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ANALYSIS OF SAUDI DEMAND FOR IMPORTED BROILER CHICKENS

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ABSTRACT

The study was aimed to analyze the Saudi demand for imported broiler chickens from Brazil, France, and other countries. The ideal demand model for time series data on imported quantities and values were adjusted during the period 1990-2016. Since the model equations are nonlinear in transactions, Non-linear least squares in estimating the parameters of the model. The results showed that the model has achieved the condition of addition, and the equations are termed as homogeneous from the zero degrees, and it was found that all the price elasticity's (own and cross both) and the elasticity of the expenditure agree with the economic theory. But it was noted that the demand for broiler chickens from France was highly elastic to the change in the price of Brazil and other countries. It was also noted that demand was found less elastic for total expenditure change for broiler chickens imported from other countries and that it was equally elasticity to change in the prices of Brazil and France chickens. The prediction of imported broiler chickens showed that there was a general trend expected to increase imports from Brazil and France.

Key words: Broilers chicken; imports; price elasticity; cross and expenditure elasticity; Almost ideal demand system; Saudi Arabia.

INTRODUCTION

Saudi Arabia relies heavily on imports of broiler chickens to meet the increasing in demand. The value of imports of imported broiler chickens from Brazil, France, and other countries ranged from a minimum of 359.450 million riyals in 1999 to a high of 5392.582 million riyals in 2013, an average of 2202.686 million SAR, and an annual growth rate of 8.2% during that period 1990-2016. The study is concerned with the statistical estimation of the demand model for the import of broiler chickens in Saudi Arabia as one of the important issues in the field of international trade, and the almost ideal demand System (AIDS) is applied as the most applied demand model in applied fields. The application form (AIDS) is expressed in a system of instantaneous equations, which represents the expenditure shares on the required quantities of the commodity from the countries studied as dependent variables, a set of explanatory variables determined in the export prices of these countries and the real income available for the quantities to be imported from these countries.

In the use and statistical estimation of this model, few researchers have addressed this model in the analysis of the import demand system. Akinbode (2015) estimated demand equations for a number of food items and estimated cross-price elasticities which are necessary for studying consumer behaviours, marketing, production planning and policy making. Data were analyzed in a system of equations with symmetry, adding-up and homogeneity restrictions imposed on the model. The study recommended that food policies should be broad based to encompass majority of the food items consumed and consumer behaviours as revealed by various elasticities be considered in formulating food-related policies. Sacli and Ozer (2017) applied ideal demand system (LA/AIDS) to analyze socio-demographic and economic factors affecting red meat and chicken meat consumption in Turkey. Affecting red and chicken meat, and egg expenditures. In this study the gender, education level, income and birthplace of consumers were significant in determining veal and beef demand. 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). Zhang, *et al* (2018) evaluated factors that affect households' meat purchase and estimated future meat consumption changes in China. An advanced linear approximated almost ideal demand system was used for data analysis. The results indicated that High-income households purchased more meat, especially pork, chicken and mutton, than low-income households. Meat consumption pattern will be affected by income changes. Collectively these results suggest that there will be a potential meat market expansion in China, and that pork consumption will increase at a quantity much larger than other meat items in the near future, assuming that consumer income will continue to increase. China's projected increase in meat demand will eventually stimulate greater meat imports, which may have a

significant influence on meat exporting countries in the world.

This study deals with the application of the AIDS demand model to study and analyze the demand system for Saudi imports of broiler chickens from Brazil, France and other countries, as well as to provide possible solutions to the problems of estimating this model.

The objective of this study estimate the Saudi demand model for imported broiler chickens from Brazil, France and other countries. Therefore, the AIDS model has been used to represent the system of the expenditure shares of these countries, and non-linear least square method can be used to estimate the parameters of the model , so testing the significance of regression coefficients, verifying the restrictions, and calculation of own , cross, and the income elasticity's.

