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AN ECONOMIC STUDY OF THE EFFECT OF AGRICULTURAL POLICIES ON VEGETABLE OILS IN EGYPT

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Abstract

The research aims to measure the impact of agricultural policies on vegetable oils in Egypt during the period (2000-2018), by measuring the impact of agricultural policies on food security indicators for vegetable oils, consumer and product protection policies and their impact on country returns, the marketing efficiency of vegetable oils, estimating domestic and external demand On vegetable oils, and the prediction of the vegetable oils gap until 2025, in order to assist decision makers in taking appropriate food policies and how to achieve food security. Four standard models have been described to predict the future vegetable oil gap. It shows an increase in vegetable oil prices during the post-revolution period and exchange rate liberalization policies at all price levels (product, wholesale, retail, consumer), as well as an increase in the amount of production, imports, consumption, gap, and the adequacy period of imports for domestic consumption, on the contrary it decreased the proportion of self-sufficiency and the sufficient of production for domestic consumption of vegetable oils. There is also a positive impact for the implementation of the policies of the second period (2011-2018) on the productive and consumer side, the total social returns, the distributional effects of producers, government revenues and foreign currency obtained**.** It was also shown that the product's share of the consumer's price increased during the second period of the study compared to the first period, it has also been shown that there is a direct relationship between the quantity of vegetable oil imports, income per capita and the total consumption of vegetable oils, finally, it was revealed through the prediction of the amount of vegetable oils gap until 2025 that the minimum potential gap of vegetable oils is estimated at about 751 thousand tons in 2024, while the maximum gap of potential vegetable oils reached about 3311 thousand tons in 2025 according to brown's one-parameter model for double- exponential smoothing.
Keywords: vegetable oil production and consumption - marketing efficiency-vegetable oil gap - prediction.

Introduction

Food consumption represents the goal of productive and economic activity, to achieve the greatest possible degree of satisfaction for the needs of an individual from food commodities. As consumption is affected by some of economic factors such as per capita income, prices, and population, therefore, the study of consumer demand, especially under the open market system, requires the provision of a high-quality commodity in a timely and appropriate form. The consumption pattern is considered an indication for the individual's consumption of different food commodities at a certain time and place, which require the necessity of studying the consumer's behavior and the different levels of spending from his disposable income. Therefore, rationalization of consumption is one of the most important goals of the food policy that achieves food security. The problem of providing food, especially vegetable oils, represents great importance to the production policy makers, as it is considered one of the necessary food ingredients for human nutrition and health, vegetable oils are obtained from oil crops such as cotton, peanuts, soybeans, sesame, sunflower, corn, and canola plant (gate.ahram.org.eg/News/2326833.aspx).

Data and measurement procedures

The data available in Ministry of Agriculture and Land Reclamation (MALR), and the Central Agency for Public Mobilization and Statistics (CAPMAS) were used, the study period was divided into two periods, the first is in the pre-revolution period (2000-2010), and the second is in the post-revolution and exchange rate liberalization policies period (2011-2018). Four standard models have been described to predict the future vegetable oil gap which are: Demand increase rate model, straight-line model of vector equations, brown's one-parameter model for double- exponential smoothing (Alexandria University, Faculty of Agriculture, Academy of Scientific Research and Technology, and Agricultural and Food Research Council, "Study of the Impact of Economic Reform Policies and Programs on Agricultural Development and Food Security", Project of the Impact of Economic Reform Policies on Development and Food Security, Project No. 25, 2000, Amol *et al*., 2015, Romain *et al*., 2016, Emad El-Din, 2018, Rasha 2019, Hansun) and Holt's two-parameter model for double-exponential smoothing (Alexandria University, Faculty of Agriculture, Academy of Scientific Research and Technology, and Agricultural and Food Research Council, "Study of the Impact of Economic Reform Policies and Programs on Agricultural Development and Food Security", Project of the Impact of Economic Reform Policies on Development and Food Security, Project No. 25, 2000, Romain *et al*., 2016, Emad El-Din, 2018).

