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Estimation of Demand for Major Crops in Egypt Using Almost Ideal Demand Model

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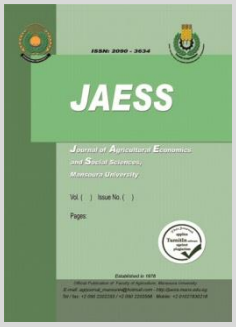

ABSTRACT

Promoting exports development and reduction of imports are top priorities on Egypt's economic development agenda as tools to reduce the sharp deficit in the balance of trade, to which wheat and corn imports are main contributors due to the fact that domestic production fails to meet national consumption from both crops. Such imports pose a heavy burden on Egypt's Balance of Payments, where imports from the two crops reached US$ 2.65 and 1.74 billion, respectively, representing 20.37% and 13.38% of the total value of food imports during 2017, estimated at US$ 13 billion. The Government also devotes great attention to boosting rice and potato exports to accelerate development in the context of global changes leading to increased competition among nations to acquire the largest share of markets, which depends not only on domestic production but also on the competitive advantage of the exported commodity. Needless to say, competitive advantage is the outcome of interaction between a combination of several factors such as growth, economic stability, private sector development, education, training, productivity, efficiency and degree of integration with the global economy.

Keywords: Almost Ideal Demand Model, Exports, Imports, Price- and Cross-Elasticity of Demand, Elasticity of Expenditure.

INTRODUCTION

Wheat and maize come are main food crops in Egypt. The growing increase in population at a rate higher than the rate of increase in wheat and maize planted areas resulted in domestic production that fails to meet national consumption from the two crops. As a result, the Government of Egypt resorts to imports from abroad to cover domestic demand, which poses a burden on the Balance of Payments, where the imports value of the two crops reached US$ 2.65 and 1.74 billion, respectively, representing 20.37% and 13.38% of the total value of food imports in 2017, estimated at US$ 13 billion *(CAPMAS,2017).* Main findings indicate that the Russian Federation, Ukraine and the United States of America represent the largest wheat exporters to Egypt, with export quantities amounting to 6.51, 2.13 and 0.219 million tons in 2017, respectively, indicating that wheat imports from the three countries accounted for 73.67% of Egypt's total wheat imports during 2017, estimated at 12.025 million tons. On the other hand, Argentina, Brazil and the USA represent the largest corn exporters to the Egypt, with export quantities amounting to 2.64, 2.11 and 0.257 million tons in 2017, respectively, indicating that corn imports from the three countries accounted for 56.85% of Egypt's total corn imports during 2017, estimated at 8.807 million tons *(Comtrade, 2017).*

Rice also occupies an important position in Egypt's economy. In 2017, domestic rice consumption reached 5.64 million tons representing 113.71% of Egypt's total rice production, estimated at 4.96 million tons. Self-sufficiency in rice reached 87.96% and per capita annual share reached around 38.7 kg *(CAPMAS,2017).* Rice cultivated area is estimated at 1.317 million acres or 20.58% of the total area under summer crops and 8.21% of the total cropped area *(MALR, 2017).* Rice is an important export crop and a hard currency earner, where rice exports value has been estimated at US$ 24.277 million in 2016 *(Trade Map, 2016).* However, the crop has been facing some problems lately, especially the problem of limited water resources, which made the Government of Egypt adopt the policy of reducing rice planted area and banning rice exports. Such decisions resulted in negative impacts on hard currency earnings and self-sufficiency in rice.

Potato crop is also one of the most important vegetable crops in Egypt, where it retains a privileged position among vegetable crops in terms of production, consumption and exports due to the nutritional value it holds, and the fact that it is a processing crop. Potato represents an important component of human food and is considered the staple food crop for many nations, especially for population of the European continent. Such importance has been reflected in the economics of potato production and the diversified varieties produced to meet the needs of consumers at the local and global levels *(Mostafa, 2016).*

Area under potato reached around 414.86 thousand acres or 22.08% of the total area under vegetable crops, estimated at 1.879 million acres. On the other hand, total potato production reached around 4.84 million tons representing 24.87% of Egypt's total vegetable production, estimated at US$19.458 million tons *(MALR, 2017).* Potatoes' exports value amounted to some US$206.858

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thousand or 10.90% of the total value of Egypt's agricultural exports, estimated at US$ 1.898 billion, which in turn represents around 7.86% of Egypt's total exports value, estimated at US$26.1 billion in 2017 *(CAPMAS, 2017).*

Due to the economic importance of wheat, corn, rice and potatoes as major import and export strategic crops for Egypt, the designed agricultural policies usually aim to maximize revenues from major exports and minimize spending on major imports to provide the hard currencies required to finance Economic development plans. Recently, however, rice has been influenced with the problem of limited irrigation water, which made the Government adopt the policy of reducing rice cultivated area and banning exports. Such governmental measures regarding rice, as well as the brown mould disease that led to successive decisions by the European Commission to ban imports of Egyptian potatoes, resulted in negative impacts on Egypt's economy. To achieve the research objectives, demand functions for wheat and corn imports, and for rice and potato exports to main foreign markets, have been estimated using Almost Ideal Demand Model to assess the economic impacts of the EC's decision to ban imports of Egyptian potatoes, in addition to assessing the impacts of decisions issued by the Government of Egypt regarding rice.

MATERIAL AND METHODS

Almost Ideal Demand Model *(Abu Talib and Amer, 2009)* differs from traditional models used in demand estimation in that it takes into account differences in commodity sources. The Model also includes special restrictions on the demand functions related to commodity sources, explains the changes that occur in demand, and illustrates the degree of competition between different sources. It provides economic policy with estimates regarding the degree to which demand responses to prices and expenditure on imports. The problem of aggregation bias is eliminated in import sources under this model, and the expenditure function in the model reflects the behavior and pattern of imports that differentiate between or separate the sources of import. In addition, it allows identifying the main influencing factors and analyzing the competitive relationship between import sources. The model relies on the value of expenditure on the commodity, i.e., its share in total expenditure instead of the quantity of each single commodity separately.