MATERIALS AND METHODS

The demand model, developed by (Deaton and Muellbauer, 1980) is very popular in the applied aspects of the study and analysis of import demand. This model derives from the expenditure function, which reflects the importer's behavior in trade-offs between a number of commodity exporting countries. This model was applied in many of econometrics studies, where source differentiated (AIDS) model was specified to estimate Japanese meat import demand by Yang and Koo (1994). Assuming that n the number of countries exporting goods, exporting the from item the of price Import p_{it} country No i , q_{it} ,t odperi time the During $i = 1,2,...,n$ Is the quantity of import from the state number ,i During the period of time t, the volume of expenditure on imports of goods from exporting countries during the period of time t is m_t it is expressed by the formula: het $w_{it} = p_{it}q_{it}/m_t$ w_{it} was it if $m_t = \sum_{i=1}^{n} p_{it}q_{it}$ market share of the country i reflects a number of total expenditure over the period of time t. The demand equations model (AIDSM) on imports of the commodity from the exporting countries under study takes the following formula:

$$w_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} \log_e(p_{jt}) + \gamma_i \log_e\left(m_t / P_t\right) + \theta_i t + \varepsilon_{it}, \quad i = 1,2,...,n,\ t = 1,2,...,T \tag{1}$$

whereas:

T Is the number of views, ε_{it} is the random error of the equation of the share of state number i of total expenditure over the period of time t It is assumed that the vector of random errors in the time period t, $\varepsilon_t = (\varepsilon_{1t}, \varepsilon_{2t}, ..., \varepsilon_{nt})'$ it follows a normal natural distribution that it's expected value be zero, and has a variance and heterogeneity matrix Σ, they are fixed from one view to another, that is $\varepsilon_t \sim N_n(0,\Sigma)$, P_t is the general price index in the time period t, and is determined by the following formula:

$$\ln P_t = \alpha_0 + \sum_{k=1}^{n} \alpha_k \log_e(p_{kt}) + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \beta_{ij} \log_e(p_{it}) \log_e(p_{jt}) \tag{2}$$

The limitations of the AIDS model: There are a number of constraints related to the ordering system, and make the model consistent with the theory of demand:

Adding up constraint: This limitation is the result of the assumption of the linear model of the budget and consumer preferences. These results in the total value of the Marshall and Hexane requests being equal to total expenditure, i.e. in any given period $m_t = \sum_{i=1}^{n} p_{it}q_{it}$ to achieve the addition constraint, the following conditions must be met for the parameters of the model:

$$\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \gamma_i = 0, \sum_{i=1}^{n} \beta_{ij} = 0, \sum_{i=1}^{n} \theta_i = 0 \tag{3}$$

Homogeneity constraint**:** The AIDS demand model is based on the assumption that it is homogenous of zero degree, meaning that the increase in prices and income available to spend on the goods studied in the same proportion does not result in a relative increase in the quantities imported from this commodity. About the parameters of the model:

$$\sum_{j=1}^{n} \beta_{ij} = 0 \tag{4}$$

Symmetry constraint: This limitation shows how cross-elasticities are associated. To achieve this limitation, the following assumptions must be made:

$$\beta_{ij} = \beta_{ji}, \quad i \neq j = 1,2,...,n \tag{5}$$

Negativity constraint: This limitation means that the Slutsky compensatory matrix, which includes all the own and cross-elasticities, must be semi-specific and negative. This matrix is the same as the class and takes the following form:

$$\begin{bmatrix} e_{11} & e_{12} & \cdots & e_{1n} \\ e_{21} & e_{22} & \cdots & e_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ e_{n1} & e_{n2} & \cdots & e_{nn} \end{bmatrix} \tag{6}$$

Since e_{ii} it represents the price elasticity of the own,price,-cross of elasticity the xpressese $i \neq j,\ e_{ij} = e_{ji}$ and this restriction is achieved only if some elements of the main diagonal $(e_{ii} \leq 0)$.

Calculation of elasticity's from the Indicators of the demand form AIDSM: The own and cross price elasticities can be calculated from the coefficients of the demand form AIDSM، by applying the following Marshall formula (Richard and Julian 1990),and (Nicholson, 1992):

$$e_{ij} = \frac{\beta_{ij} - \gamma_i(w_j - \gamma_j \ln(m/P))}{w_i} - \delta_{ij},\ \delta_{ij} = \begin{cases} 1 & if\ i = j \\ 0 & if\ i \neq j \end{cases} \quad (7)$$

If it is $i = j$, it is possible to obtain own-elasticity Own-Price Elasticity, which expresses the extent to which the quantity imported from the State responds to the change in its price. If it is $i \neq j$, cross-price elasticity can be obtained, which expresses the extent to which the requested quantity of the State i responds to the change in the price of the imported commodity from the State j.

