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ANALYSIS OF FACTORS AFFECTING RED MEAT AND CHICKEN MEAT CONSUMPTION IN TURKEY USING AN IDEAL DEMAND SYSTEM MODEL

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In this study, in consultation with 2690 households from the provincial centers of Turkey, socio-demographic and economic factors affecting red and chicken meat, and egg expenditures were determined. Although there are various demand models that can be used for this purpose, the Ideal Demand System (LA/AIDS) that is widely used in the literature, was utilized for the study analysis. In this model, it was determined that the gender, education level, income and birthplace of consumers were significant in determining veal and beef demand. No variable apart from being born in an urban area was adequately effective in determining the consumption of mutton in terms of socio-demographic variables. Chicken meat had the highest expenditure elasticity (0.9394), followed by veal and beef (0.8691), eggs (0.8528) and mutton (0.7415). When examining the cross-price elasticities for veal and beef, goat meat was estimated to have a negative value (complementary goods) and other product groups were found to have a positive value (competing goods).
Keywords: Consumption expenditure, Red meat, Chicken meat, Almost Ideal Demand System (LA / AIDS), Probit model.

INTRODUCTION

The ultimate aim of economic policies is to increase the economic welfare of all individuals and classes in society. The most important way to analyze the changes occurring in the welfare levels of individuals and social classes when the economy grows is to monitor the change in the distribution of income and consumption. Although increases in the rate of growth and per capita income provide a general sense of the changes in welfare, data about the distribution of income, consumption and poverty are the main indicators of the distribution of welfare increases that occur during the growth process for social classes and individuals (Caliskan, 2010). According to the Turkish Statistical Institute's different year and different survey data, Turkey achieved a growth rate of 6.2% in 2002 but this rate declined to 2.9% in 2014. The average growth rate in Turkey from 2002 to 2014 was 4.93%. Economic growth simultaneously led to an increase in per capita income as well. Per capita income has increased at a fast rate, as it was $3.492 in 2002 and $10,444 in 2008. After 2008, there was no significant increase in per capita income. In 2014, per capita income was $10,404 in Turkey (Turkish Statistical Institute, 2015). Considering the developments in per capita income, it could be argued that Turkey has fallen into a "middle-income trap" in the last 7 years. These changes in growth rate and income led to significant changes in consumers' consumption structure and consumption amounts. The per capita consumption of animal products is considered a significant criterion for comparing countries' levels of development (Sariozkan *et al.,* 2007). Red meat, that plays an important role in providing animal-originated nutrients in terms of nutrition, is an indispensable food product for human health as well as a rich source of protein. While red meat consumption per capita in Turkey (veal, beef, sheep and goats) was 13.6 kg in 2014, it was 18 kg in the EU, 37 kg in the US, 41 kg in Brazil and 15 kg in Russia Beef and veal consumption in Turkey was 8.7 kg in 2010. However, it increased to 11.8 kg (an increase of 36%) by 2014. Sheep and goat meat consumption is between 1.5 and 2 kg, although it varies by year (Gul and Uzun, 2014).

Chicken meat is one of the most important sources of animal protein that needs to be consumed for physical and mental development for a healthy and balanced diet (Inci *et al.*, 2014). According to data from the World Agricultural Outlook 2015 published by the OECD-FAO, average chicken meat is consumed per person annually as follows: 43.2 kg in the US, 18.1 kg in the EU, 30.1 kg in Canada, 10.1 kg in China and 22.9 kg in Russia. In Turkey, chicken meat consumption (19.3 kg) is more than the average consumption in the EU (OECD, 2015). Annual average chicken egg is consumed per person annually as follows: 352 pieces in the Mexico, 343 pieces in the Malaysia, 329 pieces in the Japan, 285 pieces in the Russia. In Turkey egg consumption 197 pieces and Per capita Egg Consumption is the nineteenth rank in the world (YUMBIR, 2016).

The estimation of demand systems for food has gained considerable research interest because of its elasticities and its roles in predicting marketing decisions and policy. For example, different models can use these elasticities in order model. In the calculation of agricultural subsidies, the impacts

of regional trade agreements on the policy changes on the local consumer market, determination of import customs tariffs etc. Producer organizations, government and marketers can use this information to make informed strategic decisions. In this study, the annual consumption demand for red meat for households in Turkey is estimate by considering socio-demographic characteristics as well as economic characteristics, such as income and the price of meat. Although there are numerous demand models that could be used for this purpose (Jensen and Manrique, 1998; Maynard and Liu, 1999; Rougier, 1997), the Almost Ideal Demand System (LA/AIDS) used in linear form and widely used in the literature is a flexible function (Deaton and Muellbauer, 1980).