AID model has been presented by *(Deaton & Mullbauer, 1980).* It is characterized by being a flexible, easy-to-use model. It is more applied in economic studies, but when applied, it either assumes aggregation at the level of the commodity, in which case it does not differentiate or distinguish between commodities according to the source of import. This assumption is possible in case commodity prices change by the same proportion, but it appears to be a difficult assumption in case of exported agricultural commodities due, inter alia, to the different quality of commodities and custom tariffs, differences in procurement contracts, and different storage and transport services. The second assumption is the complete separation between commodities by the source of import, which might contradict logic *(Deaton, 1974).* Therefore, and due to the importance of differentiating between the sources of import in analyzing demand for imports, some economic studies suggested using this model as it allows distinguishing between the sources from where commodities are imported without imposing strict separation *(Seung and Won, 1994).* Assuming that the expenditure function of Utility U, which assumes distinction between commodities according to source of import, can be derived as follows *(Abu Talib, 2007):*

$$\mathbf{Ln\,[E(P,U)] = (1-U)\,Ln\,[a(P)] + U\,Ln\,[b(P)]} \quad (1)$$

$$\mathbf{Ln\,[a(P)] = \alpha_0 + \Sigma\,\alpha_k\,Ln\,P_k + \tfrac{1}{2}\,\Sigma_k\Sigma_j\,\gamma_{kj}\,Ln\,P_k\,Ln\,P_j} \quad (2)$$

$$\mathbf{Ln\,[b(P)] = Ln\,[a(P)] + \beta_0 \prod_k P_k^{\beta_k}} \quad (3)$$

Substituting equations (2) and (3) in equation (1), we get the following expenditure function:

$$\mathbf{Ln\,[E(P,U)] = \alpha_0 + \Sigma\,\alpha_k\,Ln\,P_k + \tfrac{1}{2}\,\Sigma_k\Sigma_j\,\gamma_{kj}\,Ln\,P_k\,Ln\,P_j + \beta_0\,U \prod_k P_k^{\beta_k}} \quad (4)$$

Differentiating Ln [E(P,U)] with respect to Ln P_i, we get the imported commodity's share from expenditure W_i as follows:

$$\frac{\partial \mathrm{Ln}\,[\mathrm{E}(\mathrm{P},\mathrm{U})]}{\partial \mathrm{Ln}\,\mathrm{P}} = \frac{P_i q_i}{\mathrm{E}(\mathrm{P},\mathrm{U})} = \mathrm{W_i} \quad (5)$$

Equation (4) can therefore be rewritten as:

$$\mathbf{W_i = \alpha_i + \Sigma_j\,\gamma_{ij}\,Ln\,P_j + \beta_i\,U\,\beta_0 \prod_k P_k^{\beta_k}} \quad (6)$$

Solving equation (4) for Utility (U) and substituting in equation (6) we get W_i:

$$\mathbf{W_i = \alpha_i + \Sigma_j\,\gamma_{ij}\,Ln\,P_j + \beta_i\,Ln\left(\frac{E}{P_{index}}\right)} \quad (7)$$

Where,

$$\mathbf{Ln\,(P_{index}) = \alpha_i + \Sigma_k\,\alpha_k\,Ln\,P_k + \tfrac{1}{2}\,\Sigma_k\Sigma_j\,\gamma_{kj}\,Ln\,P_k\,Ln\,P_j} \quad (8)$$

Since P_{index} is considered non-linear and contains estimation problems, it has been replaced by Stone Price Index, as follows:

$$\mathbf{Ln\,(P_{spi}) = \Sigma_i\,W_i\,Ln\,P_i} \quad (9)$$

And since W_i refers to the percent of expenditure, in addition to representing the dependent variable in the equations, using price index might cause some simultaneous problems in the model's equations, the reason why lags are used, as follows:

$$\mathbf{Ln\,(P_{spi}) = \Sigma_i\,W'_i\,Ln\,P_i} \quad (10)$$

Where,

$$\mathbf{W'_i = \tfrac{1}{2}\,(W_{it} + W_{it-1})} \quad (11)$$

P_{index} can be considered an approximation of P_{spi} in case a high degree of multicollinearity exists in prices. Accordingly, equation (7) becomes:

$$\mathbf{W_i = \alpha_i + \Sigma_j\,\gamma_{ij}\,Ln\,P_j + \beta_i\,Ln\left(\frac{E}{P_{spi}}\right)} \quad (12)$$

Under relevant constraints on the parameters α, β, γ, equation (12) must satisfy the following conditions:

- Additivity $\quad \Sigma_i\,\alpha_i = 1,\ \Sigma_i\,\gamma_{ij} = 0,\ \Sigma_i\,\beta_i = 0$
- Homogeneity $\quad \Sigma_j\,\gamma_{ij} = 0$
- Symmetry $\quad \gamma_{ij} = \gamma_{ji}$ for $i \neq j$

The importance of such conditions originates from the fact that it makes the model comply with the theory of consumer demand *(Abu Talib and Begawe, 2006),* where the additivity condition guarantees that the sum of budget shares add up to 1 (i.e., $\Sigma_i W_i = 1$). The second condition guarantees homogeneity of degree 0 in prices and total

expenditure, and the symmetry condition guarantees satisfying symmetry of the Slutsky matrix.

