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# Agricultural policy and corn food security in Egypt

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***Abstract***
*This article examines the increase in the volume of maize imports as an agricultural policy on Egyptian food security during the period (2000-2019) and the endeavor to raise the self-sufficiency ratio in light of global crises by using food security indicators, a policy analysis matrix, estimating the nominal and effective protection factor and the comparative advantage coefficient. The decline in the food security factor shows that maize farmers in Egypt bear implicit taxes of 1005.6 and 2210 pounds as an average for the first and second period, respectively, as well as the negative impact of the Corona pandemic.*

***Keywords***: *Corn – Covid19 – Food Security – Egypt*

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## I. Introduction

Food security is considered one of the most effective factors on national economic sector in recent times, due to its huge importance that affects human life in Egyptian society. Food security has varying definitions but all are revolving around society's ability to meet its inhabitants needs from sufficient and healthy food during a certain period of time. While, from strategic sciences perspective, food security concept stands for providing a strategic stock that covers needs to basic commodities over a certain period of time. So, thee case of food security relates to society's ability to meet individuals' food needs whether through locally producing commodities or through exporting from outside, or both approaches.

Maize crop is seen as one of the most important maize grains in Egypt, which plays a critical role in food security due to its use in human food, which is rivaled by animal food where the average of total local maize consumption for the period (2017-209) has reached 16.27 million tons. While averages of both human and animal food consumption have reached 2.5 and 13.77 million tons, representing 15.37% and 48.63%, respectively, of total local consumption for the same period. With production average estimated by 6.53 million tons which represents 40.14% of total local consumption. While average imports reached 9.58 million tons representing 58.88% of total local consumption for the same period. Stats reflect the critical roe maize food security plays, as Egypt imports around 59% of local consumption.

## II. Research problem

Research problem lies in Egypt dependency on foreign imports to meet the largest portion of demand on maize as a food source for humans and animals, through importing around 9.9 million tons that represents around 60% of total local consumption that reached around 16.7 million tons in 2019. World crop price fluctuations stemming from world crises led to an increase in local prices, which in turn affected citizens' living standards increasing burdens on low-income families, that had to switch more of non-food related expenses to food related spending. With food gap of maize increasing from around 8.85 million tons in 2015 to around 10.30 million tons in 2019, with an increase rate estimated by 1.45 million tons which represents 22.62% of the average gap size during that period that's 6.41 million tons.

This underlines the importance of finding ways and methods that limits dependency on foreign countries in meeting large portion of Egypt needs from that crop, also raising self-sufficiency ratio considering this one of the highest priorities in achieving food security.

## III. Goals Of The Research

The research aims essentially at studying and analyzing economics of national food security of maize crop during the period 2000-2019 in order to recognize different concepts of maize food security, cast light on its reasons and features, understand the most important economic factors that handle the case, study the most

important economic policies that manages local crop food security, and study the effects of world crisis on international and local crop prices and its effect – locally and internationally - on the most important industries that rely on maize production.

## IV. Methodology and data sources

To achieve its goals, research depends on published and non-published secondary data in all authorities and institutions that are relating to research subject matter. This is made using quantitative and qualitative analyses through a set of economic indexes and analyses like arithmetic average, percentages, rational numbers, food security coefficient, stock sufficiency period for daily consumption, beside other food security indexes. With estimation of simple and multiple regression relationships in addition to the use of policy analysis matrix, and evaluation of nominal protection coefficient, active protection coefficient and comparative advantage coefficient.

## V. Listing and discussing most important research results

**First: Most important economic indexes of maize in Egypt**

By studying Table 1 data, it turned out that most important economic indexes of maize in Egypt during the period 2000-2019 are:

**1- Production amount of maize crop in Egypt:**

Produced amount of maize crop in Egypt during the period 2000-2019 had fluctuated between a minimum level that reached around 5.5 million tons in 2011 and a maximum level that reached 6.8 million tons in 2018, with increment of 1.3 million tons that represent increase of 23.6% compared to its counterpart of 2011, and round 21.3% of the annual average that represents 6.9 million tons. Table 2, equation has shown that significance of the increase of Egypt's maize production isn't statistically proven during the study period.

