



Impact of Egyptian Agriculture policy and comparative advantage of Tomato and Potato using PAM matrix

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ABSTRACT:

The purpose of the study is to determine the effect of the Egyptian policies on production of tomato and potato by utilizing the Policy Analysis Matrix (PAM). The study was based on descriptive and quantitative statistics in analyzing the data collected.

Results show domestic price of tomato is equal to international price, which means that tomato producers neither received government support nor incurred implicit taxes, domestic resource cost ratio amounted to 0.30, indicating that Egypt enjoyed a comparative advantage in tomato production.

It is evident that value added in potato domestic prices is lower than that in international prices, which means absence of protection policy as an average from 2015 to 2019. Such result means that the government has been imposing taxes, either direct or indirect, or it has been subsidizing potato imports, domestic resource cost ratio amounted to 0.85, indicating that Egypt enjoyed a comparative advantage in Potato production during the study period, which means that domestic production of potato is preferred than dependency on imports.

Keywords: Policy Analysis Matrix (PAM), comparative advantage, Tomato, Potato, Egypt.

1. INTRODUCTION:

The foreign trade of any commodity and in any economy is affected by some factors, including the economic policies applied by this economy and to which that commodity is subject, the production and consumption situation of that commodity, the extent of stock availability of that commodity, the demand for the commodity, and the extent to which the local price differs from the world prices (prices are the main factor in directing economic resources to obtain the maximum profit from the exploitation of those resources).
treasury.

The policies taken by the Egyptian government during the last period, had a significant impact on the economies of agricultural sector. The government intervenes in the pricing of agricultural commodities at different times, either directly or indirectly, with the aim of providing commodity stability and thus achieving food security for low-income people, rationalizing those spent on food from foreign exchange, while trying to increase the proceeds of foreign currencies and guaranteeing a return to the state

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This intervention and the continuous change in agricultural policies may lead to imbalance in the price between international prices and domestic prices which leads to price distortions both at the local level and at the international level, as well as a lack of optimal utilization of production resources. This leads to the decline of the number of

producers of tomato and potato, that the area under tomato and potato cultivation decreased from 907 thousand feddan in 2015 to 820 thousand feddan in 2019.

The purpose of the study is to determine the effect of the Egyptian policies on production of tomato and potato by utilizing the Policy Analysis Matrix (PAM).

2. MATERIALS AND METHODS:

Data source

The study relied on secondary data issued by government agencies, such as Food and Agriculture Organization (FAO) and the Economic Affairs Sector of the Ministry of Agriculture and Land Reclamation, Egypt. In addition to Arab and foreign references related to the subject of the study.

Data analysis

Descriptive and quantitative statistics were used to analyze data collected, such as the arithmetic mean and relative importance. In addition to estimate some of the indicators of the Policy Analysis Matrix (PAM) which used to know the effect of government policies on the producers of tomato and potato in Egypt, and also the impact of those policies on Egyptian exports of those crops.

Policy analysis matrix (PAM)

The concept of Policy Analysis Matrix (PAM) was developed by Monke, et al (1989) and augmented by developments

price distortion analysis by Master, et al (1995). A PAM allows for the study of the impact of policy by constructing different enterprise budgets, one valued at market prices and the other valued at social prices. After formulation of the matrix, it provides an expedient method of calculating the measure of policy effects and events of competitiveness and economic efficiency/comparative advantage. It shows a set of values which can be used to calculate profit at the observed private price (market price) or social price. The private price is the actual price at which input are bought from the market or produce sold by a producer; that reflects the influence of government intervention in form of a tax or subsidy. If this price is used to calculate profit, it is referred to as private profit (D) =A- (B+C). The standard PAM structure is given in table 1.

Table 1. Components of Policy Analysis Matrix (PAM)

	Revenue	Costs		Profit
		Tradable inputs	Domestic resource	
Privet prices	A	B	C	D= A-B-C
Social prices	E	F	G	H= E-F-G
Divergences	I= A-E	J= B-F	K= C-G	L= D-H= I-J-K

Source: Adapted from Monke and Pearson, 1989.

