)	(0.063)	(0.085)	(0.062)	(1.554)	(0.471)	(3.050)	1.210)
Married	0.115	0.133*	0.052	0.130*	1.218	0.252	-4.640	0.137
	(0.075)	(0.068)	(0.096)	(0.067)	(1.777)	(0.535)	(3.703)	(1.309)
Employed	-0.098*	0.024	-0.116*	-0.019	-0.106	-0.380	-2.311	1.025
	(0.052)	(0.048)	(0.066)	(0.048)	(1.064)	(0.333)	(2.575)	(0.855)
Compulsory	0.171**	0.044	-0.017	0.096*	2.027	-0.463	-1.591	-0.716
	(0.068)	(0.058)	(0.088)	(0.058)	(1.989)	(0.414)	(4.285)	(1.066)
Green card	-0.085	-0.092	-0.253*	-0.155**	-0.565	-0.215	-1.660	1.766
	(0.092)	(0.077)	(0.135)	(0.076)	(2.916)	(0.583)	(8.787)	(1.447)
Couple with kids	0.020	0.067	0.002	0.036	-1.290	-1.176***	2.584	-1.632**
	(0.050)	(0.046)	(0.066)	(0.046)	1.051)	(0.329)	(2.582)	(0.784)
Childless	0.135**	-0.109*	-0.033	-0.045	0.262	-0.506	2.560	-0.518
	(0.067)	(0.063)	(0.086)	(0.062)	(1.425)	(0.519)	(3.205)	(1.151)
Separate home	-0.333	-0.297	-2.081***	0.804	7.770	2.531	-5.207	7.789
	(0.727)	(0.628)	(0.650)	(0.693)	(14.640)	(3.741)	(18.071)	(24.458)
State apartment	-0.247	-0.165	-2.029***	0.852	9.067	2.112	-8.455	6.964
	(0.728)	(0.629)	(0.651)	(0.693)	(14.640)	(3.723)	(17.673)	(24.467)
Homeowner	0.026	-0.119***	-0.038	0.057	-0.164	-0.014	1.926	-0.458
	(0.048)	(0.044)	(0.062)	(0.043)	(0.999)	(0.328)	(2.284)	(0.775)
Renter	-0.061	-0.110**	-0.064	0.098**	-1.563	-0.003	1.706	-1.696*
	(0.049)	(0.044)	(0.063)	(0.043)	(1.124)	(0.332)	(2.635)	(0.873)
Urban	-0.028	0.120***	0.152***	0.128***	-4.174***	-0.754**	-1.484	-2.741***
	(0.040)	(0.037)	(0.054)	(0.036)	(0.851)	(0.326)	2.815)	(0.732)
Age	0.012***	-0.003**	0.012***	0.002*	0.224***	0.025**	-0.050	-0.055*
	(0.001)	(0.001)	(0.002)	(0.001)	(0.052)	(0.013)	(0.135)	(0.028)
Education	0.031***	-0.014***	0.044***	-0.003	0.267*	-0.021	-0.263	-0.232***
	(0.004)	(0.004)	(0.005)	(0.004)	(0.150)	(0.032)	0.474)	(0.076)
Age 0–5 present	0.001	-0.073***	-0.091**	0.016	-0.215	-0.071	0.333	-0.695
	(0.028)	(0.025)	(0.041)	(0.025)	(0.650)	(0.224)	2.150)	(0.432)
Age 6–14 present	0.013	0.051***	-0.042	0.083***	-0.108	0.171	-0.894	-1.358***
	(0.019)	(0.017)	(0.027)	(0.017)	(0.441)	(0.134)	(1.300)	(0.365)