**2- Consumption amount of maize crop in Egypt:**

The consumed amount of maize in Egypt during the study period fluctuates between a minimum level that reached 9.2 million tons in 2003, and a maximum level that reached 16.7 million tons in 2019 with increment of 7.5 million tons that represents 81.5% compared to its counterpart in 2003, and around 60% of the annual average that reaches 12.49 million tons. Table 2- equation 2 has shown that consumed amount of maize has increased in annual increments with an increase estimated by 2.6%, and significance of the increase has been confirmed at significance level of 1%.

**3- Exported amounts of maize in Egypt:**

Average amount of maize exports in Egypt during the study period has reached around 5.8 thousand tons. While there was no exports during the period 2000-2004, while the exported mounts have increased to reach its maximum level of 19 thousand tons in 2008. Table 2 – equation 3 has shown that exported amount of maize has increased in an annual rate achieving an increment of approximately 35.5%, and significance of the increase has been confirmed at significance level of 1%.

**4- Imported amounts of maize in Egypt:**

Imported amounts of maize in Egypt during the period 2000-2019 fluctuated between a minimum level of around 3.74 million tons in 2003, and a maximum level of around 9.9 million tons in 2019. With an increment estimated at around 6.16 million tons compared to its counterpart of 2003. And around 95.4% of the annual average of 6.46 million tons. Table 2 – equation 4 shows that exported amount of maize has increased in an annual rate that's estimated by 4.6%. Significance of the increase has been confirmed at significance level of 1%.

**5- Evolution of maize surplus or food gap in Egypt:**

Studying and analyzing evolution of maize surplus or food gap in Egypt during the period 2000-2019 has shown that Egypt suffers from a food gap in maize in each year of the study period. The gap ranged from a minimum level of around 3.46 million tons in 2003, and a maximum level of around 10.3 million tons in 2019, with an annual average of around 6.41 million tons. Table 2 – equation 5 ha shown that food gap of maize has increased by an annual increase estimated by 4.8%. Significance of that increase has been confirmed at significance level of 1%.

**6- Evolution of self sufficiency rate of maize in Egypt(Fang & Beghin, 2000):**

It became clear, during study period, that Egypt is unable to achieve self sufficiency of maize. As average rate of self sufficiency of maize in Egypt during the study period has reached around 49.9%. And ranged from a minimum level of around 38.3% in 2019 to a maximum amount of around 62.4% in 2003. Table 2 – equation 6 has shown that self sufficiency rate of maize in Egypt has decreased with an annual decreasing rate of around 2.3%. (Ghose, 2014)Statistical significance of that decrease has been confirmed at significance level of 1%.