MATERIALS AND METHODS

The main material of the study was provided by survey data obtained through one-on-one interview with the consumers from 12 provincial centers representing each region in Nomenclature of Territorial Units for Statistics (NUTS) Level 1 areas in Turkey. The 2014 population data from the Turkey Statistical Institute form a basis for the analysis of the provinces. The province with the highest number of individuals age 15 and over in NUTS Level 1 regions was included in the study. The proportional sample size formula was used to determine the number of consumers to be interviewed (Newbold, 1995).

$$n = \frac{Np(1-p)}{(N-1)\sigma^2_{\hat{p}_x} + p(1-p)}$$

In the above formula, n = sample volume; N = the number of population in the provinces within the scope of the study $\sigma^2_{\hat{p}_x}$ = Variance. Because it was desired to reach the maximum sample size, the value of p = 0.50 was adopted, which would yield the greatest value in multiplying with p(1-p) and would ensure as large a sample size as possible. Turkey's total population aged 15 and over was 68,833,474 in 2014 (Turkish Statistical Institute, 2015). The total population aged 15 and over among the 12 provinces in the study area is 31,270,936; this represents 45% of the total country's population. The sample size was found to be 2690 for the 99% confidence interval, with a 2.5 margin of error. Previously determined numbers of questionnaires were proportionately allocated to the provinces. Accordingly, the number of surveys conducted in these provinces are as follows: 1065 in Istanbul, 376 in Ankara, 306 in Izmir, 203 in Bursa, 161 in Antalya, 125 in Gaziantep, 94 in Kayseri, 92 in Samsun, 90 in Balikesir, 69 in Van, 56 in Trabzon and 53 in Erzurum. Survey studies carried out in a simultaneous manner in these provinces took place in provincial centers between October and December 2015.

Meat and egg products consumed annually per person were calculated through a household equivalence measure (OECD "Equivalent Scale") of the five different income groups. In this approach, it is accepted that a value of 1 is given for the first member of the household, a value of 0.7 is given for each additional adult, and a value of 0.5 is given for each child. This scale is also called the Oxford Scale, and OECD (1982) stated that this has the ability to be used in countries whose equivalent scales are not developed. Therefore, it is called the old OECD scale (Atkinson *et al.,* 1994).

Almost Ideal Demand System was used to determine each household's annual demand for red meat, chicken meat and egg in Turkey. The fact that the Almost Ideal Demand System (AIDS) is more widespread than other full demand system models is due to the advantages provided by this model in terms of theory and practice. The spending function that AIDS is derived from is flexible and thereby ensures a reasonable approach to a demand function that is virtually unknown. The advantages of the AIDS model are indicated below by Deaton and Muellbauer (1992) and Alston and Chalfant (1993):

a) It can demonstrate the aggregated consumer behaviors on a macro or micro level by means of its flexible functional structure.
b) It can easily be used in welfare analysis because it is based on the well-defined cost function.
c) It enables the inclusion of constraints in the model before easily testing or estimating these constraints because its homogeneity and symmetry constraints are based on estimated coefficients.
d) The estimation of the AIDS model and model parameter review are relatively easier compared to those of other models.

The stochastic version of the demand function for AIDS budget share is expressed as follows:

$$w_i = \alpha_0 + \sum_{i=1}^{n} \gamma_{ij}\ log\ p_j + \beta_i \log\left(\frac{X}{P^*}\right) + e_i \qquad (1)$$

Here, for w_i, "i" is the share of meat subgroup in expenditures that have been included in the analysis; for p_j, "j" is the product price; "x" is the total meat expenditure per household; and e_i α, β and γ represent the estimated model parameters. P^* is the translog price index and is defined as follows:

$$\log P = \alpha_0 + \sum_{j=1}^{n} \alpha_j \log p_j + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij}\ log\ p_i \qquad (2)$$

The non-linear translog price index function expressed in equation two has been used extensively in applications of the AIDS model (Deaton and Muellbauer, 1980; Moschini and Meilke, 1989; Alston *et al.,* 1994; Rougier, 1997; Jensen and Manrique, 1998; Maynard and Liu, 1999). Theoretically, the Stone Price Index as defined by (Stone, 1954) has been used in this study instead of the Translog Price Index because the Translog Price Index creates difficulties in estimating the price index as defined above (Green and Alston, 1990):

$$\log P^* = \sum_{i=1}^{n} w_i \log p_i \quad (3)$$

In this study, the effects of socio-demographic variables have also been examined. Socio-demographic variables have been included in the model by (Pollak and Wales, 1981) as described below:

$$\alpha_i = \alpha_i^* \sum_{j=1}^{N} \lambda_{ij} D_j \quad (4)$$

Here, D demographic variables express the age of the head of household, education level, and the number of individuals in the household. λ is the estimation coefficient of socio-demographic variables.

