An Econometric Analysis of Urban Households' Meat Consumption in Erbil-Iraq*

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Abstract

The objective of this study was to estimate demand elasticities for red meat and poultry meat consumption by using a two-stage demand model. The data of this study were obtained from 305 households by a 30-day dietary food record survey done by researchers in the Erbil province of Iraq. A Heckman two-stage demand model was used to estimate demand elasticities for red meat and poultry meat consumption. According to the results, the average annual per-capita meat consumption in Erbil (50 kg) was lower than the world (58.1 kg) and the developing countries (100 kg). The demand model showed that the price of red meat and poultry meat, household expenditure and eating food away from home had an important role in the demand and consumption of red meat and poultry meat. Price elasticities of red meat and poultry meat are elastic, and both types of meat are considered necessary goods in terms of income elasticity.

Key words: Red meat, Poultry, Demand, Household, Consumption, Erbil, Iraq

Irak'ın Erbil Bölgesinde Kentsel Hane Halklarının Et Tüketiminin Ekonometrik Analizi

Öz

Bu çalışmanın amacı, iki aşamalı talep modeli kullanarak kırmızı et ve tavuk eti tüketimine yönelik talep esnekliklerini tahmin etmektir. Çalışmanın verileri, Irak'ın Erbil şehrinde 305 hane halkıyla yapılan 30 günlük gıda tüketimi anket sonuçlarından elde edildi. Kırmızı et ve tavuk eti tüketimine yönelik talep esnekliklerini tahmin etmek için Heckman iki aşamalı talep modeli kullanılmıştır. Araştırma sonuçlarına göre, Erbil'de kişi başına yıllık ortalama et tüketimi (50 kg), dünya (58.1 kg) ve gelişmekte olan ülkelerden (100 kg) daha düşüktür. Talep modeli tahmin sonuçları, kırmızı et ve tavuk eti fiyatları, toplam harcamalar ve ev dışı gıda tüketiminin kırmızı et ve tavuk eti talebi ve tüketiminde önemli rol oynadıklarını göstermiştir. Tahmin edilen fiyat talep esneklik katsayılarına göre, kırmızı et ve tavuk etinin esnek olduğu, gelir esnekliğine göre ise, her iki et türünün zorunlu mallar olduğu sonucuna varılmıştır.

Anahtar Kelimeler: Kırmızı et, Tavuk eti, Talep, Hanehalkı, Tüketim, Erbil, Irak

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1. Introduction

Meat is the most important source of protein in the consumer diet. In terms of nutrition, it provides all amino acids which are essential for human health; it is an important source of absorbable iron, zinc, selenium, Vitamin A, Vitamin B12 and folic acid (Sanda and Oancea, 2012). In terms of economics, meat is the most expensive part of the food basket and constitutes a substantial part of the normal diet of each community. On the other hand, there have been considerable differences on the meat consumption preference and expenditure between the developed and developing countries because of economic factors, cultural factors and consumers' beliefs (Mirlohi *et al*., 2013). Moreover, in recent decades, some recognized factors such as income growth, urbanization and population growth have contributed to the increased demand for meat consumption (Sanda and Oancea, 2012). However, some other factors such as meat safety issues such as growth hormone abuse, mad cow disease, avian influenza, and saturated fat have affected negatively on the consumption or demand of meat in many countries during the past few years (Karli and Bilgic, 2007).

Meeting food security and safety for the community is a strategic objective of food and agricultural policies for developed and developing countries. When planning of livestock and poultry sector, quality improvement, development of the livestock system, improved livestock resources, expanding employment opportunities and improving livestock production are taken account as important purposes. It was necessary to understand the current realities and identify influencing factors on demand and supply in order to create an optimal balance point for suitable nutrition and community welfare. This study can be considered as an introduction to more accurate and principled planning. Economic studies on the demand allow decision-makers to respond the present questions and successfully select the best policies such as giving payment or elimination subsidies and social welfare (Abhari and Sadrolashrafi, 2005).