**Table 1**
The Most Important Economic Indicators Of The Maize Crop In Egypt During The Period (2000-2019)

| year | Production quantity (thousand tons) | Consumption quantity (thousand tons) | Quantity of exports (thousand tons) | Quantity of imports (thousand tons) | Food gap (thousand tons) | Self-sufficiency rate (%) | Dependence rate (%)[1] |
|---|---|---|---|---|---|---|---|
| 2000 | 5636.0 | 10900.0 | 0.0 | 5268.0 | (5264.0) | 51.7 | 48.3 |
| 2001 | 6160.0 | 11200.0 | 0.0 | 4905.0 | (5040.0) | 55.0 | 43.8 |
| 2002 | 6000.0 | 10900.0 | 0.0 | 4848.0 | (4900.0) | 55.0 | 44.5 |
| 2003 | 5740.0 | 9200.0 | 0.0 | 3743.0 | (3460.0) | 62.4 | 40.7 |
| 2004 | 5840.0 | 11300.0 | 0.0 | 5398.0 | (5460.0) | 51.7 | 47.8 |
| 2005 | 5932.0 | 10100.0 | 4.0 | 4397.0 | (4168.0) | 58.7 | 43.5 |
| 2006 | 6149.0 | 10700.0 | 4.0 | 4826.0 | (4551.0) | 57.5 | 45.1 |
| 2007 | 6174.0 | 10400.0 | 11.0 | 4151.0 | (4226.0) | 59.4 | 39.9 |
| 2008 | 6645.0 | 11100.0 | 19.0 | 5031.0 | (4455.0) | 59.9 | 45.3 |
| 2009 | 6280.0 | 12000.0 | 13.0 | 5832.0 | (5720.0) | 52.3 | 48.6 |
| 2010 | 6500.0 | 12500.0 | 13.0 | 5803.0 | (6000.0) | 52.0 | 46.4 |
| 2011 | 5500.0 | 11700.0 | 6.0 | 7154.0 | (6200.0) | 47.0 | 61.1 |
| 2012 | 5800.0 | 12000.0 | 3.0 | 5059.0 | (6200.0) | 48.3 | 42.2 |
| 2013 | 5800.0 | 13200.0 | 4.0 | 8791.0 | (7400.0) | 43.9 | 66.6 |
| 2014 | 5960.0 | 13900.0 | 4.0 | 7839.0 | (7940.0) | 42.9 | 56.4 |
| 2015 | 6000.0 | 14850.0 | 6.0 | 8722.0 | (8850.0) | 40.4 | 58.7 |
| 2016 | 6000.0 | 15100.0 | 10.0 | 8773.0 | (9100.0) | 39.7 | 58.1 |
| 2017 | 6400.0 | 15900.0 | 5.0 | 9464.0 | (9500.0) | 40.3 | 59.5 |
| 2018 | 6800.0 | 16200.0 | 3.0 | 9367.0 | (9400.0) | 42.0 | 57.8 |
| 2019 | 6400.0 | 16700.0 | 10.0 | 9900.0 | (10300.0) | 38.3 | 59.3 |
| **Average** | 6085.8 | 12492.5 | 5.8 | 6463.6 | (6406.7) | 49.9 | 50.7 |

**Source:** Foreign Agricultural Service, **Official USDA Estimates(USDA, 2006).**
*Note.* Numbers in parentheses are negative.

**Table 2**
Estimating The Growth Function For The Most Important Economic Indicators Of The Maize Crop In Egypt During The Period (2000-2019)

| No. | Statement | The equation | Period average | % Annual rate of change | R2 | F |
|---|---|---|---|---|---|---|
| 1 | Production quantity (thousand tons) | Ln $\hat{y}$ = 8.675 + 0.004 $x_t$ (354.18)** (1.738) | 6085.8 | - | 0.096 | 3.019 $^{n.s}$ |
| 2 | Consumption quantity (thousand tons) | Ln $\hat{y}$ = 9.144 + 0.026 $x_t$ (252.70)** (8.649)** | 12492.5 | 2.6 | 0.795 | 74.806** |
| 3 | Quantity of exports (thousand tons) | Ln $\hat{y}$ = 3.474 + 0.355 $x_t$ (3.58)** (4.380)** | 5.8 | 35.5 | 0.516 | 19.185** |
| 4 | Quantity of imports (thousand tons) | Ln $\hat{y}$ = 8.247 + 0.046 $x_t$ (110.75)** (7.355)** | 6463.6 | 4.6 | 0.736 | 54.101** |
| 5 | Food gap (thousand tons) | Ln $\hat{y}$ = 8.216 + 0.048 $x_t$ (110.07)**(7.641)** | 6406.7 | 4.8 | 0.751 | 58.392** |
| 6 | Self-sufficiency rate (%) | Ln $\hat{y}$ = 4.136 - 0.023 $x_t$ (104.60)**(-6.839)** | 49.9 | (2.3) | 0.707 | 46.766** |
| 7 | Dependence rate (%) | Ln $\hat{y}$ = 3.708 + 0.020 $x_t$ (73.41)** (4.646)** | 50.7 | 2.0 | 0.521 | 21.588** |

Source**:** Calculated from Table (1)
*Note.* $\hat{y}$: denotes the dependent variable , Xt: denotes the time factor , i:1,2,…….20
(**): significant at 0.01 , $^{n.s}$ : not significant , ( ): The values in parentheses are negative

**7- Evolution of Egypt's reliance on foreign countries' maize crop:**
Egypt reliance on foreign countries in meeting its needs from maize represents an average of around 50.7% for the study period (2000-209). Egypt reliance rate on foreign countries with regard to maize has ranged from a minimum level of around 39.9% in 2007, and a maximum level of around 66.6% in 2013. Table 2 – equation 7 shows an increase in Egypt reliance on foreign countries to meet its needs of maize, with an annual increasing rate of around 2%. This significance has been confirmed at significance level of 1%.

