Economic Study of Main Oilseeds Production and Consumption Indicators in Egypt

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Abstract: The study aimed to analyze the impact of price policies applied on the production of main oilseed crops in Egypt. Non-stability coefficients of planted area, production, and yield of the study oilseed crops showed that sesame crop rank first in terms of stability of production indicators, followed by cotton, peanuts, sunflower, and finally soybeans. The Policy Analysis Matrix for sunflower and soybeans showed that producers of the two mentioned crops incur implicit taxes estimated at 20% and 15%, respectively. The calculated Nominal Protection Coefficient of production inputs showed that producers of both crops receive 26% of subsidy. In addition, the calculated comparative advantage showed that Egypt enjoys comparative advantage in the sunflower and soybeans production, which allows Egypt to compete in the world markets of the two crops. Therefore, the study recommended formulating policies that aim at increasing production of oilseed crops through expansions in planted areas in New Lands, in addition to developing new high yielding varieties and providing the technical support necessary to teach farmers the know-how to cultivate them.
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1. Introduction

Oilseeds are the main source of obtaining vegetable oils used in human food besides some industries, while the extracted secondary product (meals) represent an important source for animal and poultry feed. The importance of oilseeds originates from the fact that they represent a good source of energy, in addition to feeding other industries with the necessary materials such as the margarine, paints, and cosmetics industries, in addition to some medical industries and inks used in printing purposes. Oilseed crops can be divided into two categories: one-purpose crops mainly cultivated for oil extraction purpose such as sunflower, soybeans, sesame and safflower, which are annual crops usually planted for one season; while the second category is the dual-purpose crops from which oil extraction comes as a second purpose such as cotton and flax. Despite endowed with the climate and land suitable for oilseed crops cultivation in Lower and Upper Egyptian Governorates, Egypt suffers severe shortage in the production of such crops and thus is one of the largest importers of vegetable oils, the import quantity of which ranks second after wheat imports. In 2010, self-sufficiency rate of vegetable oils reached only 13.5%, which means that local production does not cover domestic consumption and industrial needs of vegetable oil. Therefore, the Government of Egypt imports vegetable oils to cover the gap, which puts extra burden on Egypt's Balance of Trade and Balance of Payments. [1]

Study Problem

Despite the fact that oilseed crops have major economic and strategic importance to Egypt, area under oilseed crops is very modest. Therefore, production fails to meet the increasing food needs year-over-year, which resulted in increasing the gap between production and consumption, in addition to reducing self-sufficiency from 40% during the mid 1990s to 13.8% in 2010. Besides, the rising production cost per ton encourages oil extraction companies to import oil seeds from abroad to obtain the quantities required to operate their factories. [2]

Moreover, high domestic prices of oilseed crops have negative impact on domestic oil production. The problem is further complicated by advanced industrial countries' tendency to use vegetable oils in bio-diesel production, such as the United States of America, the European Union, Brazil and other countries, which resulted in reducing global supply of oilseed crops. Therefore, importing countries may not be able to meet their needs of vegetable oils due to supply shortage despite owning the foreign currency required to buy them. [1]

Study Objective

The study aims to identify main oilseed crops produced in Egypt and their relative importance over the period 2008-2012, in addition to identifying production determinant. The study also aims to identify the current situation of production, consumption, and food gap of main oilseed crops and vegetable oils in Egypt over the period 1995-2012. One more aim of the study is to identify the impact of price policies applied to the mentioned crops in Egypt.

2. Methodology and Sources of Data

In this study, both quantitative and descriptive analysis methods have been applied, in addition to some statistical methods such as Nerlove Model to estimate the supply response of the study crops. Non-Stability Coefficient of production indicators and the Policy Analysis Matrix (PAM) have been applied to main oilseed crops. As for the sources of data, the study relied on data published by the Central Agency for Public Mobilization and Statistics (CAPMAS), as well as the Bulletins of Agricultural Economics issued by The Economics Affairs Sector of the Ministry of Agriculture and Land Reclamation; and The Food and Agriculture Organization of the United Nations (FAO). In addition, many related scientific researches and studies published in scientific research magazines have been reviewed.

3. Results and Discussion

Main Oilseed Crops Produced In Egypt

Oilseed crops are identified as those crops mainly cultivated for oil extraction purposes such as sunflower, soybeans, peanuts, sesame, castor oil plant, and safflower, which are annual crops cultivated for one season. Other perennial crops such as coconut and palm oil, besides dual-purpose crops, are grown for oil extraction as a second purpose like cotton and flax.