Where α, β, γ are the model parameters; P_i stands for the price of commodity from source/origin i; b(?) and a(?) are functions in the model parameters; m is the number of export sources/origins; W_i is the imported commodity's share of expenditure; p_i and q_i are the price and quantity of commodity from source/origin i, respectively; E is total expenditure on the commodity from all sources; P_{index} is the price index; and P_{spi} is Stone Price Index.

Own and Cross-price elasticity of demand and Elasticity of Expenditure are computed as follows *(Green, 1960):*

- Own and cross-price elasticity of demand is a matrix of order (m x m):

$$\varepsilon_{Own,\ Cross} = -\delta_{ij} + (\gamma_{ij}/W_i) - \beta_i (W_j / W_i)$$

Own-price elasticity of demand (matrix diagonal):

$$(\delta_{ij} = 1, \text{where } i = j)$$

Cross-price elasticity of demand (off diagonal):

$$(\delta_{ij} = 0, \text{where } i \neq j)$$

- Elasticity of Expenditure:

$$\varepsilon_{expend} = 1 + (\beta_i / W_i)$$

To verify the obtained results, the relationship between the estimated elasticities of expenditure and the imported commodity's share of expenditure is measured by:

$$\Sigma_i W_i\ \varepsilon_{expend} = 1$$

Autocorrelation has been checked using Breusch Godfrey's test; heteroscedasticity in residual has been checked using Engel test; and non-normal distribution of the error term has been checked using Jarque- Bera test. In case the obtained results are insignificant, the equation is free of estimation problems. In order to estimate the parameters in equation (12) simultaneously, Zellner's Seemingly Unrelated Regression (SUR) Model has been applied. As for the source of data, the research relied on data published by the United Nations for the period 2000-2017.

3. Sources of -Data

The research relied on published and unpublished secondary data from various sources, including the Ministry of Agriculture and Land Reclamation (MALR), the Central Agency for Public Mobilization and Statistics (CAPMAS), the National Planning Institute, websites of Food and Agriculture Organization of the United Nations, the United Nations, cometrade and trade map, in addition to other websites specialized in publishing data statistics. The research also used some references and researches relevant to the study subject.

RESULTS AND DISCUSSION

1. Wheat in the Egyptian Market

The Russian Federation, Ukraine and the United States of America represent the top wheat exporters to Egypt, with export quantities amounting to 6.51, 2.13 and 0.219 million tons in 2017, respectively, indicating that wheat imports from the three countries accounted for 73.67% of Egypt's total wheat imports during 2017, estimated at 12.025 million tons. Data in table 1 indicate that the estimated model is statistically significant, with no estimation problems that might negatively affect the model's efficiency. Validity of the estimated model has also been verified. The estimated price elasticities of demand for Russian wheat in the Egyptian market, presented in table 2, indicate that a 1% increase in wheat export prices leads to reducing demand for the crop by 11.899%, which means that demand for wheat in the Egyptian market is elastic.

Table 1. Results of Estimating AID Model for Wheat crop in the Egyptian Market over the Period 2000-2017

Country	Russian Federation			Ukraine			USA		
	Coeffi	t-stat	Prob.	Coeffi	t-stat	Prob.	Coeffi.	t-stat	Prob.
α	-225.518	-2.330	0.020	-126.039	-2.710	0.007	451.600	3.970	0.000
LnP_1	-0.832	-0.080	0.940	14.426	2.720	0.006	-13.600	-1.050	0.294
LnP_2	23.589	1.840	0.066	-2.887	-0.470	0.640	-20.695	-1.370	0.170
LnP_3	6.664	0.550	0.581	-0.676	-0.120	0.907	-5.986	-0.420	0.673
$\ln (Y / \tilde{P})$	10.881	1.170	0.243	7.446	1.660	0.097	-18.333	-1.670	0.095
$\bar{R}^2$	0.583			0.808			0.618		

Source: http://comtrade.un.org/db.

The estimated cross-elasticities of demand indicate that a 1% increase in the prices of wheat exported to Egypt from countries competing in the Egyptian market (Ukraine and the United States of America) leads to reducing demand for the crop in the Egyptian market by 3.229% and 8.342%, respectively. In addition, the estimated cross-elasticities of demand for countries competing Russia in the Egyptian market indicate that a 1% increase in the prices of wheat exported to Egypt from such counties leads to changing demand for the crop by 20.833% and 23.144%, respectively, which means that a substitution relationship exists between wheat exported by Russia and that exported by Ukraine in case wheat export price of any of them increases, while a complementary relationship exists between wheat exported by Russia and that exported by the USA in the case the export prices of Russian and American wheat increase, respectively, due to quality standards.

Table 2. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Wheat crop in the Egyptian Market over the Period 2000-2017

Country	Own and Cross-Price Elasticity of Demand			Elasticity of Expenditure	W_i
	Russian Federation	Ukraine	USA		
Russian Federation	-11.899	-3.229	-8.342	1.231	58.00 %
Ukraine	-20.833	-8.625	-17.118	1.461	23.60 %
USA	23.144	7.496	17.170	0.501	18.40 %
Verifying the Validity of the Estimated Model				$\Sigma_i W_i\ \varepsilon_{expend}$ =100.00	

Source: Table 1

The estimated elasticity of expenditure indicates that a 1% increase in real expenditure on wheat in the Egyptian market leads to increasing expenditure on Russian, Ukrainian and American wheat by 1.231%, 1.461 and 0.504%, respectively, indicating that wheat is a normal good in the Egyptian market.