[1] - The proportion of foreign dependence for the maize crop = (import quantity / consumption quantity) x 100

**Second: Estimating food security indexes of maize crop in Egypt**

**1- Daily local maize consumption amount:**

Studying Table 3 data showed that daily local maize consumption amount in Egypt during the period 2000-2019 ranged between a minimum level of around 25.2 thousand tons in 2003, and a maximum level of around 45.8 thousand tons in 2019, with annual average of 34.2 thousand tons. Table 4 – equation 1 points out that daily local maize consumption amount has increased with an annual growth rate estimated by 2.6%, and the significance of that increase has been confirmed at significance level of 1%. Considering the aforementioned information, it's clear that the increase in annual local consumption of maize is a result to the sustainable increase in population, along with the increase in demand on the crop, whether for human or animal consumption.

**2- Maize production sufficiency period for consumption:**

Table 3 indicates that sufficiency period for maize crop consumption in Egypt during the study period ranged between a minimum level of around 139.9 days in 2019 and a maximum level o around 227.7 days in 2003, with annual average for the period reaching around 182.2 days. Table 4 – equation 2 indicates a decrease in sufficiency period of maize production consumption, with annual rate decrease estimated by approximately 2.3%. Significance of this decrease has been confirmed at significance level of 1%.(Swastika, 2002)

**Table 3**

Food Security Indicators For The Maize Crop In Egypt During The Period (2000-2019)

| year | Daily local consumption[1] (thousand tons) | Adequacy period of production for consumption[2] (day) | Period to cover imports for consumption[3] (day) | The sum of the two periods[4] (day) |
|---|---|---|---|---|
| 2000 | 29.9 | 188.7 | 176.4 | 365.1 |
| 2001 | 30.7 | 200.8 | 159.9 | 360.6 |
| 2002 | 29.9 | 200.9 | 162.3 | 363.3 |
| 2003 | 25.2 | 227.7 | 148.5 | 376.2 |
| 2004 | 31.0 | 188.6 | 174.4 | 363.0 |
| 2005 | 27.7 | 214.4 | 158.9 | 373.3 |
| 2006 | 29.3 | 209.8 | 164.6 | 374.4 |
| 2007 | 28.5 | 216.7 | 145.7 | 362.4 |
| 2008 | 30.4 | 218.5 | 165.4 | 383.9 |
| 2009 | 32.9 | 191.0 | 177.4 | 368.4 |
| 2010 | 34.2 | 189.8 | 169.4 | 359.2 |
| 2011 | 32.1 | 171.6 | 223.2 | 394.8 |
| 2012 | 32.9 | 176.4 | 153.9 | 330.3 |
| 2013 | 36.2 | 160.4 | 243.1 | 403.5 |
| 2014 | 38.1 | 156.5 | 205.8 | 362.3 |
| 2015 | 40.7 | 147.5 | 214.4 | 361.9 |
| 2016 | 41.4 | 145.0 | 212.1 | 357.1 |
| 2017 | 43.6 | 146.9 | 217.3 | 364.2 |
| 2018 | 44.4 | 153.2 | 211.0 | 364.3 |
| 2019 | 45.8 | 139.9 | 216.4 | 356.3 |
| **Average** | 34.2 | 182.2 | 185.0 | 367.2 |

**Source**: Foreign Agricultural Service, **Official USDA Estimate.**

**3- Imports coverage period for maize consumption:**

Table 3 indicates that imports coverage period for maize consumption in Egypt during the study period ranged between a minimum level of around 145.7 days in 2007, and a maximum level of around 243.1 days in 2013, with an annual average of around 185 days. Table 4 – equation 3 shows an increase in imports coverage period of maize consumption with an annual increasing rate estimated by approximately 2%. Significance of this increase has been confirmed at significance level 1%. Given the aforementioned information, it's clear that there's an increase in Egypt reliance on imports from foreign countries to meet its need from the crop, which couldn't be met through local production due to local production inability to reach the levels required to meet increasing demand on maize. This indicates lowering food security indexes of maize, as imports coverage period for consumption goes high.

