Impact of Agricultural Price Policy on Major Crops in Egypt

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ABSTRACT

Agricultural production, like other economic activities, is affected by the success of agricultural economic policies pursued by government from leaving the farmer free to cultivate his land with the desired crops and to take his production and marketing decisions in light of the mechanisms of supply and demand and the movement of prices in the markets without any intervention by the government. Therefore, the government's intervention influences the farmers' desire to grow any of the crops through its agricultural policies by imposing taxes or subsidizing inputs. To achieve the research objectives we applied the Policy analysis matrix, where is one of the most important modern methods used in policy analysis, due to it helps examine the impacts of government's intervention policies across different stages of the flow of goods, which in turn helps assess and measure such policies', efficiency in achieving the hoped-for objectives and examine their impacts on producers, consumers, and the macro-level economic conditions. The Policy Analysis Matrix (PAM) can be calculated by calculating nominal and effective protection coefficients and then identifying the policy adopted by the government, whether it is a protectionist policy or a policy of direct or indirect taxes on the producers of those crops, as well as the calculation of the cost of domestic resources to determine the relative advantage. Where wheat, maize, rice, and potatoes are among the most crucial strategic food and industrial crops in Egypt.

Keywords: Policy Analysis Matrix, Nominal Protection Coefficient, Effective Protection Coefficient, Domestic Resource Costs.

1. INTRODUCTION

Agricultural policy is considered of the most important national economic policies through which the country can achieve the goal of improving the level of national agricultural income thus the economic and social standards for workers in the agricultural sector in particular, and the whole population in general. Since the 1980s of last century, the Egyptian economy has been witnessing radical changes that led to major and direct impacts on Egypt's agricultural sector [1]. Such changes continue to have many impacts that interact together and lead to radical changes in agricultural development and the future of Egyptian agriculture. It is worth mentioning that Egypt embarked on implementing economic reform policies in 1987 by undertaking a number of measures that aims to achieve liberalization of the agricultural sector, such as adopting indicative planning of cropping pattern rather than central planning, in addition to activating the role of market mechanisms in directing economic resources towards optimal use, especially in regard to allocating investments among different production branches in the national economy, referred to as Structural adjustment, [2]. In the framework of structural adjustment program, these policies have directly and indirectly influenced agricultural price policy variables by influencing such main factors or variables affecting profit, namely yield or productivity of the acre, farmgate price per produced unit and the producing cost per acre, which directly affect the relative profitability of the produced crops thus farmers' preference to grow crops that generate high profitability [3].

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Agriculture remains an important sector in the Egyptian economy and a key pillar for food security. The Ministry of Planning, Monitoring, and Administrative Reform's databases reveal that investment in agriculture for fiscal year 2016/2017 amounted to US$ 9.2 billion, including 2.8 percent of overall public investment [4]. Agriculture's contribution to GDP averaged 13.2 percent between 2000 and 2017, while employment in agriculture averaged 29 percent over the same period [5]. This is down from 58 percent in 1960 and 34 percent in 1990, according to [6]. In addition, total value of agricultural production is estimated at US$ 20.55 billion, of which plant production represents 51.24% worth US$ 10.53 billion. Moreover, value of cereal crops' production amounted to US$ 6.54 billion representing 62.11% of the total value of plant production. Average per capita share of grains is estimated at 260.7 kg/annum. While value of vegetables crops' production amounted to US$ 2.01 billion representing 19.09% of the total value of plant production. Average per capita share of vegetables is estimated at 79.3 kg/year, [7]. Cereal crops, mainly wheat, maize and rice, are staple food crops for many nations, especially in developing countries. They also play a strategic role in the policies of developed countries as they use such crops as a tool for practicing pressure on other countries. That is why most developing countries seek to achieve self-sufficiency in cereal crops. In Egypt, official statistics indicate that cereal production reached 22.37 million tons, while domestic consumption reached 47.47 million tons, indicating a gap of 25 million tons worth US$ 4.3 billion. In 2017, self-sufficiency in cereals reached 47.12% [7].

In addition, cereal crops occupy an important position in Egypt's agriculture, either in terms of contribution to national income, or to resources, with cultivated land area estimated at 12.19 million acres representing 76% of total cropped area, estimated at 16.04 million acres [8].Also, Vegetables crops occupy an important position in Egypt's agriculture, either in terms of contribution to national income, or to resources, with cultivated land area estimated at 1.88 million acres representing 11.72% of total cropped area [9].

Wheat, maize, rice and potatoes are major crops in Egypt, domestic wheat production declined from 9.34 million tons in 2016 to 8.42 million tons in 2017, down by 9.9%. In 2017, average per capita share of wheat amounted to 163.9 kg/year and self-sufficiency rate amounted to 34.5%. While Maize production increased from 7.17 million tons in 2016 to 7.66 million tons in 2017, average per capita share of maize amounted to 52.2 kg/year and self-sufficiency rate amounted to 46.10%. Rice production also declined from 5.31 million tons in 2016 to 4.96 million tons in 2016, down by 10.2%. In 2017, average per capita share of rice amounted to 38.7 kg/year and self-sufficiency rate amounted to 87.96%. Potatoes production also declined from 5.02 million tons in 2016 to 4.84 million tons in 2017, average per capita share of potatoes amounted to 25.4 kg/year and self-sufficiency rate amounted to 116.28% [10].