The AIDS model obtained using the price index of Stone has been defined as "Almost Ideal Demand System in Linear Format (LA / AIDS)", and a LA/AIDS model that also involves the socio-demographic variables has been expressed as follows:

$$w_i = \alpha_i^* + \sum_{i=1}^{n} \gamma_{ij} \, log \, p_j + \beta_i \log\left(\frac{Xh}{P^*}\right) + \sum_{j=1}^{N} \lambda_{ij} D_j + e_i \quad (5)$$

A full-demand system should ensure the collection, symmetry, homogeneity and negativity constraints regarding model parameters. Therefore, constraints defined as follows have been expressed within the model:

$$\sum_i \alpha_i = 1, \quad \sum_i \beta_i = 0, \quad \sum_i \gamma_{ij}^* = 0 \quad (Collection\ constraint) \quad (6)$$

$$Total\ of\ budget\ shares\ equals\ to \sum w_i = 1 \quad (7)$$

$$\sum_i \gamma_{ij}^* = 0 \quad (Homogeneity\ constraint) \quad (8)$$

$$\gamma_{ij} = \gamma_{ji}, \quad (Symmetry\ constraint) \quad (9)$$

$$\gamma_{ii} \leq 0 \ (for\ all\ "i"\ Negagativity\ constraint) \quad (10)$$

The elasticity formula regarding the LA / AIDS model involve Marshall price elasticity; they have been used in a study by (Green and Alston, 1990). Own price and cross-price elasticity regarding expenditures are calculated using the following formula:

Spending elasticity: $e_i = 1 + \left(\frac{\beta_i}{W_i}\right)$ (11)

Own-Price Elasticity (Marshall Elasticity):

$$e_{ii} = -1 + \left(\frac{\gamma_{ii}}{W_i}\right) - \beta_i \quad (12)$$

Cross-Price Elasticity (Marshall Elasticity):

$$e_{ij} = \left(\frac{\gamma_{ij}}{W_i}\right) - \beta_i \left(\frac{W_j}{W_i}\right) - \delta_{ij} \quad (13)$$

δ_{ij} = Koroneker Delta

i = j ise $\delta_{ij} = 1$

i ≠ j ise $\delta_{ij} = 0$ 'dır (Mutlu, 2007; Wildner and Cramon-Taubadel, 2000)

Hicks' price elasticity

$$\eta_{ii} = -1 + \left(\frac{\gamma_{ii}}{W_i}\right) - w_i \quad (14)$$

Hicks' cross-price elasticity

$$\eta_{ji} = \left(\frac{\gamma_{ii}}{W_i}\right) + w_j \quad (15)$$

If the demographic variables used in the model have a logarithmic structure, it is calculated by the $\frac{\lambda_i}{W_i}$ formula. If the demographic variables used in the models have a constant structure, it is calculated by the $\frac{\lambda_i S}{W_i}$ formula (Tansel, 1986). Here, the p value indicates the mean value of the demographic variables used (Yilmaz, 2016).

Due to the use of income elasticity rather than expenditure elasticity in analysis for food policies in particular, income elasticity regarding each livestock product category has been determined by using the expenditure elasticities of animal products obtained from the LA/AIDS model and the total income elasticity of livestock products obtained from the following working-lesser regression model (Armagan and Akbay, 2008).

$W_i = \delta_0 + \delta_1 \log (INCOME_i) + \varepsilon_i$ (16)

Here, W_i is the proportion of total animal products in the total household income, INCOME is household income and δ_0 and δ_1 represent the estimated coefficients. The total income elasticity of animal products (η) is obtained from the following equation.

$\eta = 1 + \delta_1 / W_i$ (17)

In the absence of income elasticity of each of the animal product categories, expenditure elasticities derived from equation 11 (η_l) are obtained by multiplying the total income elasticity of animal products obtained above (Akbay, 2005; Armagan and Akbay, 2008).

$\eta_i = e_i * \eta$ (18)

Because collection and negativity constraints are directly provided by the model in full-demand system models, testing is not conducted for this constraint. However, it is necessary to test the homogeneity and symmetry constraints. Because it is necessary to estimate the parameters of full-demand system equalities in constrained and unconstrained manners, a likelihood ratio test has been used in this study (Aktas and Hatirli, 2010)

The situation in which one or more products mentioned in the questionnaire are not consumed in practical demand studies is common. In these cases, the removal of these observations from the data set negatively affects the reliability of the analysed results by causing them to be biased. The Two-step Heckman Approach is usually applied to eliminate this problem (Heien and Wesseils, 1990; Hatirli *et al.*, 2007). In the first stage of this method, consumer preferences obtained with the questionnaire through the probit method and the

possibilities of product consumption or product purchase are determined. This decision-making process constitutes the distribution expressed as follows: if a household consumes the product Z_i= 1 and does not consume it, then Z_i=0. Independent variables include variables such as product price, total expenditure and demographic features.

