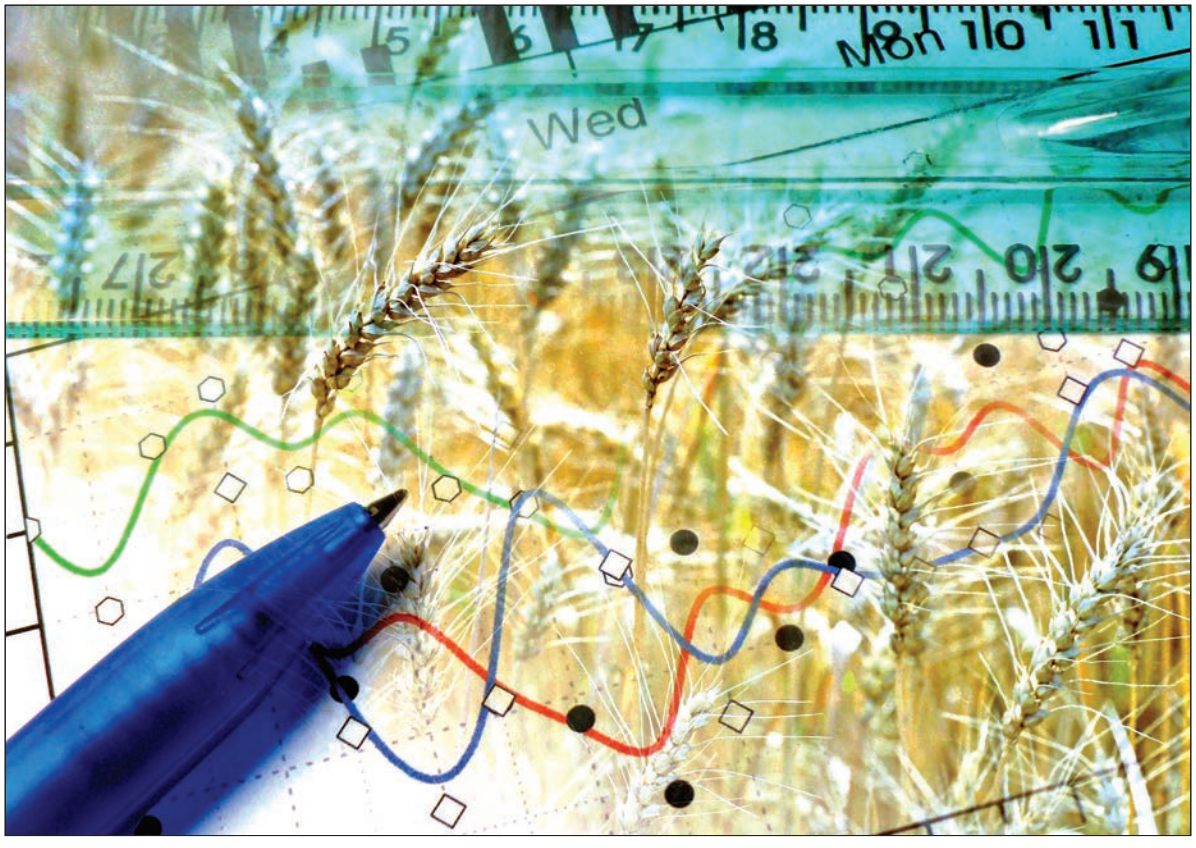

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An Economic Study of the Demand for Red Meat in the Kingdom of Saudi Arabia using Almost Ideal Demand System

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ABSTRACT

Animal protein is one of the most important food products essential for normal growth of human body. The main objective of this study were to assess the demand of Saudi red meat, to estimate the system of Almost Ideal Demand System (AIDS) on various types of red meat and study the variances of price elasticity, cross elasticity and income elasticity according to the types and sources of meat in the Kingdom of Saudi Arabia. Mean spending (billion Saudi Riyals) on different types of meat ranged from 9.533-23.607, 1.554-7.064 and 1.377-3.418 for red meat, fish and poultry, respectively. The average consumption per capita increased to 16.96, 9.80 and 5.90 kg year^{-1} for red meat, fish and poultry, respectively. The mean annual change rate was 0.034, 0.57 and 0.72% for red meat, fish and poultry, respectively. While, the annual growth rate was 50.24, 4.81 and 8.77% for red meat, fish and poultry, respectively. The value of coefficient of Uncompensated own price elasticity showed that the demand of red meat and fish is flexible and that of poultry is inflexible. Furthermore, the value of coefficient of compensated own price elasticity showed that red meat and fish are complementary goods. The increase of fish price increased the consumption of red meat which indicated that red meat and poultry are competitive commodities. However, an increase of red meat price will increase the consumption of poultry. The study highlighted the potential indicators affecting the red meat demand as compared to other meat sources i.e., fish and poultry.