Income Elasticity of Demand: It expresses the extent to which the imported quantity of the exporting country responds to the change in the income of the importer and is measured by the percentage change in the quantity imported from the commodity to the relative change in income.

$$\eta_i = 1 + \frac{\gamma_i}{w_i},\ i = 1,2,...,n \quad (8)$$

Statistical Estimation of the Demand Form AIDSM: In the case of compensation by the formula equation $\log_e(P_t)$, on the right side of equation (2), the State's share i of the total expenditure on imports in the period of time t becomes non-linear in the coefficients and can be expressed as follows:

$$w_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} \log_e(p_{jt}) + \gamma_i \{\log_e(m_t) - \alpha_0 - \sum_{j=1}^{n} \alpha_j \log_e(p_{jt}) - \frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} \log_e(p_{it}) \log_e(p_{jt})\} \quad (9)$$

Since the exporting countries n of total expenditure share w_{nt} on imports of imported goods from the countries under study can be deduced from other shares, of equations of number the $[w_{nt} = 1 - \sum_{i=1}^{n-1} w_{it}]$ expenditure in the model systems of demand for imports of goods from countries is equivalent and expressed as follows:

$$\begin{bmatrix} w_{1t} \\ w_{2t} \\ ..... \\ w_{(n-1)t} \end{bmatrix}' = \begin{bmatrix} \alpha_1 + \sum_{j=1}^{n} \beta_{1j} \log_e(p_{jt}) + \gamma_1 \{\log_e(m_t) - Log_e P_t\} + \varepsilon_{1t} \\ \alpha_2 + \sum_{j=1}^{n} \beta_{2j} \log_e(p_{jt}) + \gamma_2 \{\log_e(m_t) - Log_e P_t\} + \varepsilon_{2t} \\ ..... \\ \alpha_{n-1} + \sum_{j=1}^{n} \beta_{n-1,j} \log_e(p_{jt}) + \gamma_{n-1} \{\log_e m_t - Log_e P_t\} + \varepsilon_{n-1,t}, \end{bmatrix}'$$

$$t = 1,2,...,T \quad (10)$$

The above equation contains $\{(n(n+2)\}$ an anonymous parameter:

$$B = (\alpha_0, \alpha_1, ..., \alpha_n, \beta_{11}, \beta_{12}, ..., \beta_{nn}, \gamma_1, ..., \gamma_{n-1})' \quad (11)$$

It can then be estimated using the nonlinear least squares method, a characteristic of nonlinear least squares (NLS) estimates are consistent, and its distribution close to normal distribution when the sample size is sufficiently large, Greene(2003). In order to obtain this estimate, tests can be made of the significance of regression coefficients, tests for verifying form limitations, and tests on the significance of the own and cross-elasticities, as well as the elasticity of income or expenditure.

Data sources: In order to achieve the above research objectives, the study was relied on time series data from 1990 to 2016, obtained from the publications of imports and foreign trade of the General Organization for Statistics (appendix 1). This series included data on the quantity of imports q_{it} of frozen chicken meat, as well as spending values m_{it} On these quantities, the price data series has been calculated $p_{it} = m_{it} / q_{it}$ appendix 1 presents this data.