2. Maize in the Egyptian Market

Argentina, Brazil and the USA represent the top Maize exporting countries to Egypt, with import quantities amounting to 2.64, 2.11 and 0.257 million tons in 2017, respectively, indicating that Maize imports from the three countries accounted for 56.85% of Egypt's total Maize imports during 2017, estimated at 8.807 million tons. Data in table 3 indicate that the estimated model is statistically significant, with no estimation problems that might negatively affect the model's efficiency. Validity of the estimated model has also been verified. The estimated price elasticities of demand for Argentinean Maize in the Egyptian market, presented in table 4, indicate that a 1% increase in Argentinean Maize export prices leads to reducing demand for the crop by 20.695%, which means that demand for Maize in the Egyptian market is elastic.

Table 3. Results of Estimating AID Model for Maize crop in the Egyptian Market over the Period 2000-2017

Country	Argentina			Brazil			USA		
	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob
α	-334.190	-2.970	0.003	-372.205	-2.540	0.011	806.426	3.450	0.001
LnP_1	41.478	0.920	0.360	5.052	0.090	0.932	-46.539	-0.490	0.621
LnP_2	-11.828	-0.260	0.796	44.459	0.750	0.454	-32.621	-0.340	0.731
LnP_3	-4.364	-0.270	0.789	-25.373	-1.200	0.232	29.738	0.880	0.380
$\ln (Y / \tilde{P})$	21.257	2.740	0.006	24.251	2.400	0.016	-45.512	-2.820	0.005
$\bar{R}^2$	0.439			0.369			0.435		

Source: http://comtrade.un.org/db.

The estimated cross-elasticities of demand indicate that a 1% increase in the prices of Maize exported to Egypt from competing countries (Brazil and the USA) leads to reducing demand for the Maize in the Egyptian market by 13.796% and 45.617%, respectively. In addition, the estimated cross-elasticities of demand for countries competing Argentinean in the Egyptian market indicate that a 1% increase in the prices of Maize exported by Argentina leads to changing demand for the crop by 38.308% and 20.456%, respectively, which means that a substitution relationship exists between Maize exported by Argentina and that exported by Brazil in case the export price of any of them increases, while a complementary relationship exists between Maize exported by Argentina and that exported by the USA in case the export prices of Argentinean and American Maize increase, respectively, which can be explained by the good quality of the exported commodity.

Table 4. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Corn in the Egyptian Market over the Period 2000-2017

Country	Own and Cross-Price Elasticity of Demand			Elasticity of Expenditure	W_i
	Argentina	Brazil	USA		
Argentina	-20.695	-13.796	-45.617	1.801	47.81
Brazil	-38.308	-22.584	-79.895	2.454	40.93
USA	20.465	12.794	45.036	0.198	11.26
Verifying the Validity of the Estimated Model				$\Sigma_i W_i \varepsilon_{expend} = 100.00$	

Source: Table 3

The estimated elasticity of expenditure indicates that a 1% increase in real expenditure on Maize in the Egyptian market leads to increasing expenditure on Argentinean, Brazilian and American Maize by 1.801%, 2.454% and 0.198%, respectively, indicating that Maize is a normal good in the Egyptian market.

3. Rice Crop

1. Egyptian Rice in the Belgian Market: Data in table 5 indicate that the estimated model is statistically significant, with no estimation problems that might negatively affect the model's efficiency. Walt test, which has been applied to test for additivity, homogeneity and symmetry conditions, proved insignificant. Validity of the estimated model has also been verified. The estimated price elasticities of demand for Egyptian rice, presented in table 5, indicate that a 1% increase in rice export prices leads to reducing demand for rice by 16.006%, which means that demand for rice in this market is elastic.

Table 5. Results of Estimating AID Model for Egyptian Rice in the Belgian Market over the Period 2000-2017

Country	Egypt			Italy			Spain		
	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob
α	-135.332	-3.220	0.001	-15.426	-0.150	0.882	250.641	2.680	0.007
LnP_1	5.468	1.290	0.198	21.200	2.020	0.043	-26.663	-2.820	0.005
LnP_2	11.463	1.440	0.149	15.512	0.790	0.430	-26.982	-1.520	0.127
LnP_3	-12.605	-1.360	0.173	-26.628	-1.160	0.245	39.228	1.900	0.057
$\ln (Y / \tilde{P})$	15.820	2.210	0.027	-0.297	-0.020	0.987	-15.501	-0.970	0.330
$\bar{R}^2$	0.682			0.416			0.706		

Source: http://comtrade.un.org/db.

The estimated cross-elasticities of demand indicate that a 1% increase in the prices of rice exported by competing countries (Italy and Spain) leads to reducing demand for the crop by 81.366% and 138.360%, respectively. Moreover, the estimated cross-elasticities of demand for countries competing Egypt, indicate that a 1% increase in the prices of rice exported by Egypt leads to changing demand for the crop by 0.657% and 1.337%, respectively, which means that a complementary and substitution relationship exists between rice exported from Egypt and that exported by competing countries.

Table 6. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Egyptian Rice in the Belgian Market over the Period 2000-2017

Country	Own and Cross-Price Elasticity of Demand			Elasticity of Expenditure	W_i
	Egypt	Italy	Spain		
Egypt	-16.006	-81.366	-138.360	3.354	22.53
Italy	0.657	-0.264	0.927	0.992	35.00
Spain	1.337	8.970	15.178	0.733	42.47
Verifying the Validity of the Estimated Model				$\Sigma_i W_i \varepsilon_{expend}$ =100.00	

Source: Table 5

The estimated elasticity of expenditure indicates that a 1% increase in real expenditure on rice in the Belgian market leads to increasing expenditure on Egyptian rice by 3.354%, which means that rice is a normal good in the Belgian market, as shown in table 6.