Materials and Methods

In this section, the regression model was used to explain the variables that affect the consumption demand function of vegetable oils, as well as the function of imports of vegetable oils, in The double logarithmic function form, and the model was formulated as follows:

For consumption demand function:

$$\ln Y_t = \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + \beta_5 \ln X_{5t} + \varepsilon_{it}$$

Where: Y_t amount of vegetable oils consumption (1000 ton), X_{1t} retail price of vegetable oils (LE/ton), X_{2t} retail price of

maize oils (LE/ton), X_{3t} vegetable oils imports (1000 ton), X_{4t} vegetable oils per capita (kg/person), X_{5t} population (million) and, individual income (LE).

For imports function:

$\ln Y_t = \beta_0 + \beta_1 \ln X_{1t} + \beta_2 \ln X_{2t} + \beta_3 \ln X_{3t} + \beta_4 \ln X_{4t} + \beta_5 \ln X_{5t} + \beta_6 \ln X_{6t} + \varepsilon_{it}$

where: Y_t amount of total vegetable oils imports (1000 ton), X_{1t} production of vegetable oils (1000 ton), X_{2t} vegetable oils consumption/(1000 ton), X_{3t} price of vegetable oils imports (US$/ton), X_{4t} vegetable oils per capita (kg/person), X_{5t} population (million) and, individual income (LE).

Prediction of vegetable oils gap:

Four standard models were used to estimate prediction of vegetable oils gap: as follows:

1-Demand increase rate model:

$E_d = E_p + (E_i * E_r)$ where: E_d: growth rate on demand of vegetable oils, E_p: growth rate of population, E_i: income elasticity, E_r: growth rate of real individual income

2- Straight-line model of vector equations,

3- Brown's one-parameter model for double-exponential smoothing,

$$S''_t = \alpha \acute{s}_t \div (1- \alpha) S''_{t-1}$$

the forecast for Y_{t+k}, for any k>1, is given by:

$$\hat{Y}_{t+k} = L_t + kT_t$$

Where:

$$L_t = 2\acute{s}_t - S''_{t-1}$$

...is the estimated level at period t, and

$$T_t = (\alpha / (1- \alpha))(\acute{s}_t - S''_{t-1})$$

is the estimated *trend* at period t.

4- Holt's two-parameter model for double-exponential smoothing.

The formulation for the Holt's exponential smoothing shown as follow:

$$S_t = \alpha y_t + (1 - \alpha) (S_{t-1} + T_{t-1}) \quad ...(1)$$

$$T_t = \gamma (S_t + S_{t-1}) + (1 - \gamma) T_{t-1} \quad ...(2)$$

$$\hat{y}_t (k) = S_t + kT_t \quad ...(3)$$

S_t and T_t are the smoothed level and trend; α and γ are the smoothing parameters; y_t is the actual value of the time series in period t; and $\hat{y}_t (k)$ is the k step-ahead forecast made from forecast origin t. The trend and the level are initialed by the following governing equations:

$$T1 = 0 \quad ...(4)$$

$$S1 = y2 - y1 \quad ...(5)$$

Results and Discussion

Results in table (2) of applying simple regression analysis reveal that vegetable oils production followed a statistically significant increasing trend over the period 2000-2018, at an annual growth rate of 4.7%. As for vegetable oils imports, results reveal that it followed a statistically significant increasing trend, at an annual rate of 6.5%. Turning to consumption, results presented in Table (2) reveal that vegetable oils consumption followed a statistically significant increasing trend, at an annual rate of 6.5%. Studying producer's price of vegetable oils reveals that followed a statistically significant increasing trend, at annual rate of 10.2%, (Table 2). As for wholesaler's price of vegetable oils reveals that followed a statistically significant increasing trend, at annual rate of 9.6%. Finally, results reveal that consumer's price of vegetable oils reveals that followed a statistically significant increasing trend, at annual rate of 8.9%.

A paired samples T test was conducted to clarify the impact of agricultural policies on the most important factors related to the food security of vegetable oils (Rasha, 2019) and reveal of 68.3%, 106.9%, 95.5% and 134.6% statistically significant increasing of vegetable oils production, imports, consumption and gap over the second period of the study as shown in tables 1, 3, also the difference between two periods of import of vegetable oils was also significant. While the significance of decrease self-sufficiency ratio and sufficiency of production and imports for consumption of vegetable oils over the second period was not statistically proven.