In economics, demand elasticity tells us how factors such as income, price, and other socio-demographic variables affect the demand of a particular good or categories of goods. There have been many studies about meat consumption demand and the effect on meat consumption. These include Taniguchi and Chern (2000), Abdulwadud (2006), Akbay (2006), Akbay et al. (2007), Karli and Bilgic (2007), Samadi (2007), Armagan and Akbay (2008), Tey et al. (2009), Alboghdady (2010), Dudek (2011), Hoai and Thai (2012), Bilgic and Yen (2014), Tümer et al. (2016), Selvanathan et al (2020) and Zhou et al. (2020). For example, Taniguchi and Chern (2000), Karli and Bilgic (2007), Tey et al. (2009) and Dudek (2011) used a two-stage model to estimate the demand model for red and white meat. They found that red meat is elastic, which total food expenditure, the age of the head of the household, and household size variables have an impact on the demand for red meat, but the demand for white meat was not elastic and most of the variables used in the model have not an effect on the demand. Samadi (2007) investigated meat consumption demand in the urban areas of Iran by using the Almost Ideal Demand System and found that meat in urban areas is not elastic, but considered essential goods. So, change on the price of this product will not be a lever for reforming consumption patterns. As the results show, the increases in relative prices and real household expenditure increased consumption of fish and poultry, and reduced consumption of red meat. Abdulwadud (2006) used the Almost Ideal Demand System to analyze meat demand in Bangladesh and found the lowest price elasticity was for beef and the highest income elasticity for mutton. Unexpectedly, they found negative expenditure elasticity for beef. Similarly, Selvanathan (2020) reported that red meat is a necessity and price inelastic while white meat is found to be a luxury consumption item and price elastic in Bangladesh. Armagan and Akbay (2008) used Linear Approximation of Almost Ideal Demand

System (LA/AIDS) to analyze the animal products consumption of urban households in Turkey and found that the annual per capita consumption of animal products were 6.45 kg for meat, 22.11 kg for poultry and 10.05 kg for fish. Price elasticities were found to be lower than 1 for poultry and fish and higher than 1 for meat.

The range of products and per capita consumption will increase with urbanization. According to the FAO report in 2017, average per capita meat consumption was 58.1 kg in the world and 27 kg in developing countries. In developed countries, however, meat consumption (100 Kg) is more than three times of that amount (Akbay et al., 2007; FAOSTAT, 2020). According to FAO 1995 reports, the mean annual consumption per capita was 7.1 kg of meat (3.6 kg of red meat, 2 kg of poultry and 1.5 kg of fish) in Iraq (Scotti, 2011; FAOSTAT, 2020). Furthermore, according to FAO reports in 2017, the overall per capita consumption of meat in Iraq (22.7 kg) remains low when compared with neighboring countries such as Turkey (43.4 kg), Iran (47.5 kg) and Egypt (49.7 kg) (FAOSTAT, 2020).

The objective of this study was to estimate meat demand elasticities in the Northern region of Iraq. To accomplish the objective of this paper, red meat and poultry meat consumption behavior of consumers analyzed by using a cross-sectional consumer survey data and applying the two-stage demand model. The predicted elasticities of demand provide important information to policy-makers in predicting consumption of meat and meat products and making future decisions.

The remainder of the article is organized as follows. Section two presents the definition and description statistics of variables used in econometric modeling of meat demand. This section presents the estimation procedures of the demand model. Section three presents the empirical results and the last section provides conclusions and recommendations for future research.

2. Material and Method

Research area for this study was chosen as the province of Erbil in Northern Iraq. The sample size was found to be 384 by using the ungrouped one stage random likelihood sampling method. Questionnaires were conducted with the households randomly chosen. However, only 305 questionnaires were entered into the study because a number of questionnaires, for various reasons such as none or late-return of some questionnaires, and incomplete questionnaires, could not be entered in the research. For the first time in the Iraq and may be in the world, we designed a questionnaire to record purchased and consumed household food for 30 consecutive days and named that 30 days dietary record and consumption questionnaire. The survey was done in November 2014. In this study, we used a flexible model known as the Heckman Two-step Procedure to solve the zero consumption problems (Heckman, 1979). This estimation method can provide consistent estimation of the parameters (Greene, 2007; Heien and Wessells, 1990). In the first step, Probit equations were used to estimate probability consuming of red meat and poultry meat:

$$D_i = \alpha_0 + \alpha_1 INCOME + \alpha_2 HSIZE + \alpha_3 GENDER + \alpha_4 NWORKER + \alpha_5 WWORK + \alpha_6 MWORK + \sum_{J=1}^{2} \alpha_{6+J} DE_J + \sum_{J=1}^{2} \alpha_{8+J} DB_J + u_i$$

where D_i is dependent variable takes 1 if consume and 0 not consume for i^{th} meat group, α_i is the estimated parameters for i^{th} meat group, u_i is the error terms and it has bivariate normal distribution. A complete set of all variables are given in Table 3. We calculate the Inverse Mills Ratio as (Akbay et al., 2007; Greene, 2007):