Key words: Red meat, per capita consumption, elasticity, annual rate, growth rate, meat demand

INTRODUCTION

The protein products of animal food contain different amino acids and fats, which are necessary for normal growth of human body. As a result of constant increase in population, the demand increased for animal protein products of various types such as red meat, fish or poultry due to awareness for health and nutrition. Also, the average per capita income is one of the most important indicators of the progress or failure of States. A study of the demand of necessities of life requires high degree of importance. It is an admitted fact that the living standards of members of the community and the spending on a particular commodity or a certain group of food items are heavily influenced by the level of overall spending on the sets of goods and services.

In the more than two decades since its introduction by Deaton and Muellbauer (1980), the Almost Ideal Demand System (AIDS) has been widely used in demand analysis. The majority of empirical applications follows Deaton and Muellbauer's lead and replace the trans-log price index with Stone's index to deflate income. This generates the Linear Approximate Almost Ideal Demand System (LA-AIDS), which is linear in the unknown parameters and therefore simpler to estimate. Karagiannis *et al.* (2000) presented a dynamic specification of the Almost Ideal Demand System

(AIDS) based on recent developments on co-integration techniques and error correction models. Based on Greek meat consumption data over the period 1958-1993, it was found that the proposed formulation performs well on both theoretical and statistical grounds, as the theoretical properties of homogeneity and symmetry are supported by the data and the Le Chatelier principle holds. In the short-run, beef was found to have price elastic demand, pork an almost unitary elasticity, whereas mutton-lamb, chicken and sausages had inelastic demands; in the long-run, beef and pork were found to have a demand elasticity greater than one, whereas mutton-lamb, chicken and sausages still had inelastic demands. All meat items are found to be substitutes to each other except chicken and mutton-lamb and chicken. Jabarin (2005) reported the results of the estimation of a linear approximate almost ideal demand system for Jordan meat demand. The results revealed that the demand for mutton and poultry is elastic while the demand for beef and fish is inelastic. The cross-price elasticities indicate that poultry and beef are substitutes to mutton. The expenditure elasticities confirm that beef and mutton are luxury goods while poultry and fish are necessity goods. La France (2004) solved the integrability of the linear Approximate Almost Ideal Demand System (AIDS), including closed form solutions for the expenditure function and generating a new method to nest the rank and functional form of a Quadratic Price Independent Generalized Linear Incomplete Demand System (QPIGL-IDS). Moschini (1995) stated that one of the most commonly used specifications in applied demand analyis is the most ideal (AI) demand system proposed by Deaton and Muellbauer. Because, the linear form of AI model specification typically utilizes a Stone price index. Elhawary (1992) reported the results of estimation of meat demand in Egypt with Almost Ideal Demand System (AIDS) from 1990-2006. He concluded that the most important variables affecting the demand of meat are the average retail prices of meat, fish and poultry and the total expenditure on groups. The average consumption of meat, fish and poultry reached 16.84, 12.16 and 8.68 kg year^{-1} while the annual growth rate was about 0.24, 4.81 and 8.77%, respectively. It was also noticed that the increase in population growth rate exceeded the improvement and increase in demand rate resulted from the increase of individual income. Dhehibi and Gil (2003) Forecasted food demand in Tunisia under alternative pricing policies. They found that food demand is flexible under varying prices of commodities.

The market for meat, fish and poultry in Saudi Arabia increased at a compound annual growth rate of 4.7% between 2003 and 2008. The frozen meat products category led the meat, fish and poultry market in Saudi Arabia, accounting for a share of 61.8%. Leading players in Saudi Arabian meat, fish and poultry market include Al Kabeer Group of Companies and Americana Group (MOCI, 2009).