The current research investigates the problems arising from impact of agricultural price policy in agricultural production through adopting development strategies that aim to achieve free market economy [11] and dependency on interaction between supply and demand forces as main pillar to raise efficiency of the national economy and achieve the hoped for development, which all resulted in producers bearing the burden of paying indirect taxes (implicit) due to price distortions resulting from imbalances between domestic and international prices [12].Such situation obstructs efforts exerted to achieve optimum economic efficiency in domestic resources' use as well as the welfare of producers and consumers. As a result, producers started choosing to cultivate other crops that are not subject to taxes and in the same time are profitable [13].

Accordingly, the current research mainly aims at assessing the impact of agricultural price policy by studying and analyzing the indicators that can be deduced from PAM, which can help identify trends of agricultural policies implemented in the agricultural sector and measure the efficiency of economic resources' use. In addition to assess the impact of the implemented policy by measuring Nominal Protection Coefficient for outputs and inputs, Effective Protection Coefficient and Comparative Advantage Coefficient (Domestic Resource Cost Coefficient).

2. REVIEW OF LITERATURE

A study conducted by El-Gundy [14], to analyze the Impact of Agricultural Policy on the most Important Economic variables of Wheat Crop in Egypt, as well as to evaluate Egyptian agricultural policies applied to wheat crop using Policy Analysis Matrix. The study concluded that the estimated nominal protection

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coefficient of output during the pre-implementation of economic liberalization period reached 0.63, which implies that farmers incurred high taxes while consumers received subsidies during this period. As for the value of this coefficient reached 0.93 during the post-implementation of economic liberalization period, indicating that domestic price of wheat is close to world price, which also means reduced value of indirect taxes and subsidies to consumers during the second period compared to the first period. Such results indicate reduced price distortions. The study recommended pursuing economic liberalization policies for the positive impacts on the cost and net revenue of wheat production.

According to study that applied a number of research methods by Tolba and Kamel [15], including descriptive and quantitative analysis, PAM and Partial Equilibrium Model to measure the impacts agricultural price policy have on wheat variables. Results revealed that producers received subsidy representing 33% of their product's value, and that the implemented policy aimed at encouraging producers expand in wheat planted area to increase domestic production. The study also found that domestic value of inputs used in wheat production was less than the international prices of corresponding inputs, and that wheat enjoyed governmental protection, which all indicate that the implemented production policy has been in favor of wheat producers, where the government pursued protection policies represented in increasing the value added per ton in farmgate price over the corresponding border price value. Distortions in domestic market prices of production and production inputs have also been eliminated after implementing economic liberalization policy.

Another study by Georgi and Hanna [16] investigated the impacts agricultural price policies have on some cereal crops in Egypt between two periods: (1977-1987) and (1998-2011), The study assessed the financial and economic values of production cost items and found that the financial assessment of labor wages outmatched the economic assessment of labor wages for all the study crops over the two study periods, which means that domestic labor wages are higher than international labor wages. By contrast, economic assessment of the cost of mechanical work outmatched the financial assessment over the two study periods. As for production inputs (seeds, chemical fertilizers, pesticides), economic assessment outmatched the financial assessment over the two study periods, indicating that production inputs are subsidized by the government. Turning to revenue per acre, economic assessment outmatched the financial assessment for the three study crops over the two study periods. On the other hand, results of PAM analysis revealed that subsidy to production inputs declined from 31%, 30% and 29% during the first period to 8%, 7% and 9%, during the second period. Results also revealed that producers' shares of the value of their products have been increasing; indicating positive incentives that contribute to curbing the differences between international and domestic prices, and help accelerate the wheel of economic development. The computed effective protection coefficient revealed reduction in implicit tax producers incurred during the two study periods, where it declined from 32% to 23% for wheat, from 37% to 27% for maize and from 52% to 34% for rice, respectively, indicating that full liberalization of farm land rent led to raising the value added for the study crops, and to reducing the difference between value added in local price and that in international price. The study revealed that Egypt enjoyed comparative advantages in wheat, maize and rice produced during the two study periods, where the computed values of the coefficient of comparative advantage reached 0.30, 0.31 and 0.23 for the mentioned crops during the first study period, respectively, and 0.41, 0.42 and 0.43 for the mentioned crops during the second study period respectively. The study recommended designing production policies that aim to raise the comparative advantage in wheat and maize production; and to enhance farmers expand wheat and maize planted areas by setting procurement prices close to international prices to guarantee rewarding net revenues to farmers, and pursuing early announcement of prices before the start of the planting season, in addition to designing policies that aim at: reducing direct and indirect taxes producers incur; subsidizing producers, especially where major import commodities are concerned in order to reduce net losses producers and consumers incur; and reducing the burdens producers incur to save hard currency.

According to study by, Khamis [17] investigated price policy applied to some of the cereal crops grown in Egypt in the light of economic liberalization in order to identify the features of price policies applied to wheat, rice and maize and in the same time monitor the currently applied policies. The study applied Policy Analysis Matrix to calculate nominal and effective protection coefficients, and also applied partial equilibrium models. The study recommended devoting more attention to studying markets in general, and

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prices in particular, in addition to devoting great attention to developing the agricultural sector, reducing subsidies to production inputs, moving towards implementing indicative pricing policy to encourage producers grow the required crops, examine the negative impacts of cultivating rice due to excess water consumption, rationalizing food consumption patterns and redistribution of income.