Description of the Saudi demand form on imported broiler chickens: The study includes the application of the almost-ideal demand model for Saudi imports of chicken broilers from Brazil, France and other countries $i\ i = 1,2,3$ in the following equations:

$$w_{it} = \alpha_i + \sum_{j=1}^{3} \beta_{ij} \log_e(p_{ij}) + \gamma_i \{\log_e(m_t) - \alpha_0 - \sum_{j=1}^{3} \alpha_j \log_e(p_{jt}) - \frac{1}{2} \sum_{i=1}^{3} \sum_{j=1}^{3} \beta_{ij} \log_e(p_{it}) \log_e(p_{jt})\} \quad (12)$$

As m_t it reflects the total expenditure in thousand riyals on Saudi imports of broilers chicken from the three countries $\{m_t = p_{1t}q_{1t} + p_{2t}q_{2t} + p_{3t}q_{3t}\}$, (q_{3t}, q_{2t}, q_{1t}) The quantities imported are expressed in tones of broiler chickens from the three countries (Brazil, France and other countries), respectively, over the period of time t, $t = 1,2,...,36$, (p_{3t}, p_{2t}, p_{1t}) Prices of

broilers chicken are expressed in thousands of riyals per ton from Brazil, France and other countries, respectively, over the period of time t, Since the number of equations is three, the systems of equations to be evaluated include two equations:

$$\begin{aligned}
\textit{Brazil eq.}\quad w_{1t} &= \alpha_1 + \sum_{j=1}^{3}\beta_{1j}\log_e(p_{jt}) + \gamma_1\{\log_e(m_t) - \alpha_0 - \sum_{j=1}^{3}\alpha_j\log_e(p_{jt}) \\
&\quad -\frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3}\beta_{ij}\log_e(p_{it})\log_e(p_{jt})\}Log_eP_t\} + \varepsilon_{1t} \\
\textit{France eq.}\quad w_{2t} &= \alpha_2 + \sum_{j=1}^{3}\beta_{2j}\log_e(p_{jt}) + \gamma_2\{\log_e(m_t) - \alpha_0 - \sum_{j=1}^{3}\alpha_j\log_e(p_{jt}) \\
&\quad -\frac{1}{2}\sum_{i=1}^{3}\sum_{j=1}^{3}\beta_{ij}\log_e(p_{it})\log_e(p_{jt})\}Log_eP_t\} + \varepsilon_{2t}, \\
t &= 1,2,...,36
\end{aligned} \tag{13}$$

Limitations of the Saudi demand Form on imported broiler chickens:

Constraints of addition, homogeneity and symmetry are expressed in the following equations:

(Adding up): $\{\alpha_1 + \alpha_2 + \alpha_3 = 1\}$ (14)

(Homogeneity): $\left\{\begin{matrix}\beta_{11}+\beta_{12}+\beta_{13}=0\\ \beta_{21}+\beta_{22}+\beta_{23}=0\\ \beta_{31}+\beta_{32}+\beta_{33}=0\end{matrix}\right\}$ (15)

(Symmetry): $\left\{\begin{matrix}\beta_{12}=\beta_{21}\\ \beta_{13}=\beta_{31}\\ \beta_{23}=\beta_{32}\end{matrix}\right\}$ (16)

Negativity is achieved only if the compensatory matrix of Slutsky, which includes all the own and cross-elasticities, is

$$\begin{bmatrix} e_{11} & e_{12} & e_{13} \\ e_{21} & e_{22} & e_{23} \\ e_{31} & e_{32} & e_{33} \end{bmatrix} \tag{17}$$

Semi-specific negativity, or that some of the main diameter elements must be $(e_{ii} \le 0)$.

(SAS 9.2, 2008) program was used to obtain the results of the applied study that achieved the research objectives. A program in Appendix 2 was designed to obtain the following outputs**:**

- Tabular presentation of market shares.
- Results of the estimates of the non-linear NLSs for the coefficients of the regression of the market shares shown in Equation Systems (13) The results of the tests of the restrictions placed on the Saudi application form under study (adding up equation (14), the homogeneity equations (15), and the equivalence equations (16).
- Estimates of price and income elasticities. Appendix 2 shows the sentences and phrases of this program.

RESULTS AND DISCUSSION

First: Market shares of the exporting countries of broilers chicken to Saudi Arabia.

Table 1 shows the market shares of the exporting countries, the average of import values from Brazil about 1590 million riyals represented 72.2%, while the average of import values from France about 588 million riyals represented 25.3% from total imports of chicken meat. Brazil represents the largest source for chicken meat to Saudi Arabia.

Table 1. Average values and market shares (%) of chicken meat during (2016-1990).

Country	Average value (thousands riyals)	Market share (%)
Brazil	1589806	72.2
France	558304	25.3
Other countries	54576	2.5
Total	2202686	100

Source: computed from appendix 1 data.