Social profit measures the competitiveness from the use of domestic resources. On the other hand, the price that does not reflect the effect of a tax or subsidy is called the social price. When this price is used to calculate

profit, the profit becomes social profit (H)=E- (F+G). Social profit shows whether the producer allocated the scarce resources very well and whether there is long run competitiveness or comparative advantage in

producing that commodity. Private revenue is the product of the output produced and the private price while social revenue is the product of the output and social price. Domestic factor costs are the costs of other production resources that are being used in producing a commodity.

Generally, social value of a labor can be calculated as the minimum wage rate prevailing in the economy while the interest rate can be used as the social price of a capital. Output transfers (I) and tradable transfers (J) are obtained from application of the divergence's identity (entries in private prices less entries in social prices equal the effects of divergences). Output transfers (I), measures the implicit tax or subsidy on outputs, equals, private revenues (A) less social revenues (E). In turn, tradable input transfers (J), a measure of the implicit tax or subsidy on tradable inputs, equal private tradable input costs (B) less social tradable input costs (F).

Note that social factor prices (G) are found by adjusting private factor prices (C) for observed divergences causing factor price transfers (k). The final result, net transfers (L), can be found by applying either the profitability identity ($I - (J + K) = L$). The net transfer (L) thus can be interpreted either as the net effect of all divergences or as the difference between private and social profitability. This single measure thus shows

the extent to which distorting policies and market failures implicitly subsidize a system by transferring resources into the system or tax that system by transferring resources away from the system.

Domestic Resources Cost ratio (DRC) is computed at social prices. It provides a measure of the level of comparative advantages achieved by the selected systems [$DRC = G / (E-F)$]. If the $DRC > 1$, the system has no comparative advantage, $DRC < 1$, shows that the use of domestic resource is socially profitable and the system has a comparative advantage.

Nominal Protection Coefficient (NPC) measures the level of protection for the output. It can be calculated as the ratio of A and E that is, ($NPC = A/E$). $NPC > 1$ indicates that the system is protected by the government (Implicit subsidy for producers), while $NPC < 1$ shows that the system is not protected (Producers incur implicit taxes).

Effective Protection Coefficient (EPC) compares the added value at private price to added value at social price [$EPC = (A-B) / (E-F)$] which give a combined index of the level of trade distortions on both inputs and outputs. $EPC > 1$ suggests that government policies provide positive incentive to producers, while value $EPC < 1$ indicates that producers are not protected through policy interventions.

3. RESULTS AND DISCUSSION:

Input cost estimations

To estimate the social prices of inputs, we used the Standard Conversion Factor (SCF), when SCF is less than 1; the social prices would be less than the market prices. This means that a farmer would earn greater income from selling crop in the domestic market than in the international market. There could be several reasons for this; that domestic resources for production are more expensive than in the international market. (Table 1 in the appendix)

Input cost analysis of tomato using market and social prices

The financial and economic values of the average production costs was calculated using market and social prices as an average from 2015 to 2019.

Domestic resource cost

Labor wages

Table 2 shows, labor wages of tomato production in market prices is higher than wages computed in social prices. Average value of labor wages in financial value

reached 2602 EGP/ feddan, while that computed in economic value reached 1743.3 EGP/ feddan.

Cost of machinery

Table 2 shows, cost of machinery rented for tomato production in market prices is equal to that computed in social prices reached 1003.6 EGP/ feddan.

Total costs of production and total revenue

When comparing the total costs of production inputs at market and social prices as an average from 2015 to 2019, it is clear from Table 2 that the financial value is greater than the economic value, with 2823.4 EGP/ feddan at market prices, amounting to 2752.6 EGP/ feddan at social prices,

indicating that Tomato producers incurred implicit taxes for total production costs.