1. Cottonseed: is considered the main source of vegetable oils produced in Egypt. However, quantity produced cannot be controlled because it is a by-product product of the cotton ginning industry. Therefore, annual production is subject to political, economic, and technical factors related to cotton crop. Oil content in cottonseeds ranges between 18% and 20%.[3]
2. Soybeans: is a summer crop introduced to Egypt after proving success globally as a source of vegetable oil and protein necessary for human food, as well as a source of oil meals used for poultry feeding purposes. The oil content in soybean seeds reaches about 20% of the seed weight.[3]
3. Sunflower: is cultivated either for direct consumption without processing, or for the extraction of a good quality vegetable oil that is distinguished by stable characteristics. Sunflower oil meal obtained after oil extraction has a high nutritional value and is used as animal feed. The oil content in sunflower seed reaches about 45%.[3]
4. Peanut: is mainly grown for direct human consumption, or for processing sweets and for exports. It is never domestically used for oil production. Peanut oil is usually used in margarine processing, while the peanut oil meal resulting after oil extraction has a high nutritional value as animal feed. The oil content in peanut seeds ranges between 48% and 52%.[3]
5. Sesame: is grown over a relatively small area in Egypt. However, it is not used for oil extraction purposes due to the high processing cost per unit, but mainly used in producing "*Tahina*" and "*Halawa*", in addition to supplying the needs of bakeries and confectionary factories. A small percent of the crop is used in producing sesame oil. The oil content in sesame seeds ranges between 55% and 60%.[4]
6. Flax: is mainly cultivated as a fiber crop, and the seeds are used for oil production. Flax oil is not widely used, but is recommended for human consumption due to the high ability of dissolving blood cholesterol. Flax oil is also used in paints processing. The oil content in flax seeds ranges between 40% and 45%.[5]
7. Corn: is one of the major grain crops in Egypt. Corn is used as human food, as well as animal and poultry feed. The corn content in dry fodder accounts for 70%, while accounts for 20% in bread processing. Corn products include glucose, fructose, and vegetable oil. Corn oil is characterized by a high degree of purity, high quality, and color clarity compared with other vegetable oils. The oil content in corn seeds ranges between 35% and 39%.[5]
8. Canola (Rapeseed): is the only winter oil crop that Egypt succeeded in cultivating in New Land, especially in highly saline parts. The crop was first introduced to Egypt in 1995. It is one of the major oil crops in Europe, where it is used in food, in addition to margarine and bread processing. Canola crop is characterized by relative tolerance to drought and salinity, which encourages future expansions in New Lands with limited water resources. The oil content in rapeseed is considered high, where it ranges between 45% and 50%.[5]
9. Safflower: is cultivated in small areas that ranged between a minimum of 75 feddan in 2005 and a maximum of 390 feddan in 2004, with yield per feddan estimated at 30.5 tons. The oil content in safflower seeds is about 35%.[5]
10. Jojoba: is a perennial shrub which age may range between 100 and 200 years. It tolerates harsh natural conditions including drought and salinity, in addition to resisting diseases and pets. Jojoba shrub is also resistant to erosion thus is used in sand fixing besides the importance it represents as a seed-making crop. Jojoba seeds are rich in aromatic oils, and contain wax oil that may reach up to 40-60%. However, it is not classified under medicinal and aromatic plants. [5]
11. Canula: is a newly cultivated crop in Egypt. Area cultivated reached about 1083 feddans in 1989, but declined sharply to reach 143 feddans in 2006. It is worth noting that some health-related precautions surround its consumption.[3]

Relative Importance of Oilseed Crops

Table (1) shows the relative importance of oilseed crops in terms of areas and production. It is clear that area under soybeans, cottonseed, sunflower, sesame, and flax seeds represent about 3.48%, 55.54%, 23.21%, 3.91%, 11.82%, and 2.03% of the total area under oilseed crops estimated at an average of 655 thousand feddans for the period 2008-2012, respectively. Relative importance of the mentioned crops in terms of production reached 6.14%, 38.12%, 40.73%, 5.27%, 8.23%, and 1.52% of the total oilseed production estimated at an average of 501.4 thousand tons for the period 2008-2012, respectively.