Studying the economic impacts of price policies on rice production in Egypt by El-Saeed and [18]. The study computed Egypt's comparative advantage in rice production by applying PAM to identify protection indicators (nominal and effective protection coefficients), and to identify comparative advantage indicators (domestic resource cost) at the country and governorate levels. Results revealed that the computed nominal protection coefficient reached a minimum of 0.32 in 2008 and a maximum of 0.83 in 2003, which means that it is less than unity, indicating that domestic rice prices are less than the international prices of rice, which means that rice producers incur implicit taxes. As for the computed effective protection coefficient reached a minimum of 0.29 and 0.24 in 2008 and 2009, respectively, and a maximum of 0.84 in 2001. The estimated value of domestic resource cost revealed that Egypt enjoys a comparative advantage in rice production, and that such advantage is higher in some governorates than others. The study offered some recommendations including: promoting expansion in rice planted areas in the governorates that enjoy higher comparative advantages in rice production and higher average revenue per cubic meter of irrigation water and cutting rice planted areas in the governorates that proved otherwise, especially under the current water scarcity conditions. The study also recommended increasing implicit taxes on rice producers in Egypt to boost the competitive ability of Egyptian rice in world markets, where it represents a source of hard currency earning for Egypt, in addition to exerting efforts to improve the production efficiency of rice and pursuing efforts to develop new varieties that consume less amounts of water to tackle the problems associated with the changing water condition in Egypt.

3. MATERIALS AND METHODS

To achieve the research objectives, the impacts of agricultural price policy will be assessed for wheat, maize, rice and potato crops in Egypt, as follows:

3.1 Policy Analysis Matrix (PAM)

Policy analysis matrix is one of the most important modern methods used in policy analysis, where it helps examine the impacts of government's intervention policies across different stages of the flow of goods, which in turn helps assess and measure such policies' efficiency in achieving the hoped for objectives and examine their impacts on producers, consumers and the macro-level economic conditions [19].The set of indicators that can be deduced from PAM can help identify trends of agricultural policies implemented in the agricultural sector and measure the efficiency of economic resources' use [20].PAM is usually built using farm budget, including revenues and costs, which occur in the form of tradable inputs (production inputs) and domestic resources (land and labor). In PAM, both revenues and costs are evaluated financially (at market prices) and economically (at border prices) to assess the impact of the implemented policy by measuring Nominal Protection Coefficient for outputs and inputs, Effective Protection Coefficient and Comparative Advantage Coefficient (Domestic Resource Cost Coefficient). The general structure of PAM is presented as follows:

General Structure of Policy Analysis Matrix

	Total revenue	Total production input	Total cost of domestic			Net Revenue	Value Added
			Total labor	**Total rent (land)**	**Total**		
Financial prices	A	B	C	D	E	F	G

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Economic prices	H	I	J	K	L	M	N
Policy impact	O	P	Q	R	S	T	U

3.1.1 Nominal Protection Coefficient on Tradable Outputs (NPC_O)[1] : Nominal Protection Coefficient on Tradable Outputs provides a comparison between domestic and economic prices of outputs. It represents such kinds of protection or taxes that prevent equating domestic prices with border prices. It reflects the level of incentives or non-incentives offered to domestic farmers. It can be calculated as follows:

$$NPC = \frac{A}{H}$$

- NPC> 1 means that domestic prices are higher than border prices, indicating implicit subsidy for producers.
- NPC <1 means that domestic prices are lower than border prices, indicating that producers incur implicit taxes.
- NPC = 1 means absence of intervention in price policy, as well as absence of protection.

3.1.2 Nominal Protection Coefficient on Tradable Inputs (NPC_I)[2]: Nominal Protection Coefficient on Tradable Inputs is the ratio between domestic and economic prices of outputs:

$$NPCI = \frac{B}{I}$$

- NPCI> 1 means that the government subsidizes production inputs.
- NPCI <1 means that the government imposes taxes on inputs.
- NPCI = 1 means lack of distortions in input prices.

3.1.3 Effective Protection Coefficient (EPC)[3] : Effective Protection Coefficient is an extension of the concept of the Nominal Protection Coefficient. However, it measures price distortions at the level of output and input markets, where it measures the net impact of economic policy on domestic output and input markets. It is the ratio of the value added [4] of a particular product in domestic market price to the value added in economic price:

$$EPC = \frac{G}{N}$$

- EPC = 1 means lack of distortions.
- EPC> 1 means effective protection or incentives for producers.
- EPC <1 means negative protection in the form of taxes imposed on producers.

It should be noted that the nominal protection coefficient for both inputs and outputs is used to estimate the structure of incentives at the commodity level, while effective protection coefficient is a measure of price incentives.

(1) Nominal Protection Coefficient on Tradable Outputs (NPC_O).
(2) Nominal Protection Coefficient on Tradable Iutputs (NPC_I).
(3) Effective Protection Coefficient (EPC).
(4) Value added = Revenue – Inputs excluding domestic factors

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3.1.4 Local Resource Cost Ratio (DRC)[5]: it is the ratio between benefits and costs. It is a measure of efficiency or comparative advantage of a certain commodity system. A commodity system is considered to enjoy a comparative advantage when DRC is less than or equal to the equilibrium exchange rate. It can be computed as follows:

$$DRC = \frac{L}{N}$$

- DRC <1 means that using less than one unit of domestic resources yields one unit of hard currency, indicating that the country enjoys a comparative advantage.
- DRC> 1 means that more than one unit of domestic resources is used to acquire one unit of hard currency, indicating that country has no comparative advantage in the global market. Alternatively, the opportunity cost of using domestic resources exceeds the value added estimated at world prices, indicating that the economic activity is unprofitable.