Age 15–19 present	0.009 (0.026)	0.046** (0.024)	-0.084** (0.038)	0.072*** (0.024)	0.537 (0.573)	-0.175 (0.177)	-1.205 (1.799)	-0.792* (0.427)
Age is 20 or older	-0.017 (0.022)	0.115*** (0.020)	-0.010 (0.028)	0.143*** (0.020)	-0.596 (0.447)	-0.454* (0.233)	-2.272** (1.069)	-1.802*** (0.467)
Income earners	0.127*** (0.027)	-0.085*** (0.025)	-0.054 (0.037)	-0.010 (0.025)	1.273* (0.679)	0.342* (0.207)	-1.946 (1.489)	-0.223 (0.444)
Technology	0.047*** (0.009)	0.033*** (0.008)	0.007 (0.011)	-0.008 (0.008)	-	-	-	-
Automobile	-0.007 (0.029)	0.021 (0.027)	0.026 (0.037)	-0.074*** (0.027)	-	-	-	-
Durables	0.008 (0.013)	-0.042*** (0.012)	0.041** (0.016)	-0.063*** (0.012)	-	-	-	-
Equities	0.016 (0.015)	-0.001 (0.014)	0.009 (0.017)	-0.001 (0.014)	-	-	-	-
Total food expenditure	-	-	-	-	0.018*** (0.001)	0.005*** (0.000)	0.035*** (1.489)	0.020*** (0.001)
PDF	-	-	-	-	19.636*** (4.369)	-3.776 (2.239)	3.205 (10.761)	-20.441*** (4.504)
Log-Likelihood Value	-4,833.291	-5,800.942	-2,667.128	-5,943.333	-82,643.500			

Note: Values in parentheses are standard errors . Significance Levels: *** = 1%, ** = 5%, * = 10%.

Table 3- Marginal effects of explanatory variables for Probitand SUR models

Variables	**1st step = Probit Model**				**2st step =SUR Model**			
	Butter	**Margarin-vegetable oil**	**Olive oil**	**Edible oil**	**Butter**	**Margarine-vegetable oil**	**Olive oil**	**Edible oil**
Constant	-0.530** (0.229)	-0.040 (0.241)	-0.028 (0.110)	-0.514* (0.272)	-11.483*** (4.097)	1.566 (2.521)	1.864 (2.528)	-2.031 (17.704)
Male	-0.029 (0.021)	-0.011 (0.024)	-0.014 (0.014)	0.001 (0.024)	0.363 (0.418)	0.216 (0.268)	-0.147 (0.447)	0.743 (1.152)
Married	0.035 (0.023)	0.050* (0.025)	0.008 (0.015)	0.050* (0.026)	0.388 (0.477)	0.487* (0.288)	-0.284 0.496)	1.973 (1.235)
Employed	-0.030* (0.016)	0.009 (0.018)	-0.019* (0.011)	-0.007 (0.018)	-0.088 (0.291)	-0.086 (0.197)	-0.616 (0.429)	0.252 (0.862)
Compulsory	0.053** (0.021)	0.016 (0.022)	-0.002 (0.014)	0.037* (0.029)	0.633 (0.521)	-0.063 (0.239)	-0.216 (0.519)	1.026 (1.046)
Green card	-0.026 (0.028)	-0.035 (0.029)	-0.041* (0.022)	-0.060** (0.029)	-0.199 (0.788)	-0.355 (0.324)	-1.009 (1.135)	-1.330 (1.375)
Couple with kids	0.006	0.025	0.001	0.014	-0.322	-0.289	0.263	-0.336