Table 1. The relative importance of area and production of the most important oilseed crops average during the period (2008-2012)
Area: thousand feddan, production:ton, productivity: (tons /feddan)

Crop	Area	%	Productivity	Production	%
Cottonseed	363.8	55.54	0.63	191.14	38.12
Soybeans	22.8	3.48	1.36	30.8	6.14
Sunflower	25.6	3.91	1.05	26.4	5.27
Peanut	152	23.21	1.34	204.2	40.73
Sesame	77.4	11.82	0.53	41.26	8.23
Flaxseed	13.3	2.03	0.59	7.6	1.52
Total	655	100	1.1	501.4	100

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics (2008-2012). [6]

1. Current Situation of Production, Consumption, and Self-Sufficiency Rate of Oilseed Crops In Egypt

Introduction: self-sufficiency is defined as the ratio of local production of a certain commodity to local consumption of the same commodity during a specific time period.

Evolution of Oil Production in Egypt: Data in Table (2) show that average oil production reached an average of 152.89 thousand tons for the period 1995-2012, where it ranged between a minimum of 93 thousand tons in 1998 and a maximum of 207 thousand tons in 2006, and has been steadily increasing from 94 thousand tons in 1995 to a high of 198 thousand tons in 2012, at a rate of 110.6%.

Evolution of Oil Consumption in Egypt: Data in Table (2) show that local consumption of vegetable oils surpass local production, which can be explained by the fact that population has been increasing at rate higher than the rate of increase in local production of vegetable oils, the consumption of which increased from 843 thousand tons in 1995 to a high of 1455 thousand tons in 2012, up by 72.6% of the average local consumption of vegetable oils, estimated at 1194.9 thousand tons for the period 1995-2012.

Evolution of Vegetable Oil Gap and Self-Sufficiency in Egypt: studying vegetable oils' production over the period 1995-2012 showed that domestic production of vegetable oils does not cover the increasing domestic consumption. In addition, studying self-sufficiency of vegetable oils showed that it reached 12.76% of the period's average. Self-sufficiency ranged between a minimum of 8.9% in 2000 and a maximum of 16.3% in 2005. It is clear from the table that Egypt's gap in vegetable oils during the study period amounted to 1040.06 thousand tons, and ranged between a minimum of 749 thousand tons in 1995 and a maximum of 1257 thousand tons in 2012.

It is therefore clear from what preceded that the Government of Egypt is forced to resort to imports to cover local consumption, the value of which adds to the burden of providing foreign currency required to pay the imports bill, which in turn increases deficit in the Country's Balance of Payments.

Table 2. Evolution of the size of the gap and the proportion of self-sufficiency in vegetable oils during the period (1995-2012).

year	Production	Consumption	GAP	%
1995	94	843	749	11.2
1996	114	900	786	12.7
1997	119	1019	900	11.7
1998	93	979	886	9.5
1999	93	1040	944	9.2
2000	99	1107	1008	8.9
2001	129	959	830	11.5
2002	144	1097	953	13.1
2003	135	1252	1117	10.8
2004	141	1007	1866	14
2005	204	1248	1044	16.3
2006	207	1389	1182	14.9
2007	206	1420	1214	14.5
2008	205	1444	1235	14.2
2009	202	1450	1248	13.9
2010	201	1452	1251	13.8
2011	201	1452	1251	13.8
2012	198	1455	1257	13.6
Average	154.89	1194.94	1040.06	12.76

Source: Calculated from the Ministry of Agriculture
- the Central Administration of Agricultural Economics
- records of the Department of Statistics (1995-2012). [6]
- Mahoud Mohamed Hanafi, *Economic Study Of Oilseeds Production and Consumption in Egypt*, Egyptian Magazine of Agricultural Economics, Vol. 21, Issue No. 2, Jun, 2011. [7]

2. Main Determinants of Oilseed Crops' Production in Egypt

Local production of vegetable oils depends on available production of oilseed crops cultivated in Egypt; these are cotton, soybeans, sunflower, peanuts, and sesame. Oilseed crops production depend on area planted and yield per feddan. Regression analysis applied to area planted, yield, and total production of oilseed crops produced over the period 1995-2012 revealed the following results:

(1) Cottonseed: results in table (3) show that cottonseed area, yield, and total production followed declining trends, statistically significant at 1% for both area and yield, and at 5% for total production. The estimated annual rates of decline for the three mentioned variables reached 5.35%, 1.27%, and 4.4% of the period's average, respectively.

(2) Soybean Seed: results in table (3) show that soybean seeds' area and total production followed declining trends, statistically significant at 1% for both area and yield. As for yield, it followed an increasing trend, statistically significant at 1%. The estimated annual rates of change for the three mentioned variables reached 4.45%, 2.1%, and 1.6% of the period's average, respectively.

(3) Sunflower Seeds: results in table (3) show that sunflower seeds' area and total production followed declining trends, statistically significant at 1% for both area and yield. In contrast, yield followed an increasing trend, statistically significant at 1%. The estimated annual rates of change for the three mentioned variables reached 4.6%, 3.9%, and 0.8% of the period's average, respectively.