In the second stage, inverse Mills ratio (λ_I) values are calculated with the help of a standard normal cumulative distribution function (Φ), and the standard normal probability distribution functions (φ) are estimated and obtained for each product by means of the probit model (Heien and Wesseils, 1990; Green and Alston, 1990; Greene, 2008). The inverse Mills ratio is also calculated to eliminate the biased selection of observations. Inverse Mills ratios have been included in the demand model as tool variables for each product in the model; they are calculated with the help of equity number 14 using the results obtained from the probit regression model (Aktas and Hatirli, 2010) Therefore, inclusion of a household that never consumes these products within sub-product groups in addition to observations regarding consumers of meat and meat products is ensured as well. By including the inverse Mills ratio in the AIDS model, unbiased results from the models are ensured.

$$Z_i = 1 \rightarrow \lambda_i = \frac{\Phi(h_i)}{\phi(h_i)} \qquad Z_i = 0 \rightarrow \lambda_i = \frac{\Phi(h_i)}{1-\phi(h_i)} \qquad (19)$$

Equity number 5 that was created according to the research objective has been estimated by the Seemingly Unrelated Regression (SUR) method. According to Zellner (1962), it has been concluded that the use of the SUR method in solving the system equities would be more appropriate. Each of the equities is estimated individually in the SUR estimation method. The obtained residuals are used in estimating the variance-covariance matrix method in a prediction carried out with the generalized least squares method. The most important reason for using this estimation method is that the product categories whose livestock product demands are examined correlate with each other and that each equation is associated with error terms within other equations (Armagan and Akbay, 2008). In addition, it is also necessary to remove one of the equations from the model when estimating the system equations due to the use of the SUR model. For this purpose, the fisheries consumption category was removed when estimating the system equation.

The results were obtained using the LA/AIDS model Eviews 7.2 software package (McKenzie and Takaoka, 2012), which was created according to the scope of this research.

RESULTS AND DISCUSSION

Meat and egg products consumed annually per person were calculated through a household equivalence measure of the five different income groups in the 2690 questionnaires conducted in urban areas throughout Turkey and are shown in Table 1. The average consumption expenditure of the households surveyed calculated to be 1164.69 TL/Mount "420.47 $/Mount" (Average rate in 2015 is 1 dollar 2.77 TL). It was found that expenditures for meat type's increase in direct proportion to income groups when the results are evaluated overall. Nonetheless, it is clear that there is not a significant difference between expenditures for egg production consumption in terms of income groups.

The LA/AIDS model has been used for the calculation of coefficients and elasticities regarding meat and egg products as noted in the methodology as well. The LA / AIDS model and variables and their definitions used in the associated two-step Heckman model stated in Table 2.

***Estimation of LA/AIDS model*:** In accordance with the data obtained, it was intended to generate a subgroup demand model for meat types and egg. In this regard, the ratio of the total meat and egg expenditure of each product group should be interpreted as dependent variables. The average price range of meat and egg products and the share of meat and eggs among household expenses are given in Table 3. Seventeen of the 2690 households included in the study stated that they do not consume meat or eggs at all. These households were

Table 1. Annual consumption of meat (Kg/year) and eggs (Pcs/year) per capita.

	The first group of 20%	The second group of 20%	The third group of 20%	The fourth group of 20%	The fifth group of 20%	General
Veal and Beef	7.5409	9.7220	12.1959	13.7053	18.6431	12.36144
	(9.1010)	(9.7350)	(11.5119)	(11.5926)	(16.7600)	(12.61629)
Mutton	3.3309	3.7594	4.9825	5.7000	7.9598	5.146504
	(5.9537)	(6.1320)	(7.3848)	(7.9868)	(11.7972)	(8.288867)
Goat meat	5.191406	3.113081	8.228173	7.906167	5.840329	6.0558
	(25.63239)	(23.50015)	(43.13024)	(38.21906)	(28.71517)	(32.7548)
Chicken (food)	13.6002	15.9511	16.6720	15.2201	15.6106	15.41078
	(10.9114)	(14.7935)	(15.1012)	(13.3691)	(14.3691)	(13.82015)
Egg	223.2374	259.5106	247.4154	256.3039	275.9301	252.4795
	(182.9059)	(213.3903)	(198.9683)	(230.1202)	(227.0059)	(211.7682)

*: Values in parentheses indicate the standard error.

excluded from the scope of the household analysis, and the demand model was generated encompassing 2673 households.

Table 2. Variables and description of variables.

W_1	Veal-beef consumption share in total meat expenditure (%)
W_2	Mutton consumption share in total meat expenditure (%)
W_3	Chicken meat consumption share in total meat expenditure (%)
W_4	Egg consumption share in total meat expenditure (%)
W_5	Goat meat consumption share in total meat expenditure (%)
P_1	Price of Veal and Beef (Kg / TL)
P_2	Price of Mutton (Kg / TL)
P_3	Price of Chicken meat (Kg / TL)
P_4	Price of an egg (Pcs/ TL)
P_5	Price of Goat meat(Kg / TL)
TGH	Total household food expenditure (Kg / TL)
HAR	Total meat and egg consumption expenditure (Kg-Unit / TL)
HBE	Household equivalent measure (person)
HRC	The gender of the head of household; 1 is female, and 0 is male
YAS	The age of household head (years)
KENT	Birthplace of the head of household; 1 is urban, and 0 is rural area
MS	1 is that the head of household has fixed income (civil servants, worker, pensioners); 0 is the alternative
D1_ilk *	Education of the head of household; 1 is primary education (primary school and secondary school) and below, and 0 is the other
D2_lis to	1 is that the education level of the of head household is high school or equivalent, and 0 is the other
D3_ uni	1 is that the education level of the head of household is university and higher levels, and 0 is the other
Lambda	Inverse mills ratio (calculated through the probit model)

*Reference category removed from the model to prevent multiple correlations. (If D2_lise and D3_ uni dummy variables are in the value of zero, educational level of household head will be expressed at the level expressed in D1_ilk dummy variable.)