Presently, a high proportion of family budget is covered by the food budget in the Kingdom of Saudi Arabia. The provision of food for a citizen is one of the core functions of the State. Besides, the red meat is one of the staple food commodities, which is still below the self-sufficiency ratio of about 62.35% in 2006 with an average of about 57.49%. Also, the consumption of available red meat reached to about 1448 thousand tons in 2008. The average per capita consumption of red meat was about 16.8 kg year^{-1} in 2008 which grew at an annual rate of about 0.24% from 1999-2008 (MOCI, 2009). This shows that the rate of increase in population growth exceeded the rate of increase and improved the demand for red meat due to increased income, which resulted in continuous rise in the price of red meat. This caused concern among the population to look for alternative sources of red meat in the market such as fish and poultry. The main objectives of this research were: (1): To estimate the demand for red meat in the Kingdom of Saudi Arabia by applying Almost Ideal Demand System (AIDS) according to the diversity of products and sources of animal protein, (2): To identify the most important variables affecting the base prices of red meat,

fish and poultry, (3): To determine and analyze the relationship between these food items and the rate of spending and (4): To suggest productive policies which ensure food security and health of the Saudi citizens.

MATERIALS AND METHODS

Data sources: Research was carried on the secondary data collected from Ministry of Commerce and Industry (MOCI) (2009) and Ministry of Agriculture (MOA, 2009). The data collected related to spending, prices of different commodities, per capita consumption of red meat, fish and poultry in the Kingdom of Saudi Arabia.

Research methodology: The Linear approximation model of Almost Ideal Demand System (AIDS) described by Deaton and Muellbauer (1980) was applied to estimate the demand for red meat in the Kingdom of Saudi Arabia from 1999-2008. It also derived the application form of the AIDS through utility functions, which represents the expenditure function for commodities.

This assumed a distinction between the goods according to its type as follows:

$$\ln[E(p,u)] = (1-u)\ln[a(p)] + u\ln[b(p)] \quad (1)$$

$$\ln[a(p)] = \alpha_o + \sum \alpha_k \ln P_k + \frac{1}{2}\sum_k \sum_j \gamma_{kj} \ln P_k \ln P_j \quad (2)$$

$$\ln[b(p)] = \ln[a(p)] + \beta_o \prod_k P_k^{\beta_k} \quad (3)$$

where, α, β and γ represent the parameters of the function, PI: the retail price of items in this study. By substituting Eq. 2 and 3 in Eq. 1, the expenditure function can be reformulated as follows:

$$\ln[E(p,u)] = \sum_k \alpha_k \ln P_k + \frac{1}{2}\sum_k \sum_j \ln P_k P_j + \beta_o u \prod_k P_k^{\beta_k} \quad (4)$$

Also can obtain consumer spending Budget Shares (W_i) per item according to its type (i) and differentiated ln [E (p, u)] for the price P_i as follows:

$$\frac{\partial \ln E(p,u)}{\partial \ln P_i} = \frac{p_i q_i}{E(p,u)} = W_i \quad (5)$$

where, p_i and q_i are the price and quantity of the item, respectively according to its type (i).

Therefore, the Eq. 4 can be reformulated as follows:

$$W_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i u\, \beta_o \prod_k P_k^{\beta_k} \quad (6)$$

Furthermore, by substituting Eq. 4 in the utility function u and replacement in the Eq. 6, An application form of Almost Ideal Demand System (AIDS) can be obtained as follows:

$$W_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln(\frac{E}{p}) \quad (7)$$

where, W_i is the share of item (i) of the total consumer spending on a range of goods.

E is the total expenditure for different range of goods. P_j is the prices of goods (j) which is the subject of this study on the image logarithm and P is a number for Stone standard engineering of prices, calculated by the following equation:

$$\overset{*}{\ln p} = \sum_k W_k \ln p_k \quad (8)$$

Uncompensated own price elasticity (∈ii): It is known as Marshall's non-compensatory flexibility, which estimates the changes in price without taking into account the impact of price changes on the real income of the consumer (Green and Alston, 1990). It is calculated by the following equation:

$$Eii = -\delta ii + (\gamma ii / Wi) - Bi\,(Wi/Wi)$$

Compensated cross price elasticity (ɛ́ij): It is known as compensatory Palmronat or elasticities Hicks-Slutsky which are estimated keeping in view the changing prices and taking into account the impact of price changes on the real income of the consumer (Green and Alston, 1990). The ɛ́ij is calculated by the following equation:

$$\acute{\epsilon} ij = -\delta ij + (\Gamma ij / Wi) - \beta i\,(Wj / Wi)$$

The expenditure elasticity (μi) is calculated by the following equation.

$$\mu i = 1 + \beta i / Wi$$

It can verify the results from the relationship between the spending power elasticity and the weighted share of the commodity group under consideration as follows:

$$1 = Wi\ \Sigma i\ \mu i$$

where, the total elasticity of expenditure of the commodity groups under study and the weighted share of the Group from the total expenditure of the group commodity is equal to 1.