(4) Peanuts: results in table (3) show that peanuts' area, yield, and total production followed increasing trends, statistically significant at 1% for the three variables. The estimated annual rates of increase for the three mentioned variables reached 2.02%, 0.8%, and 2.57% of the period's average, respectively.

(5) Sesame: results in table (3) show that sesame's area, yield, and total production followed statistically significant increasing trends. The estimated annual rates of increase for the three mentioned variables reached 1.4%, 0.98%, and 1.85% of the period's average, respectively.

Table 3. Equations of general time trend for area, productivity and total production of oilseed crops during the period (1995-2012)

Crops	Item	Equations	t	Sig.	R^2	F	Annual rates%
Cotton	Area	$\hat{y}_t$=907.7-32.2x_t	(-6.83)	**	0.73	46.69	-5.35
	Yield	$\hat{y}_t$=1.22-1.2x_t	(7.5)	**	0.23	2.03	0.8
	Production	$\hat{y}_t$=640-19.9x_t	(-2.39)	**	0.25	5.72	-4.4
Soybean	Area	$\hat{y}_t$=34.8-1.09 x_t	(-4.73)	**	0.49	22.37	-4.45
	Yield	$\hat{y}_t$=1.05-0.02x_t	(4.56)	**	0.54	20.82	1.6
	Production	$\hat{y}_t$=36.5-0.64xt	(-2.8)	*	0.33	7.84	-2.1
Sunflower	Area	$\hat{Y}_t$=51.4-1.65x_t	(-4.73)	**	0.37	10.82	-4.6
	Yield	$\hat{Y}_t$=0.91+0.008x_t	(6.65)	**	0.72	44.32	0.8
	Production	$\hat{y}_t$=47.8-1.36x_t	(2.960)	*	0.31	8.76	3.9
Peanuts	Area	$\hat{Y}_t$=111.6+2.8x_t	(4.58)	**	0.54	21.02	2.02
	Yield	$\hat{Y}_t$ =1.24+0.01x_t	(3.63)	**	0.42	13.22	0.8
	Production	$\hat{Y}_t$ =137.4+4.7x_t	(5.58)	**	0.68	31.14	2.57
Sesame	Area	$\hat{Y}_t$ =55.7+1.03xt	(3.34)	**	0.37	11.15	01.4
	Yield	$\hat{Y}_t$ =0.47+0.005x_t	(3.63)	**	0.42	13.22	0.98
	Production	$\hat{Y}_t$ =26.9+0.69x_t	(4.9)	**	0.68	31.14	1.85

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics (1995-2012), [6].

3. Non-Stability Coefficients of the Study Crops' Productivity Indicators

Table (4) lists the calculated non-stability coefficient for the area, yield, and production of soybeans, sunflower, peanut, cotton, and sesame. Results show that areas planted with cotton, followed by sesame, then peanut are more stable compared with sunflower and soybeans areas, where non-stability coefficient of the mentioned crops reached 0.06%, 0.4%, 9.2%, 33%, and 65%, respectively. As for yield per feddan, non-stability prevailed. However, it has been noticed that yield per feddan of sesame crop is more stable than yields obtained from the rest of the study crops. Non-stability coefficient of yield per feddan of sesame, soybeans and cotton reached 2.1%, 4.2% and 17.5%, respectively, compared with the non-stability coefficient of yield per feddan of sunflower and peanuts, which reached 29.9% and 17.5% for the two crops, respectively. Finally, production of cotton crop showed more stability compared with sesame and peanuts production. The calculated non-stability coefficient of production for the three mentioned crops reached 0.05%, 0.3% and 0.4%, respectively, compared with sunflower and soybeans production for which non-stability coefficients reached 3% and 1.7%, respectively.

It is therefore clear that sesame ranked first in terms of stability of production indicators, followed by cotton, peanuts, sunflower, and finally soybeans.

Table 4. Non-Stability Coefficients of the area, productivity and production of the most important oilseed crops during the period (1995-2012)

Crops	Area	Productivity	Production
Cotton	0.06%	17.5%	0.05%
Soybeans	65%	4.2%	1.7%
Sunflower	33%	23%	3%
Peanut	9.2%	29.9%	0.4%
Sesame	0.4%	2.1%	0.3%

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics (1995-2012), [6].