Table 3. Average prices of products addressed and share of these in the total meat and egg expenses.

	Average prices	Breakdown among total meat and egg expenses (%)
Veal and beef (TL/kg)	36.325	0.4624
Mutton (TL/kg)	32.632	0.1574
Goat meat (TL/kg)	32.414	0.1986
Chicken meat (TL/kg)	9.5505	0.1471
Egg (TL/QTY)	0.3998	0.0346

Among the data obtained through the practical demand model, it was evident that instead of favouring all meat and egg products, some of the households prefer only certain meat and egg products depending on the nature of their consumption tendencies or habits, and they direct their spending accordingly. Among these households, 10.86% stated that they do not consume any veal or chicken meat at all, 85.17% of those who participated in the survey were identified as consuming goat meat, 49.81% were determined to not consume mutton, and 2.38% were revealed as not consuming egg products. It is obvious that excluding nonconsumers from the data set of survey observations would result in deviations of the results, which will affect the reliability of the results in a negative way. To eliminate this problem, the results of the probit method, which is known as the first step of Heckman's two-staged approach, are given in Table 4.

Probit models were interpreted as statistically significant for all product groups. Although the interpretation of estimated parameters obtained through the Probit model is normally thought to be necessary, it should be noted that the main point of the LA/AIDS model is to obtain inverse Mills ratios using Probit estimation results. As a result, only coefficients and the level of significance related to the model parameters were given in this section.

Two different variations of the SUR model were estimated for LA/AIDS. The first model is classified as homogeneous but non-symmetric, while the second one had homogeneity and symmetry restrictions. The reason for using two models is to determine which of these models is the most effective. Having the least consumption share, the goat meat parameter was excluded from the SUR model and the calculations that were used to ensure homogeneity of the demand model. Coefficients of goat meat were calculated using parameters of four products that were estimated through the SUR model.

The coefficients estimated in the first and second LA/AIDS models and the parameters of standard deviation are given in Table 5 and Table 6. As can be seen in these tables, the R^2 values of both equations appear to be at quite good levels. Although the chicken meat value appears to be a bit small, these values are interpreted as normal in studies and system equations where section data are used. In fact, the system R^2 value was estimated to be 0.8141, which is considered quite high. Alternatively, when the R^2 value of the second model estimation was investigated, it appeared to be very similar to that of the first model. The system R^2 value was estimated to be 0.8145 for the second model. The majority of parameters estimated through the symmetry-restricted model were interpreted as statistically significant compared to the parameters estimated with the non-symmetric constraint model. Therefore, evaluations are carried out through the model with symmetry and homogeneity restrictions. The fact that the parameters of the symmetry-constrained model are found to be statistically significant highlights the fact that meat and egg demand is susceptible to changes that may arise in the demand system.

Table 4. Estimation of Probit model parameters in the first stage of Heckman's model

	Veal and beef	Mutton	Goat meat	Chicken meat	Egg
Fixed	-0.2302	-0.92579*	-0.7098**	2.4565*	2.0420*
TGH	0.1669*	0.0403	-0.0942***	-0.1950**	-0.1783***
HRC	0.0439	-0.2665*	-0.1618**	-0.1722*	-0.0983
HBE	0.0226	0.1215*	0.1196*	0.2495*	0.2249*
KENT	0.2019*	0.0511	-0.1229***	0.0848	-0.1487
YAS	0.0000	0.0051**	-0.0012	-0.0093*	0.0119**
MES	-0.0565	0.0878	0.2223*	0.0213	0.2459***
D3_LISE	0.1522***	0.1378***	-0.2523*	-0.0708	0.4645**
D4_UNI	0.4024*	0.2521*	0.0977	-0.1414	0.3024***

*, ** and ***: Significant at P=0.01, 0,05 and 0,10 levels.

Table 5. LA/AIDS model estimation results with homogeneity restrictions.