Method of estimating the parameters of the model variables request: The parameters of equations of the application form almost ideal (AIDS) on red meat were determined by methods as described by Deaton and Muellbauer (1980) in Saudi Arabia from 1999-2008. The demand system consists of 3 equations. The dependent variable is the spending power for groups of red meat, fish and poultry. The explanatory variables are represented by the prices of groups of red meat, fish and poultry. The total expenditure on commodity groups under study is on the image logarithm.

Method of seemingly unrelated regression: This method of regression equations for the non-separatist-related (SUR) was adopted to estimate the parameters variables of the model simultaneously to the method of Zellner solving system of equations and is known in a method of regression separatist equations. The Seemingly Unrelated Regression (SUR) is a form of least squares method. The Generalized Least Square (GLS) was also one of the estimation methods of Non-Linear Estimation that assumes that the random errors within the system of equations where there is no self-link; Sync E but linked with each other through a system of different equations. The model consists of m equations in the following forms given in SAS (1984).

Test verification for the terms of demand function to model estimate: The demand estimate function model was built through a System consisting of 3 equations for red meat in Saudi Arabia from 1999-2008 according to the method of Owen (1990). It is assumed that the share of spending for each commodity within the commodity group under consideration affects the price and the prices of alternative goods and total expenditure on items of the group on the image logarithm. Where the estimation model works without imposing any restrictions of the demand function Unrestricted Model, was then estimated the model with restrictions demand function of under homogeneity and under symmetry and test the best examples of estimate by testing the hypothesis the basic lack of coherence and similarity in the function demand.

$$\text{Ho: } \Sigma_i \gamma ij \neq 0, \gamma ij \neq \gamma ji$$

Through the ratio test to Gretm most likely (LRT) Log-Likelihood Ratio Test, which is distributed according to the distribution Chi square (χ^2) degrees of freedom equal to the difference between the number of model parameters restricted and unrestricted, using the following equation (Qin and Lawless, 1994).

The basic hypothesis is rejected when the value of LRT is less than the calculated value of Chi square (χ^2) spreadsheet at a significance level specified.

Data analysis: The data were analyzed by following different statistical techniques as given in SAS (1984). Different parameters were determined as below. For example: The amount of Annual Change (AC) as of: Linear Model on the image: $Y_t = b_0 + b_1T$ and the Annual Growth Rate (AGR) of: the exponential function on image: $Y_t = A \exp^{f(t)}$.

The economic analysis of the demand for red meat in Saudi Arabia during 1999-2008 was carried using the application form closest to the ideal (AIDS). The results were presented in 3 ways. (1): Displays the test results fulfilling the conditions of demand function to model estimation. (2): Shows the estimated parameters of equations of the application form closest to the ideal (AIDS) on red meat in Saudi Arabia according to the product type. (3): Shows the most important economic indicators derived from the application form closest to the ideal (AIDS) on red meat in Saudi Arabia according to the type of item represented by: (a): Un-compensated Price Elasticity [own], (b): Compensated Cross Price Elasticity and (c): Expenditure Elasticity.

RESULTS AND DISCUSSION

Mean spending (billion Riyals) on different types of meat ranged from 9.533 to 23.607, 1.554 to 7.064 and 1.377 to 3.418 on red meat, fish and poultry, respectively from 1999-2008 (Table 1). The retail prices (Saudi Riyals per kg) of these commodities ranged between 16.40-23.71, 9,58-15.42

Table 1: The spending and retail price of red meat, fish and poultry in the Kingdom from 1999-2008 (MOCI, 2009)

	SAR (Billions)			Retail price (SR)		
Years	Red meat	Fish	Poultry	Red meat	Fish	Poultry
1999	9.533	1.554	1.377	16.40	9.58	4.50
2000	9.842	2.794	1.542	17.31	10.70	4.74
2001	1.074	3.323	1.728	19.24	11.40	5.10
2002	2.420	3.688	2.313	19.67	11.40	5.23
2003	18.998	4.498	2.717	21.44	11.96	5.77
2004	15.569	5.326	3.340	18.45	12.90	6.04
2005	21.612	4.738	3.418	22.75	13.46	6.34
2006	23.607	5.532	3.389	23.12	13.51	6.69
2007	20.511	5.956	2.321	23.34	14.40	7.73
2008	22.946	7.064	2.662	23.75	15.42	8.35
Average	22.378	6.745	4.263	18.45	12.29	6.47