As shown in Table 2, Economic value of total revenue was lower than financial value, with 28863.8 EGP/ feddan at market prices, amounting to 28575 EGP/ feddan at social prices; the government supported output prices which boosted profitability. The lower social price means that the domestic producers were supported by government policies. This suggests that domestic producers were charging higher prices for consumers; hence the export price of Egyptian Tomato (social price) was likely lower than the Egyptian domestic price. In other words, the results reflect the fact that the international (social) price was lower than the domestic (private) price.

Table 2. Total costs of production and total revenue of Tomato in Egypt as an average from 2015 to 2019 (EGP/ feddan)

Statement	Financial value	Economic value
Cost of production inputs		
Seeds	666.4	699.7
Compost	310	310
Chemical fertilizer	979.8	1077.8
Pesticides	330.8	396.9
Other expenses	536.4	268.2
Total Costs of production inputs	2823.4	2752.6
Cost of domestic resources		
Labor wages	2602	1743.3
Machinery wages	1003.6	1003.6
Total value of the work item	3605.6	2746.9
Land rent	2433.8	2677
Total revenue	28863.8	28575

Source: Data analysis of table No. (2) In the appendix.

Impact of agricultural policy on tomato

Evident from Table 3 the results of PAM applied to Tomato in Egypt over the period as an average from 2015 to 2019, that average revenue reached 28863.8 EGP/feddan in financial prices, while reached 28575 EGP/feddan in economic prices, resulting in a policy impact of 288.8 EGP/feddan, indicating that Tomato producers have received government support

estimated at 288.8 EGP/feddan as average of the study period.

Results show that Tomato farmers bear costs of production inputs as an average from 2015 to 2019, estimated at 2823.4 EGP/feddan in financial prices, corresponding to 2752.6 EGP/feddan in economic prices, resulting in a policy impact of 70.8 EGP/feddan, which means that cost of production inputs increased by 70.8 EGP/feddan during the study period. As for

net revenue, which reflects implicit taxes incurred by producers and subsidy received, it can be noted from Table 3 that it amounted to 20001 EGP/feddan in financial prices and 20398.5 EGP/feddan in economic

prices, resulting in a policy impact of 397.5 EGP/feddan, indicating that Tomato producers incurred implicit taxes amounting to 397.5 EGP/feddan as average of the study period.

Table 3. Estimation of the Agricultural Policy Analysis Matrix of Tomato in Egypt as an average from 2015 to 2019 (EGP/ feddan)

Limitations	Total revenue	Total costs of production inputs	Domestic resources		Net revenue
			Total value of the work item	Land rent	
Financial prices	28863.8	2823.4	3605.6	2433.8	20001
Economic prices	28575	2752.6	2746.9	2677	20398.5
Policy impact	288.8	70.8	858.7	(243.2)	(397.5)

Numbers in parentheses () are negative values.

Source: Calculated from Table No. (2)

Nominal protection coefficient on outputs (NPCo)

As shown in Table 4, nominal protection coefficient of outputs amounted to 1.01 as an average from 2015 to 2019, which is indicating that the production policy of

Tomato in Egypt is fair. In other words, domestic price of Tomato is equal to international price, which means that Tomato producers neither received government support nor incurred implicit taxes.

Table 4. Nominal and effective protection coefficients and comparative advantage of Tomato in Egypt as an average from 2015 to 2019

Items	Value
The nominal protection coefficient of Outputs (NPCO)	1.01
The nominal protection coefficient of inputs (NPCI)	1.02
Effective protection coefficient (EPC)	0.98
Domestic Resources Costs (DRC)	0.30
Economic surplus	397.5
Economic surplus rate %	1.99
Net revenue per feddan ratio for farms / country	0.98

Source: Calculated from Table No. (2), (3).

Nominal protection coefficient on inputs (NPCI)

Results in Table 4 shows that nominal protection coefficient on inputs amounted to 1.02 as an average from 2015 to 2019, which is indicating that the price policy of Tomato in Egypt is fair; that price of production inputs is reaching to their economic cost thus international prices.