2. Egyptian Rice in the Saudi Market: Data in table 7 indicate that the model is free of estimation problems that might negatively affect the model's efficiency. Walt test, which has been applied to test for additivity, homogeneity and symmetry conditions, proved insignificant. Validity of the estimated model has also been verified. The estimated price elasticities of demand indicate that a 1% increase in Egyptian rice export prices leads to reducing demand for the crop by 1.564%, which means that demand for Egyptian rice in this market is elastic.

Table 7. Results of Estimating AID Model for Egyptian Rice in the Saudi Market over the Period 2000-2017

Country	Egypt			India			Pakistan		
	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob
α	2.203	0.280	0.780	57.843	3.850	0.000	39.960	3.340	0.001
LnP_1	0.155	0.170	0.861	0.345	0.200	0.838	-0.503	-0.370	0.708
LnP_2	0.457	0.320	0.748	-7.765	-2.860	0.004	7.314	3.390	0.001
LnP_3	-1.807	-1.200	0.230	6.469	2.260	0.024	-4.667	-2.040	0.041
$\ln (Y / \tilde{P})$	0.712	0.590	0.553	4.242	1.850	0.064	-4.953	-2.720	0.007
$\overline{R}^2$	0.144			0.372			0.485		

Source: http://comtrade.un.org/db.

On the other hand, the estimated cross-elasticities of demand indicate that a 1% increase in the prices of rice exported by competing countries (India and Pakistan) leads to reducing demand for rice by 59.713% and 8.852%, respectively. Moreover, a 1% increase in Egyptian rice export prices leads to changing demand for Egyptian rice by -0.046% and 0.447%, respectively, which means that the substitution relationship between rice exported from Egypt and that exported by Pakistan in case Pakistani rice export prices increase is greater than the substitution relationship in case Egyptian rice export prices increase. However, results show that a substitution and complementary relationship exists in case Egyptian and Indian export prices increase, respectively.

Table 8. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Egyptian Rice in the Saudi Market over the Period 2000-2017

Country	Own and Cross-Price Elasticity of Demand			Elasticity of Expenditure	Wi
	Egypt	India	Pakistan		
Egypt	-1.564	-59.713	-8.852	1.680	1.76
India	-0.046	-5.330	-0.590	1.048	92.71
Pakistan	0.447	42.502	3.508	0.527	5.53
Verifying the Validity of the Estimated Model				$\Sigma_i W_i \varepsilon_{expend}$ =100.00	

Source: Table 7

The estimated elasticity of expenditure indicates that a 1% increase in real expenditure on rice in the Saudi market leads to increasing expenditure on Egyptian rice by 1.680%, indicating that rice is a normal good in the Saudi market, as shown in table 8.

3. Egyptian Rice in the British Market: Data in table 9 indicate that the model is free of estimation problems that might negatively affect the model's efficiency. Results of applying Walt test (to test for additivity, homogeneity and symmetry conditions) proved insignificant. Validity of the estimated model has also been verified. The estimated price elasticities of demand for Egyptian rice indicate that a 1% increase in Egyptian rice export prices leads to reducing demand for the crop by 6.288%, which means that demand for rice in this market is elastic.

Table 9. Results of Estimating AID Model for Egyptian Rice in the UK Market over the Period 2000-2017

Country	Egypt			Italy			India		
	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob
α	-43.741	-1.910	0.056	-48.736	-0.650	0.514	192.341	2.670	0.008
LnP_1	-1.428	-0.740	0.457	-5.761	-0.920	0.359	7.184	1.190	0.235
LnP_2	1.923	0.630	0.529	27.546	2.760	0.006	-29.472	-3.070	0.002
LnP_3	0.629	0.270	0.788	-7.068	-0.920	0.356	6.446	0.870	0.382
ln (Y / $\tilde{P}$)	4.875	1.680	0.094	-3.599	-0.380	0.705	-1.259	-0.140	0.891
$\bar{R}^2$	0.314			0.512			0.588		

Source: http://comtrade.un.org/db.

On the other hand, the estimated cross-elasticities of demand indicate that a 1% increase in the prices of rice exported by competing countries (India and India) leads to reducing demand for rice by 38.800% and 96.565%, respectively. In addition, a 1% change in Egyptian rice export prices leads to increasing demand for rice from competing countries by 0.240% and 0.168%, respectively, which means that a complementary and substitution relationship exists between Egyptian rice and both Italian and Indian rice in the British market.

Table 10. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Egyptian Rice in the British Market over the Period 2000-2017

Country	Own and Cross-Price Elasticity of Demand			Elasticity of Expenditure	Wi
	Egypt	Italy	India		
Egypt	-6.288	-38.800	-96.565	2.410	8.33
Italy	0.240	3.586	9.835	0.871	24.31
India	0.168	0.083	0.353	0.982	67.36
Verifying the Validity of the Estimated Model				$\Sigma_i W_i \varepsilon_{expend}$ =100.00	

Source: Table 9

The estimated elasticity of expenditure indicates that a 1% increase in real expenditure on rice in the British market leads to increasing expenditure on Egyptian rice by 2.410%, indicating that rice is a normal good in the British market, as shown in table 10.

4. Potato Crop

1. Egyptian Potatoes in the German Market: Data in table 11 indicate that the model is free of estimation problems that might negatively affect the model's efficiency (autocorrelation, heteroscedasticity, non-linearity)[i]. Results of applying Walt test (to test for additivity, homogeneity and symmetry conditions) proved insignificant. Validity of the estimated model has also been verified. The estimated price elasticities of demand indicate that a 1% increase in Egyptian potatoes' export prices leads to increasing demand for the crop by 11.697%, which contradicts the theory of consumer demand.