Second: The results of the non-linear least squares estimates (NLS) for parameters of equations system (13).

The Saudi demand system consists of the imported broiler chickens in this study of three equations that represent the expenditure shares $(n = 3)$. Therefore, the coefficients of the equation systems (13), which consist of two equations, are represented. The first equation is the share of expenditure on the quantities imported from Brazil (w_{1t}) the second is the share of expenditure on imports from France (w_{2t}), Assuming that the constant price index equation $(\alpha_0 = 0)$, the number of parameters estimated are, $\{n(n+2)-1=14\}$ parameter represented by vector $B = (\alpha_1, \alpha_2, \alpha_3, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{21}, \beta_{22}, \beta_{23}, \beta_{31}, \beta_{32}, \beta_{33}, \gamma_1, \gamma_2)'$.

Table (2) presents the results of the NLS estimation for these parameters.

Table 2. Results of NLS estimates for the parameters of equation systems (13).

Parameter	Estimate	Approx Standard Error	t Value	Approx Pr > |t|
α_1	0.4592	0.6021	0.76	0.454
β_{11}	-0.1720	0.1902	-0.9	0.376
β_{12}	0.2719	0.1866	1.46	0.159
β_{13}	-0.0999	0.0421	-2.37	0.027
γ_1	0.0003	0.0512	0.01	0.996
θ_1	0.0144	0.0038	3.83	0.001
α_2	0.3414	0.5754	0.59	0.559
β_{21}	0.2719	0.1866	1.46	0.159
β_{22}	-0.3823	0.1990	-1.92	0.068
β_{23}	0.1104	0.0620	1.78	0.089
γ_2	0.0116	0.0489	0.24	0.814
θ_2	-0.0134	0.0036	-3.72	0.001
α_3	0.1994	0.0324	6.15	<.0001
β_{31}	-0.0999	0.0421	-2.37	0.027
β_{32}	0.1104	0.0622	1.78	0.090
β_{33}	-0.0105	0.0426	-0.25	0.807
$\gamma_3 = 0 - \gamma_1 - \gamma_2$	-0.0119	0.0116	-1.03	0.315
θ_3	-0.0011	0.0009	-1.23	0.232

Source: Computed from the data of appendix No. (1)

we note from test statistics; t and calculated significance; $Pr > |t\ value|$ that, in market share of Brazil both regression coefficients β_{13}, θ_1 significant at 0.05 while the regression coefficient β_{12} significant at 0.20, while the market share of France, the regression coefficient θ_2 is significant at 0.01, but the regression coefficients β_{22}, β_{23} significant at 0.10 , and the market share of other countries the regression constant α_3 is significant at 0.01, the regression coefficient β_{31} is significant at 0.05.

Third: Results of model restrictions tests

Table 3. Results of the Saudi Application form AIDS.

Restrictions	Parameter	Estimate	Approx St. Error	t Value	Approx Pr > |t|
Adding up	$H_{10}: \alpha_1 + \alpha_2 + \alpha_3 = 1$	0.770	0.541	1.42	0.159
	$H_{20}: \beta_{11} + \beta_{12} + \beta_{13} = 0$	-43.730	42.597	-1.03	0.316
Homogeneity	$H_{30}: \beta_{21} + \beta_{22} + \beta_{23} = 0$	-63.904	44.565	-1.43	0.156
	$H_{40}: \beta_{31} + \beta_{32} + \beta_{33} = 0$	1.290	0.972	1.33	0.191
	$H_{50}: \beta_{12} = \beta_{21}$	9.952	4.835	2.06	0.036
Symmetry	$H_{60}: \beta_{13} = \beta_{31}$	-0.060	0.048	-1.25	0.218
	$H_{70}: \beta_{23} = \beta_{32}$	0.018	0.017	1.08	0.289

From the test statistic; t , and P_value in table 3 noted the following:

- As for the adding up constrain: since the probability $\{\Pr(t > 0.770) = 0.159\}$ is greater than the level of significance 0.05 so can accept the null hypothesis $H_{10} : \alpha_1 + \alpha_2 + \alpha_3 = 1$, as evidenced by the model system of Saudi demand equations on imported broiler meat chickens fulfills the adding up constraint.
- For homogeneity: since the probabilities are observed; $\{\Pr(t > |-43.730|) = 0.316\}$, $\{\Pr(t > 1.290) = 0.191\}$ each of them is greater than the significance level 0.05. Thus, the three null hypotheses; $H_{20} : \beta_{11} + \beta_{12} + \beta_{13} = 0$, $H_{30} : \beta_{21} + \beta_{22} + \beta_{23} = 0$, $H_{40} : \beta_{31} + \beta_{32} + \beta_{33} = 0$ can be accepted, this is evidenced by the fact that the model of Saudi demand system achieves the homogeneity constraint.
- As for the symmetry constraint: since the probabilities are observed $\{\Pr(t > |-0.060|) = 0.218\}$, $\{\Pr(t > 0.018) = 0.289\}$, each is greater than the significance level 0.05, the null hypothesis can be accepted $H_{60} : \beta_{13} = \beta_{31}$, $H_{70} : \beta_{23} = \beta_{32}$, this is evidenced by the fact that the model of Saudi demand equations on imported broiler meat chickens achieve certain limitations of symmetry.

Fourth: Results of calculating the elasticities: From the results of the estimates of the regression coefficients of model (13) , the own and cross price elasticities were calculated by applying equation (7), as well as the expenditure elasticities by applying equation (8) at the averages of expenditure share; of average the nda , $\overline{w}_3 = 0035$, $\overline{w}_2 = 0.301$, $\overline{w}_1 = 0.664$ in summarized were results het , $Log_e(m/\hat{P}) = 12.612$ table (4).

Table 4. The own-price, cross elasticities and the elasticity of the expenditure.

Income elasticity	Price and cross elasticities			country
	Other countries	France	Brazil	
1.0004***	-0.1505**	0.4095	-1.2594***	Brazil
1.0386***	0.3591*	-2.2743***	0.8766	France
0.6568*	-1.2397	3.2352*	-2.6522**	Other countries

Source: Calculated from the results of regression estimates of the model shown in Table (2)
*Elasticity is significant at a significant level 0.1, **Elasticity is significant at a significant level 0.05, ***Elasticity is significant at a significant level 0.01

From the table above, we note the following:

Saudi demand for imported broiler chickens from Brazil

- The own-price elasticity e_{11} is significant at a significant level of 0.01, and its estimate is $\hat{e}_{11} = -1.2594$ that the Saudi demand for broiler chickens from Brazil is elastic to the import price of broiler chickens from Brazil and that the increase in the import price of Brazil 10% leads to the reduction of the required quantity of broiler chickens imported from Brazil in the rate of 12.6% .
- The cross-price elasticity e_{12} is insignificant at a significant level of 0.05, and its estimate $\hat{e}_{12} = 0.4095$ indicates that the Saudi demand for broiler chickens is less elastic for the import price of France, and that the increase in the import price of France 10% leads to an increase in the quantity requested from Brazil 4.09% .
- The cross price elasticity e_{13} is significant at a significant level of 0.05, and its estimate $\hat{e}_{13} = -0.1505$ indicates that the Saudi demand for chicken broilers is less elastic for the import price of other countries. The increase in the import price of other countries by 10% a percentage leads to a decrease in the amount required from Brazil by 1.50% .
- The demand elasticity of the expenditure η_1 is significant at a significant level of 0.01, and is estimated $\hat{\eta}_1 = 1.0004$ to indicate that the Saudi demand for broiler chickens from Brazil is relatively elastic for the total expenditure on broiler chickens imported from the countries under studied and that the increase in total expenditure 10% increases the quantity required From Brazil by 10% .

Saudi demand for imported broiler chickens from France

- Own-price elasticity e_{22} at a significant level of 0.01, and its estimation is $\hat{e}_{22} = -2.2743$ that the Saudi

demand for broiler chickens from France is elastic for the price of imported broiler chickens from France, and the increase in the import price of France 10%, which had leads to a reduction in the quantity requested from France 22.7%.