3.2 Sources of Data

The research relied on published and unpublished secondary data from various sources, including: the Ministry of Agriculture and Land Reclamation, 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 and the World Bank, in addition to other websites specialized in publishing data statistics. The research also used some references and researches relevant to the study subject.

4. RESULTS AND DISCUSSION

Input Cost Analysis using Domestic and Border Prices

Financial analysis of average production cost per acre has been computed using domestic farmgate prices and border prices over the period 2000-2017. Findings reveal the following:

4.1 Domestic Resource Cost

4.1.1 Labor Wages

Figures in Table (1) indicate that wages of labor hired for wheat, maize, rice and potatoes production in market prices is higher than wages computed in border prices. Average value of labor wages in financial prices reached 108.6, 140.89, 126.97 and 173.92 US$, respectively while that computed in economic prices reached 81.75, 105,67, 95.23 and 130.44 US$, respectively.

Table 1: Production Cost Items Assessed in Financial and Economic Prices of main crops Grown in Egypt over the period 2000-2017

	Wheat		Maize		Rice		Potatoes	
	Financial Prices	Economic prices*	Financial Prices	Economic prices*	Financial Prices	Economic prices*	Financial Prices	**Economic prices***

(5) Domestic Resource Costs (DRC).

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Total cost of	Labor Wages	108.6	81.75	140.89	105.67	126.97	95.23	173.92	130.44
	Wages of Draft Animals	3.7	3.7	1.01	1.01	5.83	5.83	5.94	5.94
	Wages of Machinery	75.4	84.45	56.64	63.44	93.81	105.07	68.05	76.22
	General Expenses	28.4	28.4	28.66	28.66	31.02	31.02	93.92	93.92
	Rent	213.5	189.11	175.89	240.41	240.41	157.89	148.46	240.41
	Total cost of domestic resource	429.6	387.41	403.09	438.52	498.04	395.04	490.29	**546.93**
Total production	Seeds Cost	26.9	30.13	28.66	32.09	26.18	29.32	576.41	645.58
	Manure	11.6	11.6	24.01	24.01	4.6	4.6	46.69	46.69
	Fertilizers	51.2	74.24	60.81	88.17	45.51	65.99	127.59	185.00
	Insecticides	11.3	12.32	8.02	8.74	17.61	19.19	44.67	48.69
	Total production inputs	129.44	156.69	150.16	181.67	124.92	150.12	889.28	1020
	Total costs	230.44	284.98	271.66	334.68	218.82	269.22	1684.62	**1945.96**

Source: Author Calculation, 2019.

* Economic value has been computed using conversion factors estimated by experts from the World Bank in 2000, as follows: 1.12 for seeds; 1.45 for chemical fertilizers; 1.09 for pesticides; 0.75 for human labor; 1.12 for machinery. Other items remained unchanged. As for land, opportunity cost is the revenue producer can get from his land without bearing the burdens of risks in agricultural production, which is usually the economic rent (leasing to others for one year) assessed on the basis of duration of crop stay in land **(World Bank, 2000)**.

4.1.2 Cost of Machinery

Figures in Table (1) indicate that cost of machinery rented for wheat, maize, rice and potatoes production in market prices is less than that computed in border prices. Average rent in financial prices reached 75.4, 56.64, 93.81and 68.05 US$, respectively while that computed in economic prices reached 84.45, 63.44, 105.07and 76.22 US$, respectively.

4.1.3 Cost of Production Inputs

Figures in Table (1) indicate that average cost of production inputs in financial prices (including fertilizers, pesticides and seeds) reached 89.4, 97.49, 89.3 and 748.67 US$, respectively while that computed in economic prices reached 116.69, 129, 114.5 and 879.27 US$, respectively.

4.2 Impact of Agricultural Price Policy on wheat Crop:

It is also evident from Table (2), which illustrates the results of PAM applied to wheat grown in Egypt over the period (2000-2017), that average revenue reached US$ 735.43 in financial prices, while reached US$ 925.55 in economic prices, resulting in a policy impact of US$ 190.12, indicating that wheat producers incurred implicit taxes estimated at US$ 190.12 as average of the study period.

Table 2: Policy Analysis Matrix for wheat Grown in Egypt over the Period 2000-2017

	Total revenue	Total production input	Total cost of domestic			Net Revenue	Added Value
			Total labor	Total rent (land)	Total		
Financial prices	735.43	129.42	187.65	213.48	401.13	204.9	606.01
Economic prices	925.55	152.69	168.42	189.11	357.53	415.33	772.86
Policy impact	(190.12)	(23.27)	19.23	24.37	43.6	(210.43)	(166.85)

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Numbers between the brackets are Negative
Source: Author Calculation, 2019.