Table 2: Average per capita consumption (kg year^{-1}) of red meat, fish and poultry in the Kingdom from 1999-2008

Years	Red meat	Fish	Poultry
1999	14.70	9.13	4.00
2000	15.10	8.15	4.20
2001	16.80	8.82	4.70
2002	18.80	8.42	4.80
2003	18.10	8.44	5.50
2004	15.10	9.53	6.80
2005	18.40	9.80	6.70
2006	19.20	11.02	7.00
2007	15.90	11.74	6.90
2008	17.50	13.43	8.40
ACR	0.034	0.57	0.72
AGR	50.24	4.81	8.77

ACR = Annual change rate, AGR = Annual growth rate

and 4.50-8.35 for red meat, fish and poultry, respectively. The data showed significantly a wide range of fluctuations both in the spending and the retail prices of these commodities from 1999-2008 (Table 1). The fluctuation both in the spending and the retail prices of different commodities could be attributed to the supply and demand of each commodity separately on one hand and variation in the income of each individual on the other hand (Table 1).

The average per capita consumption (kg) ranged from 14.7-19.2, 8.15-13.43 and 4.0-8.40 for red meat, fish and poultry, respectively from 1999-2008. The annual growth rate was 50.24, 4.81 and 8.77% for red meat, fish and poultry, respectively from 1999-2008 (Table 2).

Test results verified the conditions of demand function to model estimate: The relation between the results of the Log-Likelyhood Ratio Test (LRT) to the possibility of rejecting hypotheses indicated lack of homogeneity and symmetry. The value of LRT is less than the calculated value of Chi square (χ^2) and is significant upto 1% level of significance ($LSD_{0.01}$) Based on this, the demand function for red meat in Saudi Arabia was estimated from 1999-2008 by using the application form closest to the ideal (AIDS) keeping view the constraints of homogeneity and symmetry (Table 3).

Estimation of parameters of model equations for red meat demand

Transactions of logarithm expenditure (βi): It was statistically significant at 1 and 5% level of significance and is different from zero for groups of red meat, fish and poultry. A direct correlation was found between the total expenditure on the three groups of commodities (red meat, fish and poultry) and relative spending on red meat and fish. The percent expenditure on red meat and fish increased with an increase in income, but it varied for poultry. This means that there was an inverse relationship between the total expenditure on the three group of commodities and the percent spending on a range of poultry. The percent expenditure was 47.65, 24.22 and 28.13% for red meat, fish and poultry, respectively (Table 4).

Transactions of logarithm prices (γij): It appears from the spending equations for the red meat group that the relationship between the percent expenditure on red meat relative to the prices of fish and poultry was statistically significant at 1% level of significance ($LSD_{0.01}$). This means that if the prices of fish and poultry are low, then it will reduce percent spending on different types of red meat (Table 5).

It appears from the spending equations for the fish commodity that the relationship between the share expenditure on fish relative to the prices of red meat group was statistically significant at 1% level of significance ($LSD_{0.01}$). This means that if the price of red meat commodity is low it will reduce the percent spending on fish. Also the relationship is significant with the prices of poultry at 5% level of significance ($LSD_{0.05}$). This would mean that with the reduction in prices of poultry group, the percent spending will increase for fish commodity (Table 5).

Table 3: Test results for the demand function by using the application form closest to the ideal (AIDS) on red meat in Saudi Arabia from 1999-2008

Model	LK	LRT	χ^2
AIDS without record	135.6	---	---
AIDS with symmetry	138.5	5.80	12.59
AIDS with symmetry and homogeneity	141.5	11.80	16.92

LK = Logarithm function of probability, LRT = Likelihood ratio test, χ^2 = Chi Square value

Table 4: Assessment of average spending power for different group of commodities

Commodity type	Average spending (Billion Riyals)	Expenditure share	Percent expenditure
Red meat	25.29	0.4765	47.65
Poultry	12.85	0.2422	24.22
Fish	14.93	0.2813	28.13
Total	53.10	1.0000	100.00