	Veal			Mutton			Goat meat
	Coefficient	**Std dev**	**Prob.**	**Coefficient**	**Std dev**	**Prob.**	**Coefficient**
C	**0.3633**	0.0368	0.0000	**0.1883**	0.0296	0.0000	-10.680
P_1	**0.1459**	0.0026	0.0000	**-0.0397**	0.0019	0.0000	-0.0061
P_2	**-0.0484**	0.0017	0.0000	**0.0955**	0.0012	0.0000	-0.0027
P_3	**-0.0507**	0.0039	0.0000	**-0.0113**	0.0028	0.0000	-0.0021
P_4	**-0.0182**	0.0076	0.0170	0.0056	0.0054	0.2988	-0.0012
P_5	**-0.0339**	0.0023	0.0000	**-0.0087**	0.0016	0.0000	0.0687
HAR	**-0.0565**	0.0052	0.0000	-0.0406	0.0037	0.0000	-0.0121
HBE	0.0003	0.0029	0.9269	0.0017	0.0021	0.4200	0.0107
HRC	**-0.0120**	0.0059	0.0414	-0.0003	0.0042	0.9400	-0.0032
YAS	**0.0006**	0.0002	0.0090	0.0001	0.0002	0.6886	0.0004
KENT	-0.0172	0.0070	0.0141	-0.0001	0.0054	0.9828	0.0070
MS	0.0080	0.0067	0.2334	-0.0078	0.0048	0.1017	0.0054
D2_lise	0.0057	0.0094	0.5413	**0.0207**	0.0071	0.0035	0.0233
D3_uni	0.0091	0.0128	0.4776	**0.0291**	0.0105	0.0054	0.0266
Lamda	**-0.3534**	0.0729	0.0000	**0.1919**	0.0635	0.0025	
R square	0.6669			0.7264			
	Chicken meat				**Egg**		
	Coefficient	**Std dev**	**Prob.**	**Coefficient**	**Std dev**	**Prob.**	
C	**0.2580**	0.0208	0.0000	**0.2584**	0.0190	0.0000	
P_1	**-0.0579**	0.0021	0.0000	**-0.0422**	0.0017	0.0000	
P_2	**-0.0234**	0.0013	0.0000	**-0.0210**	0.0011	0.0000	
P_3	**0.1106**	0.0032	0.0000	**-0.0465**	0.0025	0.0000	
P_4	**-0.0316**	0.0062	0.0000	**0.0454**	0.0049	0.0000	
P_5	**-0.0140**	0.0019	0.0000	**-0.0122**	0.0015	0.0000	
HAR	**-0.0144**	0.0042	0.0007	**0.1236**	0.0033	0.0000	
HBE	0.0003	0.0032	0.9158	**-0.0130**	0.0023	0.0000	
HRC	0.0041	0.0050	0.4159	**0.0114**	0.0037	0.0024	
YAS	**-0.0004**	0.0002	0.0837	**-0.0007**	0.0002	0.0000	
KENT	0.0016	0.0046	0.7353	**0.0088**	0.0037	0.0175	
MS	0.0014	0.0054	0.7976	-0.0069	0.0046	0.1314	
D2_lise	**-0.0258**	0.0067	0.0001	**-0.0239**	0.0058	0.0000	
D3_uni	**-0.0366**	0.0065	0.0000	**-0.0282**	0.0050	0.0000	
Lamda	-0.0369	0.0354	0.2972	**-0.3404**	0.0746	0.0000	
R square	0.4893			0.5737		System R square 0.8141	

[1]Implied estimates computed using the homogeneity restriction. [2]Data given in bold are considered statistically significant. Log likelihood Function = 11305.71

Table 6. Estimations of the LA/AIDS model with homogeneity and symmetry restrictions.