Table 11. Results of Estimating AID Model for Egyptian Potatoes in the German Market over the Period 2000-2018

Country	Egypt			The Netherlands			France			Spain		
	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob
α	128.870	4.010	0.000	-54.605	-1.400	0.161	-36.982	-1.340	0.180	62.764	1.980	0.048
LnP_1	6.072	1.320	0.186	6.719	1.210	0.227	1.914	0.490	0.627	-14.705	-3.250	0.001
LnP_2	-2.717	-0.490	0.628	-11.671	-1.720	0.085	16.373	3.410	0.001	-1.984	-0.360	0.719
LnP_3	4.036	0.720	0.469	4.836	0.720	0.474	-11.423	-2.390	0.017	2.548	0.460	0.643
ln (Y / $\tilde{P}$)	-8.877	-1.860	0.062	2.214	0.380	0.701	-3.450	-0.840	0.399	10.108	2.150	0.031
$\bar{R}^2$	0.586			0.441			0.475			0.457		

Source: http://comtrade.un.org/db.

The estimated cross-elasticities of demand indicate that a 1% increase in the prices of potatoes exported by competing countries (the Netherlands, France and Spain) leads to reducing demand for potatoes by 33.682%, 16.746% and 11.924%, respectively. On the other hand, a 1% increase in the export prices of Egyptian potatoes leads to changing demand for the crop by -3.312%, -4.237% and 2.049%, respectively, indicating that a complementary and substitution relationship exists between potatoes exported from Egypt and that exported by the Netherlands and France in case their export prices increase. As for Spain, a complementary relationship exists in case the export prices of Spanish and Egyptian potatoes increase, respectively.

Table 12. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Egyptian Potatoes in the German Market over the Period 2000-2018

Country	Own and Cross-Price Elasticity of Demand				Elasticity of Expenditure	Wi
	Egypt	The Netherlands	France	Spain		
Egypt	11.697	33.682	16.746	11.924	0.249	4.08
The Netherlands	-3.312	-10.764	-4.526	-3.451	1.211	54.55
France	-4.237	-11.128	-7.308	-4.530	1.264	27.75
Spain	2.049	7.940	4.082	2.577	0.821	13.62
Verifying the Validity of the Estimated Model					$\Sigma_i W_i \varepsilon_{expend}$ =100.00	

Source: Table 11

As for the estimated elasticity of expenditure, results indicate that a 1% increase in real expenditure on potatoes in the German market leads to increasing expenditure on Egyptian potatoes by 0.249%, indicating that Egyptian potatoes is a normal good in the German market, as shown in table 12.

2. Egyptian Potatoes in the Greek Market:

Data in table 13 indicate that the model is free of estimation problems that might negatively affect the model's efficiency (autocorrelation, heteroscedasticity, non-linearity). Results of applying Walt test (to test for additivity, homogeneity and symmetry conditions) proved insignificant. Validity of the estimated model has also been verified. The estimated price elasticities of demand for Egyptian potatoes indicate that a 1% increase in Egyptian potatoes' export prices leads to reducing demand for the crop by 29.860%, which means that demand for Egyptian potatoes in this market is elastic.

Table 13. Results of Estimating AID Model for Egyptian Potatoes in the Greek Market over the Period 2000-2018

Country	Egypt			France			The Netherlands		
	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob
α	-139.063	-2.560	0.010	113.625	2.140	0.033	125.425	3.500	0.000
LnP_1	17.990	1.420	0.155	-16.424	-1.330	0.185	-1.558	-0.190	0.852
LnP_2	3.015	0.280	0.780	5.941	0.560	0.575	-8.966	-1.260	0.209
LnP_3	-21.416	-1.400	0.160	4.233	0.280	0.777	17.182	1.700	0.088
$\ln(Y / \tilde{P})$	29.253	4.450	0.000	-8.144	-1.260	0.206	-21.104	-4.860	0.000
$\bar{R}^2$	0.737			0.292			0.745		

Source: http://comtrade.un.org/db.

The estimated cross-elasticities of demand indicate that a 1% increase in the prices of potatoes exported by competing countries (France and the Netherlands) leads to reducing demand for the crop by 14.82% and 20.198%, respectively. In addition, a 1% increase in the export prices of Egyptian potatoes leads to increasing demand for the crop from competing countries by 15.299% and 31.239%, respectively, indicating that a substitution relationship exists between potatoes exported by Egypt and that exported by France and the Netherlands in case their potatoes' export prices increase.

Table 14. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Egyptian Potatoes in the Greek Market over the Period 2000-2018

Country	Own and Cross-Price Elasticity of Demand			Elasticity of Expenditure	Wi
	Egypt	France	Netherlands		
Egypt	-29.860	-14.820	-20.198	1.639	75.05
France	15.299	7.399	11.049	0.651	15.16
Netherlands	31.239	15.632	20.660	0.317	9.79
Verifying the Validity of the Estimated Model				$\Sigma_i W_i \varepsilon_{expend} = 100.00$	

Source: Table 13

As for the estimated elasticity of expenditure, results indicate that a 1% increase in real expenditure on potatoes in this market leads to increasing expenditure on Egyptian potatoes by 1.639%, indicating that potatoes is a normal good in the Greek market, as shown in table 14.

3. Egyptian Potatoes in the Italian Market: Data in table 15 indicate that the model is free of estimation problems that might negatively affect the model's efficiency (autocorrelation, heteroscedasticity, non-linearity). Results of applying Walt test (to test for additivity, homogeneity and symmetry conditions) proved insignificant. Validity of the estimated model has also been verified. The estimated price elasticities of demand for Egyptian potatoes indicate that a 1% increase in Egyptian potatoes' export prices leads to increasing demand for the crop by 31.066%, which contradicts the theory of consumer demand.