$$\lambda_i = \frac{\phi(z_i'\hat{\alpha}_j)}{\Phi(z_i'\hat{\alpha}_i)}$$

The second step is the Working-Leser model recommend as log-liner budget share specification. In this model, Inverse Mills Ratio is used as an instrumental variable for the non-zero (censored) variables. That can be expressed as:

$$w_i = \beta_0 + \sum_j \beta_{ij} LnP_j + \delta_i \text{Ln (M/P)} + \sum_k \gamma_k * D_k + \varepsilon_i$$

where, w_i is the expenditure share of the i[th] meat items P_J is price of the j[th] meat group, M is the total expenditure of all meat items entered in the model, D_k indicates demographics and other variables, ε_i is the random disturbances assumed with zero mean and constant variance. P is a weighted average price based on Stone Price Index calculated as (Stone, 1954):

$\text{LnP} = \sum_i w_i Log(P_i)$

The expenditure (η_i) and uncompensated own ($j = i$) and cross price ($j \neq i$) elasticities (e_{ij}) are as follows (Green and Alston, 1990).

$$\eta_i = 1 + \left(\frac{\delta_i}{W_i}\right)$$

$$e_{ij} = -\xi_{ij} + \left(\frac{\beta_{ij}}{W_i}\right)$$

where ξ_{ij} is a Kronecker's delta which is 1 if $i = j$, and 0 otherwise.

3. Results and Discussions

According to survey results, 90.5% of the household heads were men, 30.17% of the household heads were illiterate or had an ability to read and write, 28.52% of them had a primary, secondary or high school degree and 41.31% of the household heads had an academic degree. The average age of household heads was 45.10 years and 30.82% of the heads of households had an age less than or equal to 35 years, 36.06% were between 36 and 50 years and 33.12% of household heads were older than 51. The average size of household was 5.39, 23.93% of households had less than 4 members and 18.03% of households had more than 7 members.

Table 1 presents the average consumption of both types of meat in three different income groups. In this study, households were divided into three income groups; the average monthly household income was 2.3 million Iraqi Dinar (ID). Average household red meat expenditure was 89396.72 ID/Month and the poultry meat expenditure was 61392.62 ID/Month. As is clear, the average amount of red meat expenditure was higher than the average amount of poultry meat expenditure. When household income increases, red meat and poultry expenditure also increases. This indicates that there is a positive relationship between both types of meat consumption and income (P<0.01). There is a significant positive correlation between red meat expenditure and income level groups of households (P<0.01) and also poultry expenditure and income has a significant positive correlation (P<0.01) at the 99% confidence interval.

Table 1. Meat consumption in different income group (ID/month)

Income Group / Meat Group	Low Income	Mid Income	High Income	Average	F-test (P-value)
Red Meat	69806.93	88087.38	110321.782	89396.72	10.857
(Std. Dev.)	(46591.64)	(64177.77)	(72067.90)	(63859.75)	(0.000)*
Poultry meat	43571.78	66507.28	73997.52	61392.62	14.787
(Std. Dev.)	(22833.32)	(42213.47)	(53388.37)	(43291.66)	(0.000)*

*The mean difference is significant at the 0.01 level.

The average monthly red meat consumption per household was 7.229 (±5.049) kg and poultry meat consumption per household was 15.272 (±10.764) kg (Table 2). The average poultry meat consumption is double of the average consumption of red meat. Results showed that households tended to consume poultry meat more than red meat. According to the results, annual per capita red meat consumption was about 17.88 kg and for poultry meat was 37.99 kg and the annual per capita total meat consumption was 55.87 kg. These amounts were higher than per capita meat consumption in the world and in developing countries (FAO, 2015).

Table 2. Monthly household/kg and person/kg meat consumption in different income group

Income Group / Meat Group	Low Income		Mid Income		High Income		Total Average	
	Per HH.	Per Per.	Per HH.	Per Per.	Per HH.	Per Per.	Per HH.	Per Per.
Red Meat	5.913	1.603	6.959	1.367	8.819	1.501	7.229	1.490
(Std. Dev.)	(4.011)	(1.330)	(4.973)	(1.015)	(5.640)	(.904)	(5.049)	(1.98)
Poultry Meat	11.300	3.000	16.795	3.372	17.693	3.121	15.272	3.166
(Std. Dev.)	(5.932)	(2.170)	(11.210)	(2.475)	(12.830)	(2.437)	(10.764)	(2.363)

HH.: Household, Per.: Person

The results show that there are significant positive correlations between the quantity of both types of meat consumption and household income level. The quantities of both red and poultry meat have a significant positive correlation (0.265), red meat quantity and household income level have a significant positive correlation (0.253) and also poultry meat quantity and household income level have a significant positive correlation (0.295) at the 99% confidence interval (Table 2).

The relationships between red meat and poultry meat consumption and socio economic and demographic characteristics of the households were analyzed by using the Working-Leser demand model. A complete set of all variables are given in Table 3.

Table 3. Descriptive statistics

Variables	Definition	Mean	Std. Deviation
PRedMeat	Average price of red meat (ID)	13110.000	2781.000
PPoultryMeat	Average price of poultry meat (ID)	4144.400	967.000
TFExpend	Total food expenditure (ID)	2302000.000	1413100.000
TMExpend	Meat expenditure (ID)	627980.000	259630.000
Income	Total household income (ID)	149130.000	88955.000
HSize	Household size	5.390	2.409
EduL1	Education level of household head (1: if illiterate and can read & write; 0: Others)	0.213	0.410
EduL2	Education level of household head (1: if primary, secondary and high school; 0: Others)	0.193	0.396
EduL3	Education level of household head (1: if academic degree; 0: Others)	0.413	0.493
HAge1	Age of household head (1: if Less than or equal to 35; 0: Others)	0.308	0.463
HAge2	Age of household head (1: if higher than or equal to 36 and Less than or equal to 50 ; 0: Others)	0.361	0.481
HAge3	Age of household head (1: if higher than or equal to 51; 0: Others)	0.331	0.471
MWork	Does the household head work? (1: if work; 0: others)	0.239	0.427
WWork	Does the household women work? (1: if work; 0: others)	0.698	0.460
NWorker	Number of worker(s) in household	1.885	1.125
EatOut	Does the household eat out? (1: yes; 0: No)	0.390	0.489

In the first stage, probit regression was used to estimate factors affecting household willingness to consume more meat. This stage explained orderly to identify the factors influencing on consumer decision (Purmozafar et al., 2014) or probability decision to consume more meat. Based on diagnostic tests, no multicollinearity problems were detected in the both stages.

In the estimated model for red meat consumption decision, only the total meat expenditure variable significantly affects red meat consumption preferences. This variable has a positive correlation with red meat consumption but its impact is very small (Table 4).

On the other hand, household size and food eaten away from home variables have a significant effect on poultry meat consumption demand, as well as both the variables having a negative correlation with poultry meat consumption decision (Table 4).

In the second stage, factors that can affect the amount of activity after the deciding influences are modelled by the linear regression model. The price of red meat and the total meat expenditure variables with a positive correlation and the price of poultry meat, number of workers in the household and the food eaten away from home variables with a negative correlation have a significant effect on red meat consumption share (Table 4).

The price of poultry meat, working woman householder and the eating of food away from home variables with a positive correlation and the price of red meat and the total meat expenditure variables with a negative correlation have significant effect on poultry meat consumption share. All of the coefficients for the price and expenditure were found as significant at the 95% level.

Table 4. Parameter estimated of probit and working-lesser models for meat consumption

Variables	Red Meat				Poultry Meat			
	Probit		Working-lesser		Probit		Working-lesser	
	Estimated coefficient	T-ratio	Estimated coefficient	T-ratio	Estimated coefficient	T-ratio	Estimated coefficient	T-ratio
Constant	1.184	1.449	0.955*	1.703	3.279*	4.033	0.630	1.104
PRedMeat	-	-	0.127*	2.837	-	-	-0.128*	-2.863
PPoultryMeat	-	-	-0.141*	-2.858	-	-	0.136*	2.745
TMExpend	0.0009*	2.821	0.082*	3.858	0.0001	0.505	-0.081*	-3.856
Hsize	-0.084	-0.916	0.001	-0.083	-0.205*	-2.278	0.007	0.737
EduL2	-0.524	-1.016	0.020	0.608	-0.075	-0.131	-0.023	-0.712
EduL3	-0.334	-0.645	0.009	0.283	-0.358	-0.690	-0.002	-0.052
HAge2	0.342	0.764	0.008	0.257	0.709	1.189	-0.022	-0.605
HAge3	0.680	0.971	0.044	1.096	0.457	0.730	-0.051	-1.262
MWork	-0.314	-0.485	-0.012	-0.395	0.377	0.618	0.005	0.142
WWork	0.366	0.895	-0.044	-1.551	-0.294	-0.533	0.051*	1.812
NWorker	-0.412	-1.322	-0.028*	-2.604	-0.003	-0.014	0.027*	2.463
EatOut	-0.003	-0.009	-0.042*	-1.835	-0.614*	-1.584	0.057*	2.025
IMR	-	-	0.066	0.511	-	-	-0.291	-0.960
R^2			0.1229				0.1207	
Log Likelihood			100.432				100.086	

* Coefficients are statistically significant at α=0.05 level.

Total food expenditure has a significant positive influence on both types of meat consumption share, but the impact on red meat was more than on poultry meat which means that whatever the increase in total food expenditure, there is an increase in both red and poultry meat expenditure share, as expected, but the increase in red meat expenditure is more than in poultry meat expenditure.

Table 5 displays expenditure, income, own-price and cross-price elasticities for both groups of meat products. We calculated the elasticity of household meat demand with respect to the income and price of red and poultry meat.

The total income elasticity for meat expenditure was 0.33, suggesting substantial future growth in household demand for meat such as red meat and poultry meat, as per capita incomes continue to grow in Erbil. Expenditure elasticities are significant and positive and own-price elasticities are negative for both red meat and poultry meat. Both red meat and poultry meat are classified as necessities with respect to income elasticities. Income has a positive effect on the demand for red meat and poultry meat. With the increase in income, the quantity of both types of meat demanded significantly increases, but the income has more effect on the quantity of red meat demanded, as expected. When the price of red meat increased, demand significantly decreased and people tended to consume less red meat and more poultry meat, if all other factors were constant. Moreover, as the price of red meat decreases, the quantity consumed increases and people tend to consume less poultry. People are inclined to replace poultry with red meat if all other factors remain constant.

Our estimates of expenditure elasticities are higher than those estimated by Basarir (2013), Zhou et al. (2020), Selvanathan (2020) and Rahman et al. (2020), but lower than Zhang et al. (2018), Jabarin (2005) and Falsafian and Ghahremanzadeh (2012). For example; Basarir (2013) conducted a study in United Arab Emirates and found that expenditure elasticities for beef and chicken were 0.80 and 0.69, respectively, and own price elasticity of chicken was -0.53. Selvanathan (2020) reported that red meat is a necessity and price inelastic while white meat is found to be a luxury consumption item and price elastic in Bangladesh. In a different study, Abdulwadud (2006) found the lowest price elasticity and negative expenditure elasticity for beef in Bangladesh. Akbay et al. (2007) reported that income had significant and positive effects on household meat consumption and found expenditure elasticity of meat and meat products (1.63) higher than our results. Similarly, Armagan and Akbay (2008) and Akbay et al. (2008) found that price elasticity is lower than one for poultry meat, but higher than 1 for red meat. By using Jordan household expenditure survey data, Jabarin (2005) found expenditure elasticities for beef and chicken as 1.54 and 0.97, respectively. Falsafian and Ghahremanzadeh (2012) estimated income elasticities of beef and chicken as necessity goods among Iranian households.

Table 5. Estimated demand elasticities

Variables	Demand Elasticities	
	Red Meat	Poultry Meat
Meat Expenditure	1.141	0.808
Price of Red Meat	-1.371	-0.305
Price of Poultry Meat	-0.190	-1.064
Income	0.377	0.267

4. Conclusion and Recommendations

This study investigates socioeconomic and demographic factors influencing red meat and poultry meat consumption decisions and the quantity demanded. The analysis has been carried out by using the Heckman two-step estimation procedure.

Our findings suggest that red meat and poultry meat are essential goods in the urban consumers' food basket. Any increase in prices and lack of compensating purchasing power cause decrease in the consumption patterns of these important foods which will be followed by anomalies and complications in nutrition from the lack of protein intake. This is a significant point for the economic prosperity policy makers.

Higher and positive red meat expenditure elasticity shows that income is still a driving force to change meat consumption patterns, and its strong influence forces consumers to consume more red meat than poultry meat.

According to results, income elasticity of red meat and poultry meat are smaller than 1. It confirms that the two types of meat are necessary goods for Erbil households. Moreover, income elasticities were positive for both types of meat which indicates they are normal goods. Generally, cross-price elasticity of red meat and poultry meat in respect to each other were negative implying that one type of meat does not substitute for the other, but these two types of meat were complement of each other.

To improve the consumption patterns of meat, the prices of red meat and poultry meat should be decreased because of elastic price elasticity as well as consumers paying a big part of their income to consume meat and meat products.

Due to the high cost of meat production, government should support the production of meat and meat products as well as decreasing prices for meat, paying loans to livestock farmers for livestock feed, veterinary medicines, vaccines and equipment.

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