Finding of which focused on studying the impact of price policies applied to vegetable oils by applying the partial equilibrium model (Hussam, 2019, www.trademap.com).

PEM through measuring the governmental revenue indicators, welfare indicators, and efficiency indicators as seen in table 4. Finding showed there is a negative impact of the implementation of the policies of the second period (2011-2018) on vegetable oils on consumer surplus only. Whereas, the implementation of these policies had a positive impact on product surplus, total societal returns, governmental revenues, and foreign currency gained during the two study periods.

With regard to the distribution of marketing margins as seen in table 5, the vegetable oil producer obtained 96% of the consumer price increasing of about 18% compared to the first period, while the middlemen obtained the remainder of the percentage over the second period. It was also found that the marketing margins of vegetable oils decreased during the second period, and the wholesaler got 2.5%, while the retailer got 97.5%.

Table 6 shows the results obtained from the demand function (Emad El-Din, 2018) for vegetable oils to identify the most important variables affecting them. The double logarithmic is the best mathematical forms has been conducted to estimate the function. The results show that 10% increase in vegetable oils imports and individual income would result in statistically significant increasing in consumption of vegetable oils, by 4.7% and 2.5%, respectively.

Table 6 presents the results obtained from estimating the total imports function of vegetable oils, it was found that the regression coefficients (in double logarithmic form) are consistent with the statistical and economic logic, here it was found that 10% increase in vegetable oils consumption, per capita vegetable oils would result in statistically significant increasing in total imports of vegetable oils by 6.2% and 7.8%, respectively.

This part of the paper presents forecast results for future estimates of the vegetable oils gap over the years 2024 and 2025, as follows:

Table 7 presents the results obtained from the expected estimates of the vegetable oils gap in 2024 and 2025. It was found, based on Demand increase rate model(1) for vegetable oils that the gap of vegetable oils based on this model reached about 751 thousand tons in 2024, and 804 thousand tons in 2025. The vegetable oils gap according to Straight-line model of vector equations is expected to reach about 1157 thousand tons in 2024, and 1203 thousand tons in 2025. While it is expected that vegetable oils gap based on brown's one-parameter model for double- exponential smoothing will reach about 3055 thousand tons in 2024, and 3311 thousand tons in 2025. Finally, according to the Holt's two-parameter model for double-exponential smoothing, the vegetable oils gap is expected to be around 2150 thousand tons in 2024, and 2191 thousand tons in 2025.

Research Recommendations

From the previous findings, the study recommends the following:

Incentive and encouraging pricing policies should be Formulating to increase the area planted with oil crops, there was a need to take the necessary measures to maintain the stock of vegetable oils, more effort should be made to activate the contract farming law for oil crop farmers, and establish marketing agencies to market production of oil crops.

Table 1 : The most important economic variables related to vegetable oils over the period (2000-2018).

Year	Production (Thousand tons)	imports quantity (Thousand tons)	Available for consumption (Thousand tons)	Producer's price (LE / ton)	Wholesaler's price (LE / ton)	Retailer's price (LE / ton)
Average	615	860	1135	7393	7586	8083
Average (2000-2010)	477	593	810	4399	4724	5289
Average (2011-2018)	803	1227	1583	11510	11521	11924
Difference between two periods	326	634	773	7111	6797	6635
Impact ratio	68.3	106.9	95.5	161.6	143.9	125.4

Source: Central Agency for Public Mobilization and Statistics, (CAPMAS).

Table 2 : Simple Regression Equations for vegetable oils over 2000-2018.

Variable	α	β	T test	average	growth rate	R^2	F
production quantity (Thousand tons)	327.8	28.7	2.93**	615	4.7	0.335	8.6**
imports quantity (Thousand tons)	298.5	56.1	3.37**	860	6.5	0.401	11.4**
consumption quantity (Thousand tons)	393.7	74.2	4.77**	1135	6.5	0.573	22.8**
Producer's price (LE / ton)	172.2	756.6	8.76**	7393	10.2	0.819	76.7**
Wholesaler's price (LE / ton)	293	729.3	8.28**	7586	9.6	0.801	68.5**
Retailer's price(LE / ton)	849.3	723.4	8.18**	8083	8.9	0.797	66.9**

** Significant at 0.01 * significant at 0.05

Source: Ministry of Agriculture and Land Reclamation (MALR).