Table 5: Estimation of parameters of AIDS to red meat demand in Saudi Arabia from 1999-2008

Commodity group	Expenditure transactions for logarithm (β_i)	Transactions for logarithm prices (γij)		
		Red meets	Fish	Poultry
Red meets	0.0189 (0.41)	0.0567 (2.24)*	-	-
Fish	0.0608 (2.91)**	0.0418 (2.27)*	-0.1741 (-9.57)**	-
Poultry	0.1595 (2.03)*	-0.0321 (-1.23)	0.1124 (4.52)**	-0.0377 (-1.08)

Values in brackets () represent the calculated value of t, *: Transactions statistically significant at 5 % level of significance ($LSD_{0.05}$), **: Transactions statistically significant at 1 % level of significance ($LSD_{0.01}$)

The spending equations for poultry group showed that there is a strong relationship between the percent spending of poultry relative to the prices of red meat commodity and is significant at 1% level of significance ($LSD_{0.01}$). This means that with the reduction in prices of red meat, the percent spending will also be less for poultry group. Also the relationship is significant at 5% level of significance ($LSD_{0.05}$) with the prices of fish. This suggested that with the reduction in fish prices, the relative spending will increase on poultry group of commodities (Table 5).

In accordance with the symmetry conditions, the share expenditure on red meat group relative to the prices of fish commodity along with share expenditure of fish group relative to the prices of red meat group is $\gamma 12 = \gamma 21$. Similarly, the share expenditure on red meat group relative to the prices of poultry group as compared to the share expenditure of poultry relative to the prices of red meat group is $\gamma 13 = \gamma 31$ (Table 5).

The most important economic indicators for the demand function on the sets of goods under study

Demand expenditure elasticity (μi)

Red meat group: The value of μi is (+) 1.1, which means that it, is a commodity than a luxury. The quantity of red meat consumption increases with an increase in individual income. This shows that if the income increases by 10%, the red meat consumption will increase by 11% which is a bit higher relative to the increasing rate of income (Table 6).

Fish group: The value of μi is (+) 0.9 i.e., it is an essential commodity. Its consumption is associated with the increase in income. This means that an increase in income by 10% will increase the fish consumption by 9% which is less than the rate of increase in income (Table 6).

Poultry group: The value of μi is (+) 0.84 which means that it is an essential commodity and the increase in the quantity consumed is associated with an increase in income. This indicates that if the income increases by 10%, it will increase the consumption of poultry meat by 8.4%, which is less than the rate of increase in income (Table 6).

Uncompensated price demand elasticity [self] (∈ii)

Red meat group: The value of μi is (-) 0.983 [a value of the built-in flexibility] which indicates that the demand for red meat is a flexible. This means that the quantity of red meat consumed will be change with the price stability of fish and poultry groups which is flexible. This means that if the price of red meat is changed by 10%, it will cause 9.83% change in the total consumption of red meat (Table 6).

Fish group: The value of μi is (-) 1.780 which means that the demand of fish group is relatively elastic. This means that the quantity of fish consumed is related to the change in prices with

Table 6: Demand price and expenditure elasticities of group of commodities in Saudi Arabia from 1999-2008

		Un-compensated price elasticity (own)			Compensated price elasticity		
Commodity	Expenditure elasticity (μi)	Red meets ($\in_{11}$)	Fish ($\in_{22}$)	Poultry ($\in_{33}$)	Red Meets	Fish	Poultry
Red meets	1.10	-0.983	0	0	-0.128	0.078	-0.079
Fish	0.90	0	-1.780	0	-0.222	0	0.385
Poultry	0.84	0	0	-1.294	-0.317	0.624	- 0.104

respect to the stability of prices of red meat and poultry. i.e., a change in the price of fish by 10% will cause a change in the quantity consumed by 17.80% (Table 6).

Poultry group: Its value of μi is (-) 1.294, which indicates the demand for poultry, is self elastic. This means that the consumption of poultry is related to the changes in price stability of red meat and fish. This means that if the price of poultry is changed by 10%, it will cause a change in the consumption of poultry by about 12.95% (Table 6).

Compensated cross price elasticity (ɛ́ij)

Red meat group with fish group: The value of ɛ́ij is (-) 0.128 for the red meat which indicates and there is a close relation between the 2-groups i.e. red meat and fish. The change in fish price adversely affected the consumption of red meat. Because the impact of increase in income is greater than the substitution between the two meat groups i.e., red meat and fish. This indicates that the effect on income from higher price of fish will decrease the total consumption of red meat and white meat simultaneously (Table 6).