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 Tomato imports.

Domestic resources cost ratio DRC (Comparative Advantage)

Results in Table 4 shows that domestic resource cost ratio amounted to 0.30, indicating that Egypt enjoyed a comparative advantage in Tomato production as an average from 2015 to 2019, which means that domestic production of Tomato is preferred to dependency on imports.

Effective protection coefficient (EPC)

It is evident from Table 4 that effective protection coefficient amounted to 0.98, which is indicating that Tomato producers incur implicit taxes. In other words, value added in domestic prices is lower than that

Input cost analysis of potato using market and social prices

The financial and economic values of the average production costs was calculated using market and social prices as an average from 2015 to 2019.

Domestic resource cost**Labor wages**

Table 5 shows, labor wages of Potato production in market prices is higher than wages computed in social prices. Average value of labor wages in financial value reached 3130.4 EGP/ feddan, while that computed in economic value reached 2097.4 EGP/ feddan.

Cost of machinery

Table 5 shows, Cost of machinery rented for Potato production in market prices is equal to that computed in social prices reached 1811.8 EGP/ feddan.

Total costs of production and total revenue

When comparing the total costs of production inputs at market and social prices

Table 5. Total costs of production and total revenue of Potato in Egypt as an average from 2015 to 2019 (EGP/ feddan)

Items	Financial value	Economic value
Cost of production inputs		
Seeds	6831.4	6899.7
Compost	756.6	756.6
Chemical fertilizer	1550.4	2325.6
Pesticides	482.4	578.9
Other expenses	1322	661
Total Costs of production inputs	10942.8	11221.8
Cost of domestic resources		
Labor wages	3130.4	2097.4
Machinery wages	1811.8	1811.8
Total value of the work item	4942.2	3909.2
Land rent	2744.4	3018.8
Total revenue	24416.8	24172.6

Source: Data analysis of table No. (3) In the appendix.

Impact of agricultural policy on potato

Evident from Table 6 the results of PAM applied to Potato in Egypt over the period as an average from 2015 to 2019, that average

as an average from 2015 to 2019, it is clear from Table 5 that the economic value is greater than the financial value, with 10942.8 EGP/ feddan at market prices, amounting to 11221.8 EGP/ feddan at social prices, indicating that Potato producers have received government support for total production costs.

As shown in Table 5, Economic value of total revenue was lower than financial value, with 24416.8 EGP/ feddan at market prices, amounting to 24172.6 EGP/ feddan at world prices; the government supported output prices which boosted profitability. The lower social price means that the domestic producers were supported by government policies. This suggests that domestic producers were charging higher prices for consumers; hence the export price of Egyptian Potato (social price) was likely lower than the Egyptian domestic price. In other words, the results reflect the fact that the international (social) price was lower than the domestic (private) price.

revenue reached 24416.8 EGP/feddan in financial prices, while reached 24172.6 EGP/feddan in economic prices, resulting in a policy impact of 244.2 EGP/feddan,

indicating that Potato producers have received government support estimated at 244.2 EGP/feddan as average of the study period.

Results show that Potato farmers bear costs of production inputs as an average from 2015 to 2019, estimated at 10942.8 EGP/feddan in financial prices, corresponding to 11221.8 EGP/feddan in economic prices, resulting in a policy impact of 279 EGP/feddan, which means that cost of production inputs declined by 279

EGP/feddan during 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 5787.4 EGP/feddan in financial prices and 6022.8 EGP/feddan in economic prices, resulting in a policy impact of 235.4 EGP/feddan, indicating that Potato producers incurred implicit taxes amounting to 235.4 EGP/feddan as average of the study period.