	Veal			Mutton			Goat meat
	Coefficient	**Std dev**	**Prob.**	**Coefficient**	**Std dev**	**Prob.**	**Coefficient**
C	**0.57174**	0.04089	0.0000	**0.26310**	0.02830	0.0000	-14.0950
P_1	**0.14390**	0.00263	0.0000	**-0.04433**	0.00124	0.0000	-0.0034
P_2	**-0.04433**	0.00124	0.0000	**0.09606**	0.00118	0.0000	-0.0112
P_3	**-0.05548**	0.00187	0.0000	**-0.02057**	0.00120	0.0000	0.0108
P_4	**-0.04072**	0.00164	0.0000	**-0.01995**	0.00103	0.0000	0.0614
P_5	**-0.03372**	0.00229	0.0000	**-0.00781**	0.00164	0.0000	0.0689
HAR	**-0.06051**	0.00518	0.0000	**-0.04069**	0.00364	0.0000	-0.0115
HBE	-0.00250	0.00292	0.3919	0.00173	0.00209	0.4071	0.0320
HRC	**-0.01912**	0.00593	0.0013	-0.00287	0.00425	0.5005	-0.0065
YAS	0.00036	0.00023	0.1189	0.00002	0.00016	0.9155	0.0006
KENT	**-0.05271**	0.00778	0.0000	**-0.01111**	0.00556	0.0462	0.0519
MS	**0.01722**	0.00673	0.0105	-0.00371	0.00481	0.4416	0.0029
D2_lise	**-0.03485**	0.01012	0.0006	0.00846	0.00724	0.2428	0.0869
D3_uni	**-0.07938**	0.01521	0.0000	0.00161	0.01087	0.8823	0.1427
Lamda	**-0.98334**	0.09358	0.0000	-0.03462	0.06664	0.6034	
R square		0.6705			0.7228		
	Chicken meat			**Egg**			
	Coefficient	**Std dev**	**Prob.**	**Coefficient**	**Std dev**	**Prob.**	
C	**0.25819**	0.02011	0.0000	**0.31645**	0.023005	0.0000	
P_1	**-0.05548**	0.00187	0.0000	**-0.04072**	0.001639	0.0000	
P_2	**-0.02057**	0.00121	0.0000	**-0.01995**	0.001035	0.0000	
P_3	**0.11023**	0.00317	0.0000	**-0.04503**	0.002317	0.0000	
P_4	**-0.04503**	0.00232	0.0000	**0.04435**	0.004863	0.0000	
P_5	**-0.01472**	0.00186	0.0000	**-0.01263**	0.001466	0.0000	
HAR	**-0.01203**	0.00419	0.0041	**0.12477**	0.003319	0.0000	
HBE	**-0.00957**	0.00433	0.0273	**-0.02165**	0.002863	0.0000	
HRC	**0.01311**	0.00552	0.0175	**0.01537**	0.003814	0.0001	
YAS	0.00012	0.00026	0.6477	**-0.00109**	0.000184	0.0000	
KENT	-0.00231	0.00478	0.6283	**0.01419**	0.003880	0.0003	
MS	0.00098	0.00537	0.8548	**-0.01735**	0.005013	0.0005	
D2_lise	**-0.02083**	0.00683	0.0023	**-0.03968**	0.006523	0.0000	
D3_uni	**-0.02692**	0.00707	0.0001	**-0.03799**	0.005312	0.0000	
Lamda	**-0.19181**	0.05736	0.0008	**-0.79003**	0.116701	0.0000	
R square	0.4889			0.5757		**System R square**	0.6980

[1]Implied estimates computed using the homogeneity restriction. [2]Data given in bold are considered statistically significant. Log likelihood Function = 11224.25

In the second model, it was intended to determine the effects of socio-demographic variables on meat and egg product demand through different factors. It was determined that the effect of demographic variables on the products studied was quite high. Among the socio-demographic variables included in the study, all variables of socio-demographic factors affecting meat and egg demand, except the equivalent criteria of age and household, were found to be significant. When mutton consumption was evaluated, none of the variables except being born in cities was found to be significant enough. Among the factors affecting chicken meat consumption, the equivalent criteria of gender and socio-demographic characteristics of the household and being either a high school or a university graduate were found to be meaningful in their respective order. Egg consumption was observed as having the most meaningful parameters compared to other products, while it was equally meaningful in terms of its socio-demographic characteristics.

Although it is evident that the household equivalent criterion refers to the number of family members, it was only found to be meaningful in terms of chicken and meat products. In short, it was identified that as the number of family members increases, the share of these in the expenditure of chicken meat and egg products decreases (negative). When the degree of education was investigated, it was revealed that being a high school or university graduate resulted in a negative tendency in terms of chicken and egg consumption. A negative statistical correlation was found between the age of

Table 7. Marshallian price elasticity.

	Veal and Beef	Mutton	Chicken meat	Egg	Goat meat
Veal and Beef	**-0.6283**	-1.1621	-1.2514	-1.2087	-0.9433
Mutton	-1.0753	**-0.3490**	-1.0940	-1.2691	-1.2716
Chicken meat	-1.0940	-1.0793	**-0.4328**	-1.4744	-0.6203
Egg	-1.2395	-1.0887	-1.2179	**-0.8233**	0.8231
Goat meat	-1.1653	-1.0407	-1.0720	-1.1152	**1.0030**
Expenditure	0.8691	0.7415	0.9394	0.8528	0.6663
Income*	0.4404	0.3757	0.4760	0.4321	0.3376
SHARE	**0.4624**	**0.1574**	**0.1986**	**0.1471**	**0.0346**

* Estimated through equation 17 given in the methods section.

Table 8. Hicks price elasticity.

	Veal and Beef	Mutton	Chicken meat	Egg	Goat meat
Veal and Beef	-1.1511	0.1807	0.1829	0.1856	0.3648
Mutton	0.0615	-0.5471	0.0538	0.0218	-0.1667
Chicken meat	0.0786	0.0679	-0.6434	-0.1075	0.5120
Egg	0.0591	0.0204	-0.0797	-0.8457	1.9211
Goat meat	-0.0384	-0.0150	-0.0395	-0.0513	0.9569

Table 9. Elasticity of demographic variables.