**Table 4**

[1] -Daily Domestic Consumption = Total Domestic Consumption / 365 days.
[2] -Production Adequacy Period for Consumption = Gross Domestic Production / Total Daily Domestic Consumption.
[3] -Period of import coverage for consumption = Quantity of annual imports / Total daily domestic consumption.
[4] -The sum of the two periods = period of sufficiency of production for consumption + period of imports coverage for consumption.

Estimating The Growth Function For The Most Important Indicators Of Food Security For The Maize Crop In Egypt During The Period (2000-2019):

| No. | Statement | The equation | Period average | % Annual rate of change | R2 | F |
|---|---|---|---|---|---|---|
| 1 | Daily local consumption (thousand tons) | Ln $\hat{y}$ = 3.245 + 0.026 $x_t$ (89.42)** (8.625)** | 34.2 | 2.6 | 0.794 | 74.397** |
| 2 | Adequacy period of production for consumption (day) | Ln $\hat{y}$ = 5.431 - 0.023 $x_t$ (137.59)** (-6.852)** | 182.2 | (2.3) | 0.707 | 46.943** |
| 3 | Period to cover imports for consumption (day) | Ln $\hat{y}$ = 5.003 + 0.020 $x_t$ (98.91)** (4.641)** | 185 | 2 | 0.52 | 21.543** |

*Note*: ŷ: denotes the dependent variable , Xt: denotes the time factor , i:1,2,…….20
(**): significant at 0.01 , ( ): The values in parentheses are negative
**Source:** Calculated from Table (3)

**4- Surplus and deficit in local consumption of maize**

A study of Table 5 data has indicted that overall surplus of maize local consumption in Egypt during the study period has reached around 3.82 million tons that was enough for around 119.6 days. Surplus of maize local consumption ranged between a minimum level of around 4000 tons in 2000 that was enough for 0.1 days, and a maximum level that reached around 1.39 million tons in 2013, that was enough for 38.5 days.

Also, overall deficit of maize local consumption in Egypt during the study period has reached around 2.69 million tons that was enough for around 75.1 days. Deficit value in maize local consumption ranged between a minimum level of around 33 thousand tons in 2018 that was enough for 0.7 days, and a maximum level that reached around 1.14 million tons in 2012 that was enough for 34.7 days. Given the aforementioned information, it's clear that food security ration of maize in Egypt must be lifted up in order to overcome the food gap, and achieve strategic surplus that could be used in periods of deficit.

**5- Amount of strategic stock of maize in Egypt**

Table 5 indicates overall strategic stock of maize in Egypt during the study period, that was estimated by around 3.77 million tons that was enough for 117.9 days. Strategic stock of maize ranged between a minimum level of around 4000 tons in 2000, which was enough for 0.1 days, and a maximum level of around 1.39 million tons in 2013, which was enough for 38.4 days. This highlights an interest in raising strategic stock of that crop, which suffers from a huge deficit between production and consumption, where strategic stock is used to cover a portion of consumption during the periods of deficit.

**6- Value of food security coefficient for maize**

Value of food security coefficient ranges between one and zero. If it approaches close to zero, that highlights a decrease in food security, and when it approaches close to one, it highlights an increase in food security. But when it goes higher or lower than one and zero (positive, negative), that points out a surplus or deficit in strategic stock for number of years equal to the number bigger than one. Table 5 shows that collective food security coefficient of maize has reached approximately 0.015, and its value during the study period ranged between a minimum level of around 0.0003 in 2018, and a maximum level that reached 0.19 in 2013. These results reflects a fall back in food security coefficient value for maize in Egypt during the study period. The decrease in coefficient value poses a threat to Egypt's food security, it means also a reliance on foreign countries in food supplies. So these results must be considered and agricultural policies that go in line with it must be put in place(Adenew, 2004).