Table 6. Estimation of the Agricultural policy analysis matrix of potato in Egypt as an average from 2015 to 2019 (EGP/ feddan)

Limitations	Total revenue	Total costs of production inputs	Domestic resources		Net revenue
			Total value of the work item	Land rent	
Financial prices	24416.8	10942.8	4942.2	2744.4	5787.4
Economic prices	24172.6	11221.8	3909.2	3018.8	6022.8
Policy impact	244.2	(279)	1033	(274.4)	(235.4)

Numbers in parentheses () are negative values.

Source: Calculated from Table No. (5).

Nominal protection coefficient on outputs (NPCo)

As shown in Table 7, nominal protection coefficient of outputs amounted to 1.01 as an average from 2015 to 2019, which is indicating that the production policy of Potato in Egypt is fair. In other words, domestic price of Potato is equal to international price, which means that Potato producers neither received government support nor incurred implicit taxes.

Nominal protection coefficient on inputs (NPCI)

Results in Table 7 shows that nominal protection coefficient on inputs amounted to 0.98 as an average from 2015 to 2019, which is indicating that very low subsidy on inputs used in Potato production. In other words, Potato producers received a subsidy as low as 2% on production inputs. This also means that subsidy to Potato 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 Potato producers.

Effective protection coefficient (EPC)

It is evident from Table 7 that effective protection coefficient amounted to 0.96, which is indicating that Potato 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 Potato imports.

Domestic resources cost ratio DRC (Comparative Advantage)

Results in Table 7 shows that domestic resource cost ratio amounted to 0.85, indicating that Egypt enjoyed a comparative

advantage in Potato production as an that domestic production of Potato is average from 2015 to 2019, which means preferred to dependency on imports.

Table 7. Nominal and effective protection coefficients and comparative advantages of Potato in Egypt as an average from 2015 to 2019

Items	Value
The nominal protection coefficient of Outputs (NPCO)	1.01
The nominal protection coefficient of inputs (NPCI)	0.98
Effective protection coefficient (EPC)	0.96
Domestic Resources Costs (DRC)	0.85
Economic surplus	235.4
Economic surplus rate %	4.07
Net revenue per feddan ratio for farms / country	0.96

Source: Calculated from Table No. (5), (6).

Conclusion and Recommendations:

From the study, it was found that production of Tomato and Potato still has a promising prospect as indicated by positive revenue. In spite of the product generates a lower profit at the private market prices; this is due to the government policies and market distortion, there is a gap between revenue in these two prices, which means there are misuse and misdistribution of the local resources. It is to be noted that the study depended on social prices to measure economic value of outputs, because the market price was dominated (and distorted) by subsidies provided in Egypt that discourages to optimize the use of resources. So, to improve competitiveness of Tomato and Potato, government policies should focus towards decreasing the costs of inputs. To improve social competitiveness, price supports both for inputs and output should be eliminated; so that the consumers will not suffer from high output prices and farmers will not be burdened with high input costs.

It is important to note that the government intervention has objectives to support the domestic production and farmers, yet not all the implementation of the policies shows positive impacts. The study showed that production of Tomato and Potato had a comparative advantage since DRC indicator was less than 1. Moreover, that government policy had almost no positive

impacts on the farmers; it even reduced the competitiveness of production. It additionally can be seen that domestic production only provides comparative not the competitive advantages. It implies that production of tomato and potato in Egypt faces challenges to compete in the international market.

Based on the previous results of the study, the following recommendations are given to be considered in the future intervention strategies aimed at promoting the production and the competitive advantage of Tomato and Potato in study area.

- i. The government does not impose indirect taxes on farmers of Tomato and Potato, which leads to these farmers obtaining a high income, thus achieving a better standard of living for them, and thus the desire of these farmers to produce Tomato and Potato.
- ii. Maintaining the foreign markets of Tomato and Potato, as it has a comparative advantage, and provides the state with foreign exchange which contributes significantly to the Egyptian national economy.
- iii. Activating the role of the cooperative sector, to provide agricultural production supplies for Tomato and Potato at prices that compete with the private sector.