	Veal and Beef	Mutton	Chicken meat	Egg	Goat meat
HBE	**-0.0150**	0.0305	**-0.1337**	**-0.4081**	2.5650
HRC	**0.9587**	-0.0182	**0.0660**	**0.1045**	-0.1880
YAS	**0.0316**	0.0045	0.0243	**-0.2989**	0.6896
KENT	**0.8860**	**-0.0706**	-0.0117	**0.0964**	1.5019
MS	**1.0373**	-0.0236	0.0049	**-0.1179**	0.0824
D2_lise	0.9246	0.0537	**-0.1049**	**-0.2697**	2.5126
D3_uni	**0.8283**	0.0102	**-0.1356**	**-0.2582**	4.1255

Data given in bold are considered statistically significant.

the head of household and egg demand. The lambda variable, which was included in the model as an inverse Mills variable, was only found to be insignificant for mutton consumption in terms of the products studied. The fact that the inverse Mills ratios were found to be meaningful for other products indicates the need to include this variable in the model.

***Income and price of products and cross elasticities*:** Price and expenditure elasticities were interpreted to evaluate the susceptibility of households against income and prices. The 11th, 12th, 13th, 14th and 15th equations given in the methods section of this article were used, and the results estimated are given in Table 7 and Table 8. The own price elasticities for all groups were found to be statistically significant. Expenditure elasticity was interpreted as significant in terms of the consumption of meat and eggs. In terms of elasticities of demographic variables, the levels of statistical significance are given in Table 9.

Chicken meat had the highest expenditure elasticity, followed by veal and beef (0.8692) and then egg (0.8528) and mutton (0.7415) consumption. If expenditure elasticity is greater than one, these consumer products are considered to be within the category of luxury goods, while they are considered necessity goods if the value is less than one. While luxury goods are products that are not essential but are highly desired, the demand for necessity goods does not decrease although the price increases.

In this study, the lowest expenditure elasticity was estimated for goat meat. For all products except goat meat expenditure, the elasticities were estimated to be close to 1. However, it would not necessarily be true to state that the animal products are within the category of essential goods after considering these results. First, in order to determine whether the investigated products can be considered luxury goods or essential goods, it is necessary to identify income elasticity for each category. In this regard, income elasticities were calculated. The income elasticity of meat and egg products was determined to be 0.5067 through the Working-Leser Model.

$$W_i = 0.2972 - \underset{(34.2231)}{0.0295}\log(INCOME_i) \qquad \underset{(-27.4221)}{\eta = 0.5067}$$

The above equations given in brackets are t statistic values and are identified as statistically significant for both coefficients. Income elasticity was estimated by multiplying the expenditure elasticity given in Table 7 with income

elasticity of animal products. As seen in the table, the income elasticity of all meat and egg products was estimated to be less than 0.5, which highlights that these are products with less elastic demand (necessity goods).

As seen in Table 7, the price elasticity of all products except goat meat was estimated to be less than 1, which means that these products have less elastic demand. In the category of goat meat, price elasticity was estimated to be positive, which violates the law of demand. The price of goat meat raises the suspicion of it being a Veblen good. Veblen goods are considered to be a symbol of a buyer's high social status and are also types of products for which demand is proportional to its high price. To evaluate this query, the unrestricted homogeneity of the LA/AIDS model was analysed again, and price elasticity was estimated to have a positive value (1.008). As can also be understood from survey data, though it may not be true to interpret goat meat consumption as a symbol of high social status, consumption tendencies for goat meat are highly dependent on the birthplace of the head of household.

Hicksian price elasticities should be considered for cross-price elasticities. In this regard, as shown in Table 8, cross-price elasticities of the meat and egg expenditure group were estimated through Hicksian price elasticity. As can also be seen in the table, when the cross-price elasticities of veal and beef were investigated, goat meat was estimated to be negative (complementary good), and other product groups were interpreted as positive (competing goods). The same results were estimated for mutton. Negative cross price elasticities were estimated among chicken meat and egg. It can be mentioned that these two products act like complementary goods with each other. Conversely, for chicken and egg, veal, beef and mutton are considered to be competing commodities.

The estimates of elasticities are useful in redefining strategies for consumption of meat and would provide insights into policies targeting livestock sector. Thus the study has important implications for policy in the livestock sector and adds to the growing literature on meat demand using LA/AIDS model (Shibia *et al.,* 2017).

***Conclusion*:** The consumption expenditure of a household increases in parallel to income groups, where the share of it in the income group relatively decreases. This fact supports the law of Engel stating that as income rises, the proportion of income spent on food falls and the share of it in income relatively decreases. When the consumption amounts of meat and egg products are evaluated in general, it can be true to state that meat production increases in parallel to the amount of income. Conversely, in terms of expenditure tendencies of egg consumption, there are no significant differences among income groups.

The effects of socio-demographic variables on meat and egg demand were evaluated, and these variables were interpreted as having a meaningful impact on all products except mutton. The fact that the price elasticities of all meat and egg products were estimated to be negative and statistically significant highlights the fact that consumers are relatively price sensitive and that price policies implemented nationwide play an important role in determining consumer preferences. In particular, subjects related to identifying consumer preferences on eco-friendly animal products in recent years should be studied in broader terms. To make an assessment of meat and egg production in different income groups in a correct manner, studies that focus on the distribution of consumption expenditure and the factors affecting consumer preferences should be carried out.

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