4. Factors Affecting Vegetable Oils Production in Egypt

Agricultural production is generally affected by several factors such as planted area and quantities of inputs used in the production process. Production quantity per crop varies according to used varieties and technology, in addition to soil type. Profitability per feddan is therefore affected by inputs used in the production process. In what follows, results of the estimated profitability for the study crops are presented.

I. Invest Profit

Profit per Egyptian Pound invested in producing oilseed crops, and competing crops, is calculated by dividing net revenue per cultivated feddan over total production cost during the period 1995-2012.

Results in Table (5) show that one Egyptian Pound invested in rice production, which is a competing crop, amounted to L.E. 0.72, while amounted to 0.42, for sunflower crop. Therefore, rice is regarded as a major competing crop.

Table 5. Compared of the total costs and net returns and profitability pound spent crops competition for oilseed crops during the period (1995-2012) in pound.

Crops	Total Cost	Net Return	Profitability
Cotton	2186.5	1141.8	0.52
Rice	1987.7	1432.4	0.72
Maize	1674.32	1134.12	0.68
Soybeans	1399.3	400.5	0.29
Sunflower	659.4	280	0.42

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics (1995-2012), [6].

Other competing crops include maize, sorghum, and cotton, which ranked second, third, and fourth after rice in terms of invest profit. The mentioned crops compete with sunflower and soybeans due to generating higher invest profits that amounted to 0.68, 0.62, and 0.52, respectively, compared with 0.42 and 0.29 for sunflower and soybeans, respectively.

II. Statistical Estimation of The Supply Response of Major Oilseed Crops

Dynamic supply response of major oilseed crops grown over the period 1995-2012 has been estimated using Nerlove Model to discover the relationship between planted area in year t (the dependent variable), and main influencing explanatory variables lagged on year (t-1). Partial correlation matrix between explanatory variables has also been estimated to identify multicollinearity. In addition, multi-stage regression analysis has been applied in both the linear and logarithmic forms in order to identify the explanatory variables that most affect the dependent variable, and to select the best models representing the relationship.

The study assumed that main factors affecting planted area in year (t) include the following variables lagged one year (t-1): area under oilseed crops, oilseed crops' yield in tons, cost per feddan of oilseed crops in Egyptian Pound, net revenue per feddan of oilseed crops in Egyptian Pound, price per ton of cotton, production cost per feddan of cotton, net revenue per feddan of cotton in Egyptian Pound, price per ton of rice crop, production cost per feddan of rice in Egyptian Pound, net revenue per feddan of rice in Egyptian Pound, price per ton of maize crop, production cost per feddan of maize in Egyptian Pound, net revenue per feddan of maize in Egyptian Pound, price per ton of tomato crop, production cost per feddan of tomatoes in Egyptian Pound, and net revenue per feddan of tomatoes in Egyptian Pound.

- Estimating soybeans' supply response model showed that the following double-log form is the best representing form:

$$Log\hat{y}_t = 3.1 - 2.31\log x_9 + 2.17\log x_8 - 0.82\log x_5$$
(5.20) (4.4) (2.20)

R^2 = 0.81 **F= 32.5**

Where:

$Log\hat{y}_t$: Estimated soybeans area in current year (t), in thousand feddans,

X_9: Net revenue per feddan of rice in year (t-1),

X_8: Farmgate price of rice in year (t-1),

X_5: net revenue per feddan of sesame in year (t-1).

As clear from the equation, there is an inverse relationship between soybeans area in current year and net revenue per feddan of both sesame and rice in the lag year, which means that a 10% increase in net revenue received from sesame and rice in the previous year leads to reducing soybeans area by 8.2% and 23.1% during the next year. On the other hand, there exists a direct relationship between soybeans area in the current year and rice price in the lag year, which violates the logic of economic theory. The model and regression coefficients proved statistically significant at 0.01.

- Estimating sunflower's supply response model showed that the following double-log form is the best representing form:

$$Log\hat{y}_t = 1.94 - 0.52\log x_{12}$$
(5.63)

R^2 = 0.67 F= 31.6969

Where:

$Log\hat{y}_t$: Estimated sunflower area in current year (t), in thousand feddans,

X_{12}: Net revenue per feddan of maize in year (t-1),

As clear from the equation, there is an inverse relationship between sunflower area in the current year and net revenue per feddan of maize in the lag year, which means that a 10% increase in net revenue received from maize crop in the previous year leads to reducing sunflower area by 5.2% during the next year, which is line with the logic of economic theory. The model and regression coefficients proved statistically significant at 0.01.