- The cross-price elasticity e_{21} is significant at a non-significant level at 0.05, and its estimate $\hat{e}_{21} = 0.8766$ indicates that the Saudi demand for broiler chickens from France is less elastic for the import price of Brazil, and that the increase in Brazil's import price 10% leads to an increase in the quantity requested from France 8.8%.

- The cross price elasticity e_{23} is significant at a non-significant level of 0.05, and its estimate for demand Saudi The that sindicate $\hat{e}_{23} = 0.3591$ chicken broilers from France is less elastic for the import price of other countries. The increase in the import price of other countries 10% leads to an increase in the quantity requested from France 3.59%.

- The elasticity of the expenditure demand η_2 is significant at a significant level of 0.01. It is estimated $\hat{\eta}_2 = 1.0386$ that the Saudi demand for broiler chickens from France is equivalent to the elasticity of the total expenditure on broiler chickens imported from the countries under studied. And that the increase in total expenditure by 10% percent leads to an increase in the amount requested from France by 10.3%.

Saudi demand for broiler chickens imported from other countries:

- The own-price elasticity e_{33} is significant at a significant level of 0.01, and its estimation is $\hat{e}_{33} = -1.2397$ that the Saudi demand for broiler chickens from other countries is elastic for the import price of broiler chickens from other countries, and that the increase in the import price from other countries 10% leads to a decrease in the required quantity of other countries by 12.4%.

- The cross price elasticity e_{31} is significant at a significant level of 0.05, and its estimate $\hat{e}_{31} = -2.652$ indicates that the Saudi demand for broiler chickens from other countries is elastic for the import price of Brazil, and that the increase in the Brazilian import price 10% increases the quantity requested by other countries by 26.5%.

- The cross price elasticity e_{32} is significant at a significant level of 0.10, and its estimate $\hat{e}_{32} = 3.2352$ indicates that the Saudi demand for broiler chickens is elastic for the import price of France, that the increase in the price of the importation of France by 10% percent leads to increase the quantity requested from other countries by 32.4% a percentage.

- The elasticity of the expenditure demand η_3 is significant at a significant level of 0.10. It is estimated $\hat{\eta}_3 = 0.6568$ that Saudi demand for broiler chickens from other countries is less elastic for the total expenditure on broiler chickens imported from the countries under studied. And that the increase in total expenditure by 10% percent leads to an increase in the amount requested from other countries by 6.7%.

Predicting the required quantities of imported broiler chickens during the period 2017-2025: The growth rates of the imported quantities as well as the expenditure on imports were calculated using the following equation: (Almalah , 2002)

$$\hat{Q}_{i,T+n} = Q_{i,T}\left[\left(1 + e_{ii}\, rp_i\right)\left(1 + \eta_i\, rm_i\right)\right]^n \qquad (18)$$

where $\hat{Q}_{i,T+n}$: Express the amount of demand of broiler chickens imported from the state number i, and predicted after the years following the last year $\hat{Q}_{i,T}$. This represents rp_i the annual rate of growth in the import price of broiler chickens from the State i, rm_i which represents the annual growth rate of expenditure on imports of broiler chickens from the State i. By applying equation (18), the demand quantities were obtained during the period from 2017 to 2025, and the results summarized in table 5.

Table 5. prediction of demand quantities during the period 2017-2030.

Year	Quantity forecasted from Brazil		Quantity forecasted from France		Quantity forecasted from other countries	
	e_{11} = -0.013	rp_1 = 0.083	e_{22} = -0.023	rp_2 = 0.023	e_{33} = -0.012	rp_3 = 0.0011
	η_1 = 1.000	rm_1 = 0.105	η_2 = 1.039	rm_2 = 0.043	η_3 = 0.657	rm_3 = 0.021
2016	509772		120812		6756	
2017	562724		126167		6847	
2018	621177		131759		6939	
2019	685702		137600		7032	
2020	756929		143699		7127	
2021	835555		150068		7223	
2022	922348		156720		7320	
2023	1018157		163666		7419	
2024	1123918		170921		7518	
2025	1240664		178497		7620	
Average	827694.6		147990.9		7180.1	

It is clear that the quantities predicted under equation (18) are expected to increase during the period 2016-2025 for the Kingdom's demand for broiler chickens imported from Brazil, France and other countries.