Results also show that wheat farmers bear costs of production inputs during the study period (2000-2017), estimated at US$ 129.42 in financial prices, corresponding to US$ 152.69 in economic prices, resulting in a policy impact of US$ 23.27, which means that cost of production inputs declined by US$ 23.27 during the study period.

In addition, wheat farmers incurred implicit taxes on hired labor (as domestic resource) estimated at US$ 19.23 as average of the study period. As for net revenue, which reflects implicit taxes incurred by producers and subsidy received, it can be noted from Table (2) that it amounted to US$ 204.9 in financial prices and US$ 415.33 in economic prices, resulting in a policy impact of US$ 210.43, indicating that wheat producers incurred implicit taxes amounting to US$ 210.43 as average of the study period.

4.2.1 Nominal Protection Coefficient on Outputs (NPC_o)

As shown in Table (3), Nominal Protection Coefficient on Outputs amounted to 0.79, which is less than unity, indicating absence of fair production policy over the study period 2000-2017. In other words, domestic prices of wheat is lower than international prices, resulting in wheat producers incurring implicit taxes amounting to 21% due to receiving only 79% of the real price they should get for their product. Such result means that the implemented policy was not in favor of domestic wheat producers.

Table 3 Price Protection Coefficients of Wheat Grown in Egypt over the Period 2000-2017

Items	Value
NPC_o	0.79
NPC_I	0.85
EPC	0.78
DRC	0.46

Source: Calculated from Table 2.

4.2.2 Nominal Protection Coefficient on Inputs (NPC_I)

Results in Table (4) show that Nominal Protection Coefficient on Inputs amounted to 0.85, which is less than unity, indicating very low subsidy on inputs used in wheat production over the study period 2000-2017. In other words, wheat producers received a subsidy as low as 15% on production inputs. This also means that subsidy to wheat producers is diminishing, which complies with the implemented agricultural policy of gradual removal of subsidy on production inputs until reaching price levels proportionate to their economic cost thus international prices. Such finding indicates that the implemented economic liberalization policy resulted in very limited subsidy on production inputs for wheat producers.

4.2.3 Effective Protection Coefficient (EPC)

It is evident from Table (4) that Effective Protection Coefficient amounted to 0.78, which is less than unity, indicating that wheat producers incur implicit taxes. In other words, value added in domestic prices is lower than that in international prices, which means absence of protection policy during the study period. Such

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result means that the government has been imposing taxes, either direct or indirect, or it has been subsidizing wheat imports.

4.2.4 Domestic Resources Cost Ratio DRC (Comparative Advantage)

Results in Table (4) show that Domestic resource Cost Ratio amounted to 0.46, indicating that Egypt enjoyed a comparative advantage in wheat production during the study period 2000-2017, which means that domestic production of wheat is preferred to dependency on imports.

4.3 Impact of Agricultural Price Policy on maize Crop:

It is also evident from Table (4), which illustrates the results of PAM applied to maize grown in Egypt over the period (2000-2017), that average revenue reached US$ 799.63 in financial prices, while reached US$ 1006.34 in economic prices, resulting in a policy impact of US$ 206.71, indicating that maize producers incurred implicit taxes estimated at US$ 206.71 as average of the study period.

Table 4: Policy Analysis Matrix for maize Grown in Egypt over the Period 2000-2017

	Total revenue	Total production input	Total cost of domestic			Net Revenue	Added Value
			Total labor	Total rent (land)	Total		
Financial prices	799.63	150.15	198.54	175.89	374.43	275.05	649.48
Economic prices	1006.34	178.26	170.76	240.41	411.17	416.91	828.08
Policy impact	(206.71)	(28.11)	27.78	(64.52)	(36.74)	(141.86)	(178.6)

Numbers between the brackets are Negative Source: Author Calculation, 2019.

Results also show that maize farmers bear costs of production inputs during the study period (2000-2017), estimated at US$ 150.15 in financial prices, corresponding to US$ 178.26 in economic prices, resulting in a policy impact of US$ 28.11, which means that cost of production inputs declined by US$ 28.11 during the study period.

In addition, maize farmers incurred implicit taxes on hired labor (as domestic resource) estimated at US$ 27.78 as average of the study period. As for net revenue, which reflects implicit taxes incurred by producers and subsidy received, it can be noted from Table (4) that it amounted to US$ 275.05 in financial prices and US$ 416.91 in economic prices, resulting in a policy impact of US$ 141.86, indicating that maize producers incurred implicit taxes amounting to US$ 141.86 as average of the study period.

4.3.1 Nominal Protection Coefficient on Outputs (NPC_o)

As shown in Table (5), Nominal Protection Coefficient on Outputs amounted to 0.79, which is less than unity, indicating absence of fair production policy over the study period 2000-2017. In other words, domestic prices of maize is lower than international prices, resulting in maize producers incurring implicit taxes amounting to 21% due to receiving only 79% of the real price they should get for their product. Such result means that the implemented policy was not in favor of domestic maize producers.

Table 5: Price Protection Coefficients of Maize Grown in Egypt over the Period 2000-2017

Items	Value
NPC_o	**0.79**
NPC_I	**0.84**
EPC	**0.78**

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DRC	**0.46**

Source: Calculated from Table 4.