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Appendixes:**Table 1. Conversion factor of Agricultural inputs and outputs for Tomato and Potato in Egypt financially and economically**

Agricultural inputs and outputs	Conversion factor
production inputs	
Seeds	1.01
Compost	1
Chemical fertilizer	1.5
Pesticides	1.2
Domestic resources	
Labor wages	0.67
Machinery wages	1
Other expenses	0.5
Land rent	1.1
Outputs	
Tomato	0.99
Potato	0.99

Source: Food and Agriculture Organization of the United Nations (FAO). (1999). Comparative advantage and competitiveness of crops, crop rotation and livestock products in Egypt.

Table 2. Total costs of production and total revenue of Tomato in Egypt from 2015 to 2019 (EGP/ feddan)

production inputs	2015	2016	2017	2018	2019	Average
Labor wages	1732	1894	2420	3306	3658	2602
Machinery wages	743	806	956	1109	1404	1003.6
Seeds	481	536	552	799	964	666.4
Compost	234	245	300	377	394	310
Chemical fertilizer	778	934	858	1039	1290	979.8
Pesticide	252	324	307	368	403	330.8
Other expenses	380	426	511	635	730	536.4
Land rent	1285	2542	2296	3018	3028	2433.8
Total costs	5885	7707	8196	10705	11871	8872.8
Total revenue	24836	28460	25260	31738	34025	28863.8

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector. (2015-2019). Agricultural Economics Bulletin, Egypt.

Table 3. Total costs of production and total revenue of Potato in Egypt from 2015 to 2019 (EGP/ feddan)

production inputs	2015	2016	2017	2018	2019	Average
Labor wages	1874	2232	3612	3949	3985	3130.4
Machinery wages	577	890	2169	2663	2760	1811.8
Seeds	4467	5066	7103	8656	8865	6831.4
Compost	420	506	1007	900	950	756.6
Chemical fertilizer	1102	1158	1739	1898	1855	1550.4
Pesticide	299	360	545	583	625	482.4
Other expenses	788	930	1456	1678	1758	1322
Land rent	1549	2673	3173	3141	3186	2744.4
Total costs	11088	13939	20408	23468	23984	18577.4
Total revenue	14488	17002	25408	33536	31650	24416.8

Source: Ministry of Agriculture and Land Reclamation, Economic Affairs Sector. (2015-2019). Agricultural economics bulletin, Egypt.

الملخص العربي

أثر السياسة الزراعية المصرية والميزة النسبية للطماطم والبطاطس باستخدام مصفوفة تحليل السياسات (PAM)

إستهدفت الدراسة تحديد تأثير السياسات المصرية على إنتاج الطماطم والبطاطس باستخدام مصفوفة تحليل السياسات (PAM). اعتمدت الدراسة على التحليل الإحصائي الوصفي والكمي في تحليل البيانات التي تم جمعها. أظهرت نتائج الدراسة أن السعر المحلي للطماطم يساوي السعر العالمي، مما يعني أن منتجي الطماطم لم يتلقوا دعمًا حكوميًا ولم يتكبدوا ضرائب ضمنية، وبلغت نسبة تكلفة الموارد المحلية 0.30، مما يشير إلى تمتع مصر بميزة نسبية في إنتاج الطماطم.

كما بينت نتائج الدراسة أن القيمة المضافة في الأسعار المحلية أقل من تلك الموجودة في الأسعار الدولية، مما يعني عدم وجود سياسة حماية كمتوسط من 2015 إلى 2019، وتعني هذه النتيجة أن الحكومة كانت تفرض ضرائب، سواء بشكل مباشر أو غير مباشر، وبلغت نسبة تكلفة الموارد المحلية 0.85، مما يشير إلى أن مصر تمتعت بميزة نسبية في إنتاج البطاطس خلال فترة الدراسة، مما يعني أن الإنتاج المحلي من البطاطس مفضل على الاعتماد على الواردات.

الكلمات المفتاحية: مصفوفة تحليل السياسات، الميزة النسبية، الطماطم، البطاطس، مصر.