Table 15. Results of Estimating AID Model for Egyptian Potatoes in the Italian Market over the Period 2000-2018

Country	Egypt			France			The Netherlands			Germany		
	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob	Coeffi	t-stat	Prob
α	253.927	2.160	0.031	-289.142	-3.280	0.001	162.069	3.370	0.001	-27.010	-0.440	0.659
LnP_1	11.392	1.650	0.100	8.567	1.660	0.097	-15.143	-5.360	0.000	-4.828	-1.340	0.180
LnP_2	2.177	0.200	0.844	3.227	0.390	0.697	-0.978	-0.220	0.829	-4.438	-0.770	0.441
LnP_3	-7.170	-0.470	0.636	-22.839	-2.020	0.044	14.878	2.410	0.016	15.162	1.930	0.054
$\ln(Y / \tilde{P})$	-0.548	-0.040	0.969	13.127	1.260	0.208	-6.244	-1.100	0.273	-6.339	-0.870	0.383
$\bar{R}^2$	0.425			0.612			0.798			0.182		

Source: http://comtrade.un.org/db.

The estimated cross-elasticities of demand indicate that a 1% change in the prices of potatoes exported by competing countries (the Netherlands, France and Germany) leads to increasing demand for the crop by 77.951%, 38.106% and 23.072%, respectively. In addition, a 1% increase in the export prices of Egyptian potatoes leads to changing demand for the crop from competing countries by -15.499%, 8.823 and -6.158%, respectively, indicating that a substitution relationship exists between potatoes exported by Egypt and that exported by the Netherlands in case Egyptian potatoes' export prices increase, while a complementary and substitution relationship exists between potatoes exported by Egypt and that exported by France in case the prices of potatoes exported by the Netherlands and Egypt increase, respectively.

Results regarding the estimated elasticity of expenditure indicate that a 1% increase in real expenditure on potatoes in the Italian market leads to reducing expenditure on Egyptian potatoes by -0.709%, indicating that potatoes is an inferior good in this market, as shown in table 16.

Table 16. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Egyptian Potatoes in the Italian Market over the Period 2000-2018

Country	Own and Cross-Price Elasticity of Demand				Elasticity of Expenditure	Wi
	Egypt	The Netherlands	France	Germany		
Egypt	31.066	77.951	38.106	23.072	-0.709	-13.04
France	-15.499	-39.754	-19.704	-11.236	1.852	84.37
Netherlands	8.823	23.458	11.284	6.698	0.484	10.90
Germany	-6.158	-14.686	-5.980	-5.731	1.315	17.77
Verifying the Validity of the Estimated Model					$\Sigma_i W_i \varepsilon_{expend}$ =100.00	

Source: Table 15

4. Egyptian Potatoes in the UK Market: Data in table 17 indicate that the model is free of estimation problems that might negatively affect the model's efficiency (autocorrelation, heteroscedasticity, non-linearity). Results of applying Walt test (to test for additivity, homogeneity and symmetry conditions) proved insignificant. Validity of the estimated model has also been verified. The estimated price elasticities of demand for potatoes indicate that a 1%

Table 17. Results of Estimating AID Model for Egyptian Potatoes in the UK Market over the Period 2000-2018

Country	Egypt			France			Netherlands			Israel			Spain		
	Coeffi.	t-stat.	Prob.	Coeffi.	t-stat.	Prob.	Coeffi.	t-stat.	Prob.	Coeffi.	t-stat.	Prob.	Coeffi.	t-stat.	Prob.
α	-1.889	-0.060	0.954	-162.678	-2.370	0.018	59.243	0.940	0.348	109.247	1.710	0.088	95.998	2.940	0.003
LnP_1	6.933	3.340	0.001	2.392	0.540	0.586	12.257	3.040	0.002	-9.912	-2.420	0.015	-11.666	-5.580	0.000
LnP_2	-0.969	-0.270	0.786	10.471	1.390	0.165	2.336	0.340	0.736	-17.333	-2.470	0.014	5.495	1.530	0.126
LnP_3	-4.021	-1.810	0.071	-0.908	-0.190	0.847	1.677	0.390	0.698	10.094	2.300	0.021	-6.831	-3.050	0.002
LnP_4	-4.711	-1.060	0.289	9.130	0.970	0.332	0.500	0.060	0.954	-10.481	-1.200	0.232	5.559	1.240	0.214
LnP_5	6.765	1.360	0.173	-6.484	-0.620	0.537	-20.744	-2.150	0.032	22.842	2.330	0.020	-2.385	-0.480	0.633
$Ln(E/P_{spi})$	-2.049	-1.340	0.179	13.419	4.160	0.000	-1.561	-0.530	0.598	-7.126	-2.370	0.018	-2.677	-1.740	0.081
Adj. RSq.	0.581			0.671			0.599			0.684			0.718		

Source: http://comtrade.un.org/db.

Table 18. Elasticities' Matrix (Own & Cross-Price Elasticities of Demand and Elasticity of Expenditure) for AID Model Estimated for Egyptian Potatoes in the UK Market over the Period 2000-2018

Countries	Own and Cross-Price Elasticity of Demand					ε_{expend}	W_i
	Egypt	France	Netherlands	Israel	Spain		
Egypt	1.984	7.881	4.991	9.432	2.341	0.724	5.36
France	-3.350	-14.058	-9.300	-14.418	-5.673	1.463	42.40
Netherlands	1.190	2.376	0.645	2.506	-0.119	0.922	18.46
Israel	1.348	5.945	4.800	5.796	3.353	0.776	24.69
Spain	0.695	7.060	3.973	7.711	1.475	0.773	9.09
Verifying the Validity of the Estimated Model						$\Sigma_i W_i \varepsilon_{expend}$ =100.00	

Source: Table 17

Increase in Egyptian potatoes' export prices leads to reducing demand for the crop by 0.847%, which means that demand for potatoes in this market is inelastic.