4.3.2 Nominal Protection Coefficient on Inputs (NPC_I)

Results in Table (5) show that Nominal Protection Coefficient on Inputs amounted to 0.84, which is less than unity, indicating very low subsidy on inputs used in maize production over the study period 2000-2017. In other words, maize producers received a subsidy as low as 16% on production inputs. This also means that subsidy to maize producers is diminishing, which complies with the implemented agricultural policy of gradual removal of subsidy on production inputs until reaching price levels proportionate to their economic cost thus international prices. Such finding indicates that the implemented economic liberalization policy resulted in very limited subsidy on production inputs for maize producers.

4.3.3 Effective Protection Coefficient (EPC)

It is evident from Table (5) that Effective Protection Coefficient amounted to 0.78, which is less than unity, indicating that maize producers incur implicit taxes. In other words, value added in domestic prices is lower than that in international prices, which means absence of protection policy during the study period. Such result means that the government has been imposing taxes, either direct or indirect, or it has been subsidizing maize imports.

4.3.4 Domestic Resources Cost Ratio DRC (Comparative Advantage)

Results in Table (5) show that Domestic resource Cost Ratio amounted to 0.50, indicating that Egypt enjoyed a comparative advantage in maize production during the study period 2000-2017, which means that domestic production of maize is preferred to dependency on imports.

4.4 Impact of Agricultural Price Policy on Rice Crop:

It is also evident from Table (6), which illustrates the results of PAM applied to rice grown in Egypt over the period (2000-2017), that average revenue reached US$ 950.99 in financial prices, while reached US$ 1169.89 in economic prices, resulting in a policy impact of US$ 218.9, indicating that rice producers incurred implicit taxes estimated at US$ 218.9 as average of the study period.

Table 6: Policy Analysis Matrix for Rice Grown in Egypt over the Period 2000-2017

	Total revenue	Total production input	Total cost of domestic			Net Revenue	Added Value
			Total labor	Total rent (land)	Total		
Financial prices	950.99	124.92	226.61	240.41	467.02	359.05	826.07
Economic prices	1169.89	146.86	205.71	175.89	381.6	641.43	1023.03
Policy impact	(218.9)	(21.94)	20.9	64.52	85.42	(282.38)	(196.96)

Numbers between the brackets are Negative

Source: Author Calculation, 2019.

Results also show that rice farmers bear costs of production inputs during the study period (2000-2017), estimated at US$ 124.92 in financial prices, corresponding to US$ 146.86 in economic prices, resulting in a

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policy impact of US$ 21.94, which means that cost of production inputs declined by US$ 28.11 during the study period.

In addition, rice farmers incurred implicit taxes on hired labor (as domestic resource) estimated at US$ 20.9 as average of the study period. As for net revenue, which reflects implicit taxes incurred by producers and subsidy received, it can be noted from Table (6) that it amounted to US$ 359.05 in financial prices and US$ 641.43 in economic prices, resulting in a policy impact of US$ 282.38, indicating that rice producers incurred implicit taxes amounting to US$ 282.38 as average of the study period.

4.4.1 Nominal Protection Coefficient on Outputs (NPC_o)

As shown in Table (7), Nominal Protection Coefficient on Outputs amounted to 0.81, which is less than unity, indicating absence of fair production policy over the study period 2000-2017. In other words, domestic prices of rice is lower than international prices, resulting in rice producers incurring implicit taxes amounting to 19% due to receiving only 81% of the real price they should get for their product. Such result means that the implemented policy was not in favor of domestic rice producers.

Table 7: Price Protection Coefficients of Rice Grown in Egypt over the Period 2000-2017

Items	Value
NPC_o	0.81
NPC_I	0.85
EPC	0.81
DRC	0.37

Source: Calculated from Table 6.

4.4.2 Nominal Protection Coefficient on Inputs (NPC_I)

Results in Table (7) show that Nominal Protection Coefficient on Inputs amounted to 0.85, which is less than unity, indicating very low subsidy on inputs used in rice production over the study period 2000-2017. In other words, rice producers received a subsidy as low as 15% on production inputs. This also means that subsidy to rice producers is diminishing, which complies with the implemented agricultural policy of gradual removal of subsidy on production inputs until reaching price levels proportionate to their economic cost thus international prices. Such finding indicates that the implemented economic liberalization policy resulted in very limited subsidy on production inputs for rice producers.

4.4.3 Effective Protection Coefficient (EPC)

It is evident from Table (7) that Effective Protection Coefficient amounted to 0.81, which is less than unity, indicating that rice producers incur implicit taxes. In other words, value added in domestic prices is lower than that in international prices, which means absence of protection policy during the study period. Such result means that the government has been imposing taxes, either direct or indirect.

4.4.4 Domestic Resources Cost Ratio DRC (Comparative Advantage)

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Results in Table (7) show that Domestic resource Cost Ratio amounted to 0.37, indicating that Egypt enjoyed a comparative advantage in rice production during the study period 2000-2017, which means that domestic production of rice is preferred to dependency on imports.

4.5 Impact of Agricultural Price Policy on Potatoes Crop:

It is also evident from Table (8), which illustrates the results of PAM applied to Potatoes grown in Egypt over the period (2000-2017), that average revenue reached US$ 1986.60 in financial prices, while reached US$ 2389.51 in economic prices, resulting in a policy impact of US$ 402.91, indicating that Potatoes producers incurred implicit taxes estimated at US$ 402.91 as average of the study period.