**Table 5**

The Amount Of Surplus And Deficit And The Value Of The Food Security Factor Of The Maize Crop In Egypt During The Period (2000-2019):

| year | Surplus | | Deficit | | stock | | | | The value of the food security factor |
|---|---|---|---|---|---|---|---|---|---|
| | The amount of surplus in domestic consumption (thousand tons) | Sufficiency period of the surplus for domestic consumption (day) | Amount of deficit in domestic consumption (thousand tons) | The adequacy of the deficit in consumption (day) | Volume of strategic stocks (thousand tons) | Stock adequacy period for daily consumption (day) | Quantity of strategic stocks (thousand tons) | The amount of change in the size of the strategic stock | |
| 2000 | 4.0 | 0.1 | — | — | 4.0 | 0.1 | 8.0 | — | — |
| 2001 | — | — | 135.0 | 4.4 | — | — | — | (139.0) | (0.012) |
| 2002 | — | — | 52.0 | 1.7 | — | — | — | 83.0 | 0.008 |
| 2003 | 283.0 | 11.2 | — | — | 283.0 | 11.2 | 566.0 | 335.0 | 0.036 |
| 2004 | — | — | 62.0 | 2.0 | — | — | — | (345.0) | (0.031) |
| 2005 | 229.0 | 8.3 | — | — | 225.0 | 8.1 | 458.0 | 287.0 | 0.028 |
| 2006 | 275.0 | 9.4 | — | — | 271.0 | 9.2 | 550.0 | 46.0 | 0.004 |
| 2007 | — | — | 75.0 | 2.6 | — | — | — | (357.0) | (0.034) |
| 2008 | 576.0 | 18.9 | — | — | 557.0 | 18.3 | 1152.0 | 643.0 | 0.058 |
| 2009 | 112.0 | 3.4 | — | — | 99.0 | 3.0 | 224.0 | (458.0) | (0.038) |
| 2010 | — | — | 197.0 | 5.8 | — | — | — | (309.0) | (0.025) |
| 2011 | 954.0 | 29.8 | — | — | 948.0 | 29.6 | 1908.0 | 1158.0 | 0.099 |
| 2012 | — | — | 1141.0 | 34.7 | — | — | — | (2092.0) | (0.174) |
| 2013 | 1391.0 | 38.5 | — | — | 1387.0 | 38.4 | 2782.0 | 2531.0 | 0.192 |
| 2014 | — | — | 101.0 | 2.7 | — | — | — | (1492.0) | (0.107) |
| 2015 | — | — | 128.0 | 3.1 | — | — | — | (29.0) | (0.002) |
| 2016 | — | — | 327.0 | 7.9 | — | — | — | (203.0) | (0.013) |
| 2017 | — | — | 36.0 | 0.8 | — | — | — | 296.0 | 0.019 |
| 2018 | — | — | 33.0 | 0.7 | — | — | — | 5.0 | 0.0003 |
| 2019 | — | — | 400.0 | 8.7 | — | — | — | (374.0) | (0.022) |
| **sum** | 3824 | 119.6 | 2687 | 75.1 | 3774 | 117.9 | 7648 | (414.0) | (0.015) |

**Source:** Foreign Agricultural Service, **Official USDA Estimates.**

*Note*:

1- The amount of surplus in domestic consumption = the sum of the two periods of sufficiency of production for consumption and the period of coverage of imports for consumption - 365 (x (daily domestic consumption)

2- The adequacy of the period of surplus domestic consumption = surplus in the amount of consumption / domestic consumption daily.

3- The amount of deficit in domestic consumption = (365 - the sum of the two periods of adequacy of production for consumption and the period of coverage of imports for consumption) x (daily domestic consumption)

4- The period of adequacy of the deficit in consumption = the amount of the deficit in domestic consumption / daily domestic consumption.

5- The size of the strategic stock = {(The sum of the two periods of sufficiency of production for consumption, and the period of import coverage for consumption - 365) x (Domestic daily consumption)} - The quantity of exports.

6- Stock Adequacy Period for Daily Consumption (per day) = Strategic Stock Size / Daily Local Consumption.

7- Quantity of strategic stock = amount of surplus in domestic consumption - amount of deficit in domestic consumption.

8-The value of the food security factor = the amount of the annual change in the size of the strategic stock / annual domestic consumption

Or = the result of the change in the size of strategic stocks / average annual domestic consumption.

*The value of the food security factor ranges between zero and one, as the closer to zero, the lower the food security factor and vice