Table 3 : A paired samples T test for the most important factors related to the food security of vegetable oils.

Variable	Average for (2000-2010)	Average for (2011-2018)	The difference	The value of (T) for the difference
Production (thousand tons)	477	803	326	-3.260**
Imports (thousand tons)	593	1227	634	-3.177**
consumption (thousand tons)	810	1583	773	-3.823**
Gap (thousand tons)	332	780	447	-1.979*
Self-sufficiency (%)	54.9	51.8	-3.2	0.020
Sufficient production period for consumption(day)	206	205	-1.0	0.025
Sufficient imports period for consumption(day)	259	285	25.8	-0.689

** Significant at 0.01 * significant at 0.05

Source: Ministry of Agriculture and Land Reclamation (MALR).

- Central Agency for Public Mobilization and Statistics, (CAPMAS).

Table 4 : Results of partial equilibrium model of vegetable oils during 2000-2018.

The statement	Unit	Average of (2000-2010)	Average of (2011-2018)
Nominal protection of production	-	2.575	2.665
Indicators			
Net producer's loss	million LE	570	2234
Net consumer's loss	million LE	1182	4923
total societal returns	million LE	1753	7157
Change in consumers surplus	million LE	-1823	-8246
Change in producers surplus	million LE	1964	7752
Change in governmental revenue	million LE	1893	6662
Change in foreign currency gained	million LE	410	2954

Source: Estimating results.

Table 5 : Market shares and margins of vegetable oils during the period (2000-2018)

Period	Share distribution				Wholesaler -producer		Retailer - Wholesaler		Retailer-producer	
	Producer	Wholesaler	Retailer	Middlemen	Absolute	%	Absolute	%	Absolute	%
(2000-2010)	81.6	5.1	10.5	16.8	325	5.1	565	10.5	890	16.8
(2011-2018)	96.2	0.1	3.5	3.6	10	0.1	404	3.5	414	3.6
Difference between two periods	14.6	-4.4	-7.0	-13.2	-314	-5.0	-162	-7.0	-476	-13.2
Impact ratio	17.9	-98.0	-66.5	-78.5	-96.8	-98.2	-28.6	-66.5	-53.5	-78.5

Source: Ministry of Agriculture and Land Reclamation (MALR).

Table 6 : Estimate results of consumption demand and vegetable oil imports function during the period (2000-2018)

Function	α	B		T test	$R^{/2}$	F	Prob.	Math. Type
consumption	1.43	X_3	0.47	5.48**	0.87	59.8	**	Double logarithmic
		X_5	0.25	3.83**				
Imports	0.42	X_2	0.62	3.4**	0.78	32.7	**	Double logarithmic
		X_4	0.75	2.96**				

** Significant at 0.01

Source: estimation result.

Table 7 : Prediction models results of vegetable oils Production, consumption and gap till 2025.

Model	Expected production (Thousand tons)	Expected consumption (Thousand tons)	Expected gap (Thousand tons)
Demand increase rate			
2024	848*	1599**	751
2025	898*	1702**	804
straight-line model of vector equations			
2024	1016	2174	1157
2015	1045	2248	1203
Brown's one-parameter model for double- exponential smoothing			
2024	402	3457	3055
2025	342	3652	3311
Holt's two-parameter model for double- exponential smoothing			
2024	681	2831	2150
2025	698	2889	2191

*The expected production of vegetable oils was calculated based on the growth rate of the production of vegetable oils during the period (2000-2017) of about (5.9%), and based on the production of vegetable oils in 2010 as a base year of about 380,000 tons, according to the formula for increasing the demand for vegetable oils , Assuming this rate remains constant over the future period**.**

The expected consumption of vegetable oils was calculated based on the growth rate of consumption of vegetable oils during the period (2000-2017) of about (6.4%), and to the consumption of vegetable oils in 2010 as a base year of about 671 thousand tons, and an average demand elasticity was calculated The income is around 0.86 according to the formula for increasing the demand for vegetable oils.**

Source: Ministry of Agriculture and Land Reclamation (MALR).

- Central Agency for Public Mobilization and Statistics, (CAPMAS).

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