- Estimating peanuts' supply response model showed that the following double-log form is the best representing form:

$$Log\hat{y}_t = 1.86 - 0.49\log x_3 - 0.99\log x_{12} + 0.821\log x_{14}$$
(4.1) (7.81) (4.9)

R^2 = 0.86 F= 39.8

Where:

$Log\hat{y}_t$: Estimated peanuts' area in current year (t), in thousand feddans,

X_3: Net revenue per feddan of soybeans in year (t-1),

X_{12}: Net revenue per feddan of maize in year (t-1),

X_{14}: Net revenue per feddan of summer tomatoes in year (t-1),

As clear from the equation, there is an inverse relationship between peanuts' area in the current year and net revenue per feddan of both soybeans and maize in the lag year, which means that a 10% increase in net revenue received from soybeans and maize crops in the previous year leads to reducing sunflower area by 4.9% and 9.9% during the next year, respectively. On the other hand, there exists a direct relationship between soybeans area in current year and net revenue per feddan of summer tomatoes in the previous year, which violates the logic of the economic theory. The model and regression coefficients proved statistically significant at 0.01.

5. Impact of Current Price Policy Applied to Oilseed Crops

In light of the implemented economic reform policies, the adopted agricultural policy tends toward inducing some structural changes that aim to maximize the economic return from the agricultural sector. Achieving this goal mainly depends on closing the gap between local and international prices of outputs and inputs since international values represent opportunity cost under perfect competition.

Policy analysis matrix (PAM) can help provide the frame to measure deviations of crop/commodity prices from the economic prices, in addition to identifying distortions in the commodity market, and the level of resource employment. The economic price of each final output and production inputs per feddan of oilseed crop has been calculated. On the production side, parity price is calculated by deducting the costs of unloading, customs, and insurance from the CIF price at the port of arrival to get to the FOB price, which is then converted into local price using the free exchange rate. Internal customs tariff is then deducted from the calculated local price, the result of which is multiplied by average yield per feddan of the cultivated crop to obtain the economic return per feddan. In order to obtain production cost in shadow prices, the study used the following conversion rates that were estimated by the World Bank in 1990: 1.156 for machinery use cost, 1.6 for chemical fertilizers' cost, 1.976 for pesticides cost, and 1.149 for seeds cost. As for human labor, the conversion rate is equivalent to 0.5. The rest of input items remained the same. As for land, the opportunity cost usually equals the economic rent. [8]

General Frame of the Policy Analysis Matrix (PAM)

Prices	***Revenue***	***Costs***		***Profit***	***Prices***
		Tradable	***Non- Tradabl***		
Market Price	**A**	**B**	**C**	**D**	***Market Price***
Economic Prices	**E**	**F**	**G**	**H**	***Economic Prices***
Transfers*	**I**	**J**	**K**	**L**	***Transfers****

Main Indicators Obtained From PAM

I. *Economic Protection Indicators*

A. *Nominal Protection Coefficient (NPC)*

Nominal Protection Coeffeceint measures the impact of policy applied to both output and input prices, where distortions highlight the level of diversity in local prices relative to international prices due to imposed direct and indirect taxes, or due to subsidizing output. NPC is calculated as follows:

$$\text{Nominal Protection Coefficient} = \frac{A}{B}$$

NPC is the ratio between revenue received from a commodity assesed in market price and commodity value in international prices:

1. If the ratio is greater than one, it means the product is subsidized by the Government,
2. If the ratio is less than one, it means there are taxes imposed on the product by the Government.
3. If the ratio equals one, it means the product price equals the international price and thus there is no Government intervention in the market.

B. Effective Protection Coefficient (EPC)

Is used to measure protection, production incentives, or taxes. In other words, it measures the overall impact of the outcome of policies applied to goods and tradable inputs. It is a value added to the product, or to the resources used to produce that product. It can be claculated as follows:

EPC=A-B/E-F

If the ratio is greater than one, it means there is protection and incentives to production, or subsidy to producers. But if the ratio is less than one, it means there are taxes imposed on the product.

II. **Comparative Advantage Indicators**

1. **Domestic Resource Cost (DRC)**

Is an indicator that measures the comparative advantage. It reflects efficiency of local resources' use, and is calculated by dividing the cost of production inputs (B) over the value added at market prices (E-F), as illustrated by the following equation:

$$\text{Domestic Resource Cost (DRC)} = \frac{B}{E - F}$$

In case the result is less than one, it means the producer acheived efficient use of resources based on world market price. If the result is greater than one, it means the producer did not acheive efficient use of resources. Finally, if the output is equal to one, it means that resources are sufficient to obtain the product.

The following are the results of the claculated Policy Analysis Matrix for major oilseed crops, namely sunflower and soybeans, during the 2008-2012 period's average.