Table 8: Policy Analysis Matrix for Potatoes Grown in Egypt over the Period 2000-2017

	Total revenue	Total production input	Total cost of domestic			Net Revenue	Added Value
			Total labor	Total rent (land)	Total		
Financial prices	1986.60	889.26	247.92	184.46	432.38	664.96	1097.34
Economic prices	2389.51	1058.2	222.54	240.41	462.95	868.36	1331.31
Policy impact	(402.91)	(168.94)	25.385	(55.95)	(30.57)	(203.4)	(233.97)

Numbers between the brackets are Negative

Source: Author Calculation, 2019.

Results also show that Potatoes farmers bear costs of production inputs during the study period (2000-2017), estimated at US$ 889.26 in financial prices, corresponding to US$ 1058.2 in economic prices, resulting in a policy impact of US$ 168.94, which means that cost of production inputs declined by US$ 168.94 during the study period.

In addition, Potatoes farmers incurred implicit taxes on hired labor (as domestic resource) estimated at US$ 25.385 as average of the study period. As for net revenue, which reflects implicit taxes incurred by producers and subsidy received, it can be noted from Table (8) that it amounted to US$ 664.96 in financial prices and US$ 868.36 in economic prices, resulting in a policy impact of US$ 203.4, indicating that Potatoes producers incurred implicit taxes amounting to US$ 203.4 as average of the study period.

4.5.1 Nominal Protection Coefficient on Outputs (NPC_o)

As shown in Table (9), Nominal Protection Coefficient on Outputs amounted to 0.83, which is less than unity, indicating absence of fair production policy over the study period 2000-2017. In other words, domestic prices of Potatoes is lower than international prices, resulting in Potatoes producers incurring implicit taxes amounting to 17% due to receiving only 83% of the real price they should get for their product. Such result means that the implemented policy was not in favor of domestic Potatoes producers.

Table 9 Price Protection Coefficients of Potato Grown in Egypt over the Period 2000-2017

Items	Value
NPC_o	**0.83**
NPC_I	**0.84**
EPC	**0.82**
DRC	**0.35**

Source: Calculated from Table 8.

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4.5.2 Nominal Protection Coefficient on Inputs (NPC_I)

Results in Table (9) show that Nominal Protection Coefficient on Inputs amounted to 0.84, which is less than unity, indicating very low subsidy on inputs used in Potatoes production over the study period 2000-2017. In other words, Potatoes producers received a subsidy as low as 16% on production inputs. This also means that subsidy to Potatoes producers is diminishing, which complies with the implemented agricultural policy of gradual removal of subsidy on production inputs until reaching price levels proportionate to their economic cost thus international prices. Such finding indicates that the implemented economic liberalization policy resulted in very limited subsidy on production inputs for Potatoes producers.

4.5.3 Effective Protection Coefficient (EPC)

It is evident from Table (9) that Effective Protection Coefficient amounted to 0.82, which is less than unity, indicating that Potatoes producers incur implicit taxes. In other words, value added in domestic prices is lower than that in international prices, which means absence of protection policy during the study period. Such result means that the government has been imposing taxes, either direct or indirect.

4.5.4 Domestic Resources Cost Ratio DRC (Comparative Advantage)

Results in Table (9) show that Domestic resource Cost Ratio amounted to 0.35, indicating that Egypt enjoyed a comparative advantage in Potatoes production during the study period 2000-2017, which means that domestic production of Potatoes is preferred to dependency on imports.

5. Conclusion and recommendations:

Agricultural policy is considered of the most important national economic policies through which the country can achieve the goal of improving the level of national agricultural income thus the economic and social standards for workers in the agricultural sector in particular, and the whole population in general. Since the 1980s of last century, the Egyptian economy has been witnessing radical changes that led to major and direct impacts on Egypt's agricultural sector .The current research investigates the problems arising from impact of agricultural price policy in agricultural production through adopting development strategies that aim to achieve free market economy and dependency on interaction between supply and demand forces as main pillar to raise efficiency of the national economy and achieve the hoped for development, which all resulted in producers bearing the burden of paying indirect taxes (implicit) due to price distortions resulting from imbalances between domestic and international prices. Such situation obstructs efforts exerted to achieve optimum economic efficiency in domestic resources' use as well as the welfare of producers and consumers. As a result, producers started choosing to cultivate other crops that are not subject to taxes and in the same time are profitable.

The research applied Policy analysis matrix to determine indicators that can be help to identify trends of agricultural policies implemented in the agricultural sector and measure the efficiency of economic resources' use. PAM is usually built using farm budget, including revenues and costs, which occur in the form of tradable inputs (production inputs) and domestic resources (land and labor). In PAM, both revenues and costs are evaluated financially (at market prices) and economically (at border prices) to assess the

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impact of the implemented policy by measuring Nominal Protection Coefficient for outputs and inputs, Effective Protection Coefficient and Comparative Advantage Coefficient (Domestic Resource Cost Coefficient).

The results showed that the financial value of workers' wages in the production of wheat, maize, rice, and potatoes at market prices exceeded the border prices, while the values of the nominal protection coefficients of outputs were about 0.81, 0.81, 0.80, 0.83 for wheat, maize, rice, and potatoes. Nominal protection coefficient values for production inputs were 0.83, 0.83, 0.85, 0.84 for the four crops, while the effective protection plant values for wheat, maize, rice, and potato crops were 0.80, 0.80, 0.80, 0.84. The values of the comparative advantage of the four crops, were 0.49, 0.52, 0.38, 0.37.