	(0.015)	(0.017)	(0.010)	(0.018)	(0.284)	(0.186)	(0.340)	(0.815)
Childless	0.042**	-0.041*	-0.005	-0.017	0.152	-0.521*	0.143	-0.935
	(0.021)	(0.024)	(0.014)	(0.024)	(0.404)	(0.270)	(0.437)	(1.124)
Separate home	-0.103	-0.112***	-0.341***	0.312	1.815	0.182	-7.437	15.866
	(0.226)	(0.237)	(0.106)	(0.269)	(3.997)	(2.381)	(5.677)	17.476)
State apartment	-0.077	-0.062	-0.333***	0.331	2.206	0.390	-7.587	16.136
	(0.226)	(0.238)	(0.107)	(0.269)	(3.996)	(2.384)	(5.576)	(17.487)
Homeowner	0.008	-0.045	-0.006	0.022	-0.026	-0.348**	0.062	0.593
	(0.015)	(0.016)	(0.010)	(0.017)	(0.268)	(0.171)	(0.329)	(0.783)
Renter	-0.019	-0.041**	-0.010	0.038**	-0.444	-0.319*	-0.043	0.532
	(0.015)	(0.016)	(0.010)	(0.017)	(0.303)	(0.178)	(0.358)	(0.795)
Urban	-0.008	0.045***	0.025***	0.050***	-1.103***	0.036	0.360	0.426
	(0.012)	(0.014)	(0.009)	(0.014)	(0.242)	(0.157)	(0.458)	(0.658)
Age	0.003***	-0.001**	0.002***	0.001*	0.066***	0.000	0.036	0.011
	(0.001)	(0.001)	(0.001)	(0.001)	(0.015)	(0.006)	(0.031)	(0.028)
Education	0.009***	-0.005***	0.007***	-0.001	0.088***	-0.051***	0.120	-0.179**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.030)	(0.016)	(0.102)	(0.070)
Age 0–5 present	0.001	-0.027***	-0.015**	0.006	-0.054	-0.240**	-0.272	-0.126
	(0.008)	(0.009)	(0.006)	(0.009)	(0.177)	(0.106)	(0.318)	(0.448)
Age 6–14 present	0.004	0.019***	-0.007	0.032***	-0.020	0.218***	-0.231	0.504
	(0.006)	(0.006)	(0.004)	(0.006)	(0.120)	(0.071)	(0.186)	(0.306)
Age 15–19 present	0.002	0.017*	-0.013**	0.028***	0.145	0.062	-0.399	0.641
	(0.008)	(0.009)	(0.006)	(0.009)	(0.153)	(0.093)	(0.293)	(0.418)
Age is 20 or older	-0.005	0.043***	-0.001	0.055***	-0.166	0.145*	-0.260*	1.143***
	(0.006)	(0.007)	(0.004)	(0.008)	(0.128)	(0.079)	(0.144)	(0.357)
Income earners	0.039***	-0.031***	-0.009	-0.004	0.409**	-0.096	-0.374	-0.277
	(0.008)	(0.009)	(0.006)	(0.010)	(0.182)	(0.107)	(0.234)	(0.455)
Technology	0.014***	0.012***	0.001	-0.003	0.029***	0.095***	0.024	-0.117
	(0.002)	(0.003)	(0.001)	(0.003)	(0.010)	(0.260)	(0.039)	(0.122)
Automobile	-0.002	0.008	0.004	-0.029***	-0.004	0.062	0.087	-1.089***
	(0.009)	(0.010)	(0.006)	(0.010)	(0.018)	(0.078)	(0.125)	(0.394)
Durables	0.002	-0.016***	0.006**	-0.024***	0.005	-0.122***	0.136**	-0.923***
	(0.004)	(0.004)	(0.002)	(0.004)	(0.007)	(0.034)	(0.058)	(0.173)
Equities	0.005	-0.001	0.001	-0.001	0.010	-0.005	0.031	-0.020
	(0.004)	(0.005)	(0.002)	(0.005)	(0.009)	(0.042)	(0.059)	(0.215)
Total food expenditure	-	-	-	-	0.004***	0.002***	0.003***	0.010***
					(0.000)	(0.000)	(0.000)	(0.000)

Note: Values in parentheses are standard errors. Significance Levels: *** = 1%, ** = 5%, * = 1

Conclusions and Recommendations: The economic and political stability in the last ten years in Turkey has brought some inevitable changes in consumer food patterns. In this context, we determined which factors affect the household spending levels on oil and fat andon what level they play roles in corresponding levels using TUIK 2012 household budget surveys for the study. Factors affecting spending levels on different types of oils and fats were identified and analysed using a two-step SUR equation system. In addition, the superiority of the SUR equation system over the OLS method was proven by conducting the Lagrange multiplier test statistic. Additionally; the magnitude of the cross correlation coefficient and their corresponding levels between butter, margarine-vegetable oil, olive oil and other types of edible oils was also estimated.

While the socio-demographic and economic factors of household heads and households generally played key role in determining the expenditure probabilities of the different types of oils and fats consumed by households, less socio-demographic factors were found to be deterministic in spending levels. In summary, as the household income increases, oils and fats expenses also increase, indicating that butter, olive oil and particularly edible animal fats will increase among the oils and fats expenses, which increases along with the income growth. Therefore, as the positive effects of olive oil consumption on human health are more commonly emphasized within the society along with revenue growth, olive oil consumption probability and expenditure levels is expected to be increasing gradually. Although it is not directly conclusive from the results of the analysis, it is however inevitable that household will likely spend more on olive oils as the pressure on olive oil producer companies to reduce their market prices works effectively. Also, considering that households with relatively lower income levels with lower olive oil expenditure probabilities, government could provide these families with in-kind food aid in and include especially olive oil within this program, like the WIC (Women, Infants and Children), anin-kind food aid program organized in the United States of America.

It is important for future studies to construct a multivariate Heckman sample selection models for different types of edible oils and fats towards solving both steps within the same system instead of using a two-step model. This approach will provide cross correlation coefficients among all expenditure probabilities and expenditure levels.

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