Results of the Policy Analysis Matrix for Sunflower Crop

Tables (6) and (7) illustrate average cost and PAM results for sunflower crop. It is clear from the results that:

1. Nominal Protection Coefficient of Production: the calculated NPC of sunflower production amounted to 0.8, which means that producers incur 20% as implicit taxes based on the currently applied price policy, while receive about 80% of the products value assessed using sunflower international price, which amounted to L.E. 3567/ton.
2. Nominal Protection Coefficient of Inputs: the calculated NPC of inputs (table 7) indicate lower prices of production inputs compared with the international prices, which means there is a kind of subsidy to sunflower producers that does not exceed 26% of inputs' international price estimated at L.E. 572.7 during the study period.
3. Effective Protection Coefficient: the calculated EPC amounted to 0.81, which means there are implicit taxes imposed on sunflower producers. In other words, the value added of sunflower in local prices is lower than the value added in international prices. This means that the crop did not enjoy any kind of protection during the study period.
4. Comparative Advantage: the calculated value of Comparative Advantage, which amounted to 0.95, indicates that Egyptian production of sunflower has a comparative advantage in international markets, which in turn means that domestic production of sunflower allows Egypt to compete in international markets. It also means that producing the crop domestically is better than importing from international markets. It was

also found that the impact of the net value of taxes appears in the value of remittance, which amounted to L.E. 503.8.

Table (6) Average cost of production per feddan of sunflower crop, according to the wages and production requirements resident financially and economically during the period (2008-2012) in pound.

Statement	Financial evaluation	Economic evaluation
1 - Value of production inputs		
seeds	88	101.1
Chemical fertilizers	223.2	357.12
Pesticide	1.6	3.16
2- Value of local materials		
The value of human labor	490.8	245.4
Wages machines	258	299.02
Rent resource Earth	1038	2110

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics. [6]-The Central Agency For Public Mobilization and Statistics, Information Center, Unpublished Data. [9]

Table (7) Results of PAM for sunflower crop during the period (2008-2012) in pound.

statement	Total return	Commercial Resource cost	Domestic Resource Cost		Net return
			labor	Land	
Financial evaluation	2854	424.2	748.8	1038	643
Economic evaluation	3567.5	572.8	645.5	2210	139.2
Impact of policy	(713.5)	(148.6)	103.3	(1172)	503.8

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics. [6] & [9]

Results of the Policy Analysis Matrix for Soybeans Crop

Tables (8) and (9) illustrate average cost and PAM results for soybeans crop. It is clear from the results that:

1. Nominal Protection Coefficient of Production: the calculated NPC of soybeans production amounted to 0.85, which means that producers incur 15% as implicit taxes based on the currently applied price policy, while receive about 85% of the products value assessed using soybeans' international price, which amounted to L.E. 4444/ton.

2. Nominal Protection Coefficient of Inputs: the calculated NPC of inputs (table 9) indicate lower prices of soybeans production inputs compared with the international prices, which means there is a kind of subsidy to soybeans producers that does not exceed 26% of the international price of inputs estimated at L.E 929.3 during the study period.

3. Effective Protection Coefficient: the calculated EPC amounted to 0.88, which means there are implicit taxes imposed on soybeans producers. In other words, the value added for this crop in local prices is lower than the value added in international prices. This means that the crop did not enjoy any kind of protection during the study period.

4. Comparative Advantage: the calculated value of Comparative Advantage, which amounted to 0.86, indicates that Egyptian soybeans production has a comparative advantage in international markets, which in turn means that domestic production of soybeans allows Egypt to compete in international markets. It also means that producing soybeans domestically is better than importing from international markets. It was also found that the impact of the net value of taxes appears in the value of remittance, which amounted to L.E. 503.8.

The previously presented results indicate that oilseed production and marketing problems are mainly due to:

1. Competition between oilseed crops and other major crops of strategic importance such as rice and maize, in addition to vegetable crops grown in Old Lands.

2. Lower profitability of some oilseed crops compared with the profitability of some other crops such as vegetables and fruits.

3. Lack of factories required for oil extraction from the seeds of some oilseed crops like sunflower that requires special treatments, in addition to abolishing supply contracts with factories.

Table (8) Average cost of production per feddan of soybeans crop, according to the wages and production requirements resident financially and economically during the period (2008-2012) in pound.