During the results achieved with respect to the sown and cross-elasticities, the expenditure and the predicted values during the period 2016-2025 we recommend the following:

1- Need to expand local production so as to increase own-sufficiency.

2. Need to broiler chickens for the, imports of broiler chickens from the Brazilian state.

3. Identify the spatial demand for directing producers to high consumption places in the framework of production and marketing.

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REFERENCES

Akinbode, S. O. (2015). A linear approximation almost ideal demand system of food among households in South-West Nigeria. Int. J. Soc. Econ. 42 (6): 530-542

Almalah, G. F. (2002). The economic approach to market research: analytical tools for Studying demand supply and prices. 1st Ed. Hofuf authoring, translation, and Publishing Center; King Fasial University (Saudi Arabia).240 p (in Arabic)

Deton, A., and J. Muelbauer (1980). An almost ideal demand system. AM. ECON. REV. 70 (3): 312-326.

Greene, W. H. (2003). Econometrics Analysis. 5th Ed. New Jersey, 07458, Prentice Hall, Pearson Education International; USA.

Nicholson, W. (1992). Microeconomic theory: Basic principles and extension. 5th Ed. In Fort Worth: by Dryden Press; NewYork:168-169.

Richard, G., and M. A. Julian (1990). Elasticities in AIDS Models. AM. J.AGR. ECON. 72(2) : 442-445.

Sacli, Y., and O. Ozer (2017). Analysis of factors affecting red meat and chicken meat consumption in Turkey using an ideal demand system model. Pakistan J. Agri. Sci. 54(4): 933-942.

SAS 9.2 (2008). SAS institute Inc., Cary, NC; USA.

Yang, S.R., and W.W. Koo (1994) . Japanese meat import demand estimation with the source Differentiated AIDS model. J. AGR. RESOUR. ECON. 19(2):396-408.

Zhang ,H., J. Wang ,and W. Martin (2018). Factors affecting households' meat purchase and future meat consumption changes in China: a demand system approach. J. Ethnic Food 5(1):24-32.

Appendix. (1). data on imported quantities of broiler chickens from Brazil, France and other countries.

Year	Brazil		France		Other countries	
	quantity ton	Value (1000SRD)	quantity ton	Value (1000SRD)	quantity ton	Value (1000SRD)
1990	96473	429346.1	97169	475083.6	15564	73233.12
1991	109984	551806.3	104322	541212.4	8805	43525.21
1992	76034	343416.7	71918	359492.9	12738	62882.03
1993	84992	381545.2	68225	316461	5505	25224.02
1994	57833	256564	68685	309392.3	6841	29746.99
1995	126168	612993.5	107421	517624.2	15610	71680.03
1996	108364	565836.7	112258	530386.5	9388	49604.97
1997	118243	661582.6	75051	409770.2	4590	29212
1998	153174	718539.2	93606	441996.3	3748	20944.99
1999	28530	205956.1	25638	140087.1	2720	13406.99
2000	163124	674181.7	72233	308726.7	7754	41018.97
2001	197908	716432.9	46580	222185.2	12997	65081.05
2002	195235	695883.9	38491	148375.1	9545	42264.97
2003	230792	924702.8	85106	367177.9	30272	133581
2004	268774	1175389	81784	352789.2	11070	50620.01
2005	331817	1661063	86683	423822.7	7449	35274.96
2006	304971	1470592	75429	344273	3965	18704.02
2007	343075	1931111	78533	453428.3	7667	43343.01
2008	320266	2604864	92374	732978.5	10581	84643.98
2009	390195	2600170	94369	614389.4	9189	62580.03
2010	447300	3073935	111578	754108.8	7847	50266
2011	471596	3941557	145451	1214027	9560	77386
2012	458502	3655164	146803	1134538	9111	71427.96
2013	464697	4029485	151506	1272088	10473	91007.96
2014	366122	2647428	121466	915286.4	6936	50201.03
2015	443321	3311085	139409	1047523	13313	96250.99
2016	509772	3084131	120812	726976.5	6756	40435

Source: General Authority for Statistics (1990-2016)