The estimated price elasticities of demand for Egyptian potatoes indicate that a 1% increase in potatoes' export prices leads to increasing demand for the crop in by 1.984%, which contradicts the theory of consumer demand.

As for the estimated cross-elasticities of demand, results indicate that a 1% change in the prices of potatoes exported by competing countries (France, the Netherlands, Israel and Spain) leads to increasing demand for the crop by 7.881%, 4.991%, 9.432% and 2.341%, respectively. In addition, the estimated cross-elasticities of demand for countries competing Egypt indicate that a 1% change in Egyptian potatoes' export prices leads to changing demand for the crop from competing countries by -3.350%, 1.190, 1.348, 0.695 respectively, which means that a complementary relationship exists between potatoes exported by Egypt and that exported by the Netherlands, Israel and Spain in the British market, while a substitution relationship exists between potatoes exported by Egypt and that exported by France in case the export prices of any of the two countries increase.

The estimated elasticity of expenditure indicates that a 1% increase in real expenditure on potatoes in the British market leads to increasing expenditure on Egyptian potatoes by 0.724%, indicating that it is a normal good in the British market, as shown in table 18.

In the light of the achieved results, the research offers the following recommendations:

- Opening new markets, especially in African countries, to overcome the negative consequences of EU's attempts to put barriers to Egyptian potato exports
- Stopping to cultivate varieties that do not conform to international quality standards.
- Strict supervision and inspection of seeds imported from abroad before entering the country.
- Changing areas cultivated with export-oriented potatoes on regular basis.

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تقدير دوال الطلب لأهم المحاصيل الاستراتيجية فى مصر بإستخدام نموذج الطلب الأمثل

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تعتبر تنمية الصادرات والحد من الورادات فى مقدمة الاولويات التى تستحوذ على النصيب الأكبر من اهتمام الدولة حتى يمكن خفض العجز الحاد فى الميزان التجارى المصرى نتيجة لتلك الواردات والتى تتمثل بصفة كبيرة فى محصولى القمح والذرة الشامية حيث اصبح الانتاج المحلى من هذين المحصولين لا يكفى للاستهلاك القومى منه، الأمر الذى جعل الدولة تتجه الى الاستيراد من الخارج لتغطية العجز فى الانتاج المحلى، مما يشكل عبئا على ميزان المدفوعات للدولة. حيث بلغت قيمة ما استوردته مصر من هذين المحصولين حوالى 2.65، 1.74 مليار دولار على الترتيب تمثل حوالى 20.37%، 13.38% من اجمالى قيمة الورادات الغذائية البالغة حوالى 13 مليار دولار خلال عام 2017، من جهة اخرى أولت الدولة الاهتمام بتصدير محصولى الأرز والبطاطس لدفع عجلة التنمية فى ظل التغيرات العالمية المتساوية والتى تؤدى دائماً الى زيادة المنافسة بين الدول للحصول على النصيب الاكبر فى الاسواق العالمية والذى لا يتوقف على الانتاج المحلى فقط ولكن لا بد من توفر الميزة التنافسية للسلعة والتى تنتج من تفاعل مجموعة من العوامل معاً مثل النمو والاستقرار الاقتصادى وتطوير القطاع الخاص والتعليم والتدريب والانتاجية والكفاءة ودرجة الاندماج فى الاقتصاد العالمى. الا انه فى الأونة الاخيرة تعرض محصول الأرز لمشكلة محدودية مياه الرى مما جعل الدولة تتبنى سياسة تحديد المساحة المزروعة وحظر الصادرات وبالتالى أثر ذلك على صادرات مصر من ذلك المحصول التصديرى الهام، كذلك مرض العفن البنى الذى يصيب البطاطس أدى الى صدور قرارات متتالية من المفوضية الأوروبية بوقف واردات البطاطس المصرية، وما لذلك من تأثيرات على الاقتصاد المصرى، ولتحقيق اهداف البحث فقد تم تقدير دوال الطلب على واردات محصولى القمح والذرة الشامية فى السوق المصرى، وصادرات محصولى الأرز والبطاطس المصرية بأهم أسواقهما الخارجية وذلك باستخدام نموذج الطلب الأمثل بهدف تفسير وتوضيح الأسباب الاقتصادية للقرارات المتتالية للمفوضية الأوروبية بوقف واردات البطاطس المصرية واثر القرارات التى اتخذتها الحكومة المصرية تجاه محصول الأرز.وكان من اهم النتائج أن روسيا الاتحادية واوكرانيا والولايات المتحدة الامريكية من اكبر الدول المصدرة للقمح الى السوق المصرى اذ بلغت كمية ما تصدره تلك الدول حوالى 6.51، 2.13، 0.219 مليون طن على الترتيب بما يعنى أن الدول الثلاثة مجتمعة تصدر ما نسبته حوالى 73.67% من اجمالى واردات القمح البالغة حوالى 12.025 مليون طن خلال عام 2017، بينما تعتبر كلا من الارجنتين والبرازيل والولايات المتحدة الامريكية من اكبر الدول المصدرة للذرة الشامية الى السوق المصرى حيث بلغت كمية الواردات من تلك الدول 2.64، 2.11، 0.257 مليون طن على الترتيب بما يعنى أن الدول الثلاثة مجتمعة تصدر ما نسبته حوالى 56.85% من اجمالى واردات الذرة البالغة حوالى 8.807 مليون طن خلال عام 2017.

الكلمات المفتاحية: نموذج الطلب الامثل، الصادرات، الواردات، المرونة السعرية والتقاطعية.

[i] **Except for some equations**