Statement	Financial evaluation	Economic evaluation
1 - Value of production inputs		
seeds	84.6	97.20
Chemical fertilizers	374.6	559.36
Pesticide	68	134.3
2- Value of local materials		
The value of human labor	704.6	352.3
Wages machines	358.8	415.8
Rent resource Earth	1116.6	2244

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics. [6]

Table (9) Results of PAM for soybeans crop during the period (2008-2012) in pound.

statement	Total return	Commercial Resource cost	Domestic Resource Cost		Net return
			labor	Land	
Financial evaluation	3777.5	692	1063.4	1116.6	905.5
Economic evaluation	4444.1	929.36	768.14	2244	502.6
Impact of policy	(666.6)	(237.30)	294.86	(11127.4)	402.9

Source: Calculated from the Ministry of Agriculture - the Central Administration of Agricultural Economics - records of the Department of Statistics. [6]

Recommendations

The study emphasizes the necessity of developing oilseed crops through devoting efforts to cultivate them in New Lands so that they do not compete with the traditional crops grown in the Delta and Valley, same as cultivating peanuts in sandy lands, and cultivating sesame in sandy soil and limestone lands. In addition, the study recommends encouraging the adoption of contract farming by signing contracts between farmers, cooperatives, responsible entities, and oil extraction factories in order to ensure the product marketing and payments to farmers at suitable time. Moreover, it is recommended to link between local and international prices to encourage farmers expand oil crops cultivations. It is also recommended that the Ministry of Agriculture and Land Reclamation devotes attention to developing new high yielding varieties of the study crops, and supplying to farmers together with the various technical guidelines of production, which may help solve problems associated with the production of these crops.

Summary

Despite the strategic economic importance oilseed crops represent to Egypt, local production does not cover the increasing needs year-over-year, which resulted in widening the gap between production and consumption, in addition to reducing self-sufficiency rate to 20%. The study aimed to analyze the impact of price policies applied on the production of main oilseed crops in Egypt. Non-stability coefficients of planted area, production, and yield of the study oilseed crops showed that sesame crop rank first in terms of stability of production indicators, followed by cotton, peanuts, sunflower, and finally soybeans. The Policy Analysis Matrix for sunflower and soybeans showed that producers of the two mentioned crops incur implicit taxes estimated at 20% and 15%, respectively. The calculated Nominal Protection Coefficient of production inputs showed that producers of both crops receive 26% of subsidy. In addition, the calculated comparative advantage showed that Egypt enjoys comparative advantage in the sunflower and soybeans production, which allows Egypt to compete in the

world markets of the two crops. Therefore, the study recommended formulating policies that aim at increasing production of oilseed crops through expansions in planted areas in New Lands, in addition to developing new high yielding varieties and providing the technical support necessary to teach farmers the know-how to cultivate them.

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References

1. Nihal Nagui Abd El-Salam Ibrahim (2007), *Economics of Producing Some Oilseed Crops In Egypt*, M.Sc. Thesis, Department of Agricultural Economics, Ain Shams University.
2. Huaain Hasan Ali Adam (2008), *Economics Of Producing And Consuming Main Oilseed Crops in Egypt*, Ph.D. Thesis, Department of Agricultural Economics, Ain Shams University.
3. Mahmoud Ahmed Ibrahim Khalil (2010), *Expected Trends Of Self-Sufficiency Rates of Main Agricultural Crops In Egypt (Case Study of Major Oilseed Crops*, Department of Agricultural Economics, Mansoura University.
4. Shouqi Amin Abd El-Azeez & Alaa El-Deen Saad El-Shabrawe (2008), *Economic Study Of Production, Consumption, and Marketing Indicators of Some Oilseed Crops*, Egyptian Magazine of Agricultural Economics, Vol. 18, Issue No. 4.
5. Mohamed Salah El-Deen El-Guindy & Others (2012), *Applying ARIMA to Predict Egypt's Self-Sufficiency Rates of Vegetable Oils During The Period 2011-2010*, The 20th Conference of Agricultural Economists, Egypt's Food Security In The Light Of International Markets' Risks, The Egyptian Society Of Agricultural Economists, October 30-31, 2013.
6. Ministry of Agriculture and Land Reclamation, The Central Administration For Agricultural Economics, Economics Affairs Sector, Records of The Agricultural Economics Division, Unpublished Data.
7. Mahoud Mohamed Hanafi, *Economic Study Of Oilseeds Production and Consumption in Egypt*, Egyptian Magazine of Agricultural Economics, Vol. 21, Issue No. 2, Jun, 2011.
8. Food and Agriculture Organization of the United Nations, Electronic Website.
9. The Central Agency for Public Mobilization and Statistics, Information Center, Unpublished Data.

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