Based on the research results, we recommend the following:

I. Must continue implementing food subsidy policy and reforming the implemented price policy at the sectoral and national levels.

II. Revisiting governmental policies and devoting more attention to increasing wheat, maize, rice and potatoes planted areas in main producing governorates based on production efficiency indicators, and taking into account wheat, maize, rice and potatoes profitability relative to the profitability of competing crops.

III. It is important to link price policy to non-price policies and procedures in order to realize successful implementation of the designed price policy.

IV. Establishing an Agricultural Policy Information Center that comprises an integrated field information unit and a unit for technical aspects related to the implementation agricultural policy.

V. Setting a procurement price, close to the international prices of wheat, maize, rice and potatoes, three months prior to wheat, maize, rice and potatoes planting season, such that the announced price is fair to producers, i.e., it covers production cost and provide a fair profit margin, and in the same time is a fair price for consumers.

REFERENCES

1. El-Batran, Mohsen., Mahmoud., and Khalil, Sahra. Impact of Economic Reform Policy on Agricultural Labor in Egypt. Egyptian Society for Agricultural Economics, Egyptian Journal of Agricultural Economics, 2002;12 (2), 860-877.

2. Gado, El-Sied., Hasan, Mohamed. Analytical Study of Policy Analysis Matrix Applied to Cereal Crops Grown in Egypt. Egyptian Journal of Agricultural Economics. 2017; 27 (2), 475-486.

3. Khamis, Safa. Price Policy of Some Cereal Crops in the Light of Economic Liberalization. MSc.Thesis (unpublished), Department of Agricultural Economics, Faculty of Agriculture, Fayoum University. 2015; pp: 102-156.

4. MPMAR (Ministry of Planning, Monitoring and Administrative Reform). Statistical Database. Cairo, Egypt: Ministry of Planning, Monitoring and Administrative Reform. 2017.

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5. World Bank. 2017. World Development Indicators database. Accessed June 25, 2018.

6. Owen, R., and Ş. Pamuk. A History of Middle East Economies in the Twentieth Century. Cambridge, Massachusetts: 1998; Harvard university Press.

7. CAPMAS. Foreign Trade Database, Foreign Trade Bulletins, Govt. Egypt., Cairo. 2017.

8. MALR. Economic Affairs Sector, Central Administration for Agricultural Economics, Bulletin of Agricultural Economics. 2017.

9. Ahmed, Moataz. E. An Economic Study of Egyptian Exports of Potatoes crop. M.Sc. Thesis (unpublished). 2016; Department. Of Agri. Economics., Univ. Agri., Minia.

10. The Central Agency for Public Mobilization and Statistics. (CAPMAS), Annual Bulletin of Agricultural Commodities' Production, Foreign Trade and Consumption Statistics 2017.

11. Ahmed, H. An Economic study to evaluate the impact of the direct and indirect government intervention on wheat crop in Egypt. Egyptian J. of Agri. Eco. 2015; 25(4): 1963-1974.

12. Said, M, A. The effect of the agriculture pricing policies on the Maize crop in Egypt. J. Agric. Economic. and Social Sci., Mansoura Univ. (2013); 12 (4): 2393-2404.

13. EL-Sayed, A. Impacts of the agricultural price policy on onion crop in Egypt. Alex. J. of Environmental and Agri. Sci. (2007);6(2): 1-23.

14. El-Gundy, Haidy., Ali, Hassan., Ahmed. Impact of Agricultural Policy on the most Important Economic variables of Wheat Crop in Egypt. The Egyptian Society for Agricultural Economics, The Egyptian Journal of Agricultural Economics, (2010); 20 (2), 264-279.

15. Tolba, Ahmed., Abo Rawash, and Kamel, Abeer. Impact of Agricultural Price Policy on Wheat Crop in Egypt. Egyptian Journal of Agricultural Economics. (2011); 24 (4), 1201-1224.

16. Georgi, Mona., Fakhry, and Hanna, Basim., Doos. Impact of Agricultural Price Policy on Some Cereal Crops Grown in Egypt. Egyptian Society for Agricultural Economics, Egyptian Journal of Agricultural Economics, (2013); 23 (2), 414-434.

17. Khamis, Safa. Price Policy of Some Cereal Crops in the Light of Economic Liberalization. MSc. Thesis (unpublished), Department of Agricultural Economics, Faculty of Agriculture, Fayoum University. (2015); pp: 102-156.

18. El-Saeed, Attiat., Mohamed, and Mansour, Fatma., Abd El-Sahfe. Economic Impacts of Price Policy on Egypt's Rice Production". Mansoura Journal of Agricultural Science, Faculty of Agriculture, Mansoura University, (2017); 8(5), 281 – 285.

19. Kamel, A. and Saleh, A. Analyzing of the agricultural policies on the economic indicators of the cropping patterns in Egypt. Egyptian J. of Agri. Eco. (2015) ;25(4): 1891-1904.

20. Moataz Eliw Mostafa, Abd El-Wakil M. Abou-Taleb and Umar ljaz Ahmed. Impact of Governmental Intervention on Wheat Crop Grown in Egypt, Journal of Social Sciences and Humanity Studies, (2019); 5(5)1-17.

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