Red meat group with poultry group: The value of ɛ́ij is (-) 0.104 which means that the Group of red meat is elastic and there is strong relation between the two groups. This shows that the impact on the prices of poultry will adversely affect the consumption of red meat. Because the impact of change in income is greater than the impact of substitution between the two groups. This means that the effect on income resulting from higher prices of poultry will reduce the total consumption of red meat and fish simultaneously (Table 6).

Fish group with red meat: The value of ɛ́ij is (-) 0.222, which means that fish group, is elastic and there is close relation between the two groups i.e., red meat and fish. This means that a change in the prices of red meat will adversely affect the total consumption of fish because the effect of change in income is greater than the impact of substitution between the two groups. It also infers that the effect of change in income resulting from higher prices of red meat caused a decline in the consumption of fish and poultry simultaneously (Table 6).

Fish group with poultry group: The value of ɛ́ij is (+) 0.385, which means that fish group is elastic and there is no relation between the two, groups i.e., fish and poultry. It also indicated that the high prices of poultry caused a decline in the consumption of fish (Table 6).

Poultry group with red meat: The value of ɛ́ij is (-) 0.317, which means that poultry group, is elastic and there is close relation between the two groups i.e., poultry and red meat. It means that the impact of any change on the prices of red meat will adversely affect the total consumption of poultry. Because the impact of change in income will overcome the impact of substitution between the two groups. This infers that the effect on income resulting from higher prices of red meat caused a decline in total consumption of fish and poultry simultaneously (Table 6).

Poultry group with fish group: The value of ɛ́ij is (+) 0.624 which means the poultry group is inelastic and there is no relationship between the two groups. i.e., the high prices of fish might cause a reduction in poultry consumption (Table 6).

The study showed that the demand on red meat in the Kingdom of Saudi Arabia depends on the total income of an individual, prices flexibility of different other meat sources such as fish and poultry. The values of expenditure elasticity showed that fish and red meat and fish and poultry are not closely related while other groups such as red meat and poultry as well as fish and red meat are closely related. This means that price elasticity and variation in prices will affect the demand and consumption of each other commodity. Also the increase or decrease in income will affect the demand and consumption of different commodities. The application of Almost Ideal Demand System (AIDS) proved useful in estimating the red meat demand in Saudi Arabia. The study also showed that demand for fish and red meat is relatively flexible. Red meat is a commodity than a luxury, while fish and poultry are essential commodities. The study results agree with those of Jabarin (2005), who reported the results of the estimation of a linear approximate almost ideal demand system for Jordan meat demand. He revealed that the demand for mutton and poultry is elastic while the demand for beef and fish is inelastic. The cross-price elasticities indicate that poultry and beef are substitutes to mutton. The expenditure elasticities confirm that beef and mutton are luxury goods while poultry and fish are necessity goods. Similar views were expressed by Elhawary (1992) who reported the results of estimation of meat demand in Egypt with Almost Ideal Demand System (AIDS) from 1990-2006. He concluded that the most important variables affecting the demand of meat are the average retail prices of meat, fish and poultry and the total expenditure on groups.

CONCLUSIONS

Mean spending (billion Saudi Riyals) on different types of meat ranged from 9.533-23.607, 1.554-7.064 and 1.377-3.418 for red meat, fish and poultry, respectively. The average consumption per capita increased to 16.96, 9.80 and 5.90 kg year^{-1} for red meat, fish and poultry, respectively. The mean annual change rate was 0.034, 0.57 and 0.72% for red meat, fish and poultry, respectively. While, the annual growth rate was 50.24, 4.81 and 8.77% for red meat, fish and poultry, respectively. The value of coefficient of Uncompensated Own Price Elasticity showed that the demand of red meat and fish is flexible and that of poultry is inflexible. The values of expenditure elasticity showed that fish and red meat and fish and poultry are not closely related while other groups such as red meat and poultry as well as fish and red meat are closely related. Furthermore, the value of coefficient of Compensated Own Price Elasticity showed that red meat and fish are complementary goods. The increase of fish price decreased the consumption of red meat, thereby indicating that meat and poultry are competitive goods. However, an increase of red meat price will increase the consumption of poultry. The study highlighted the potential indicators affecting the red meat demand as compared to other meat sources i.e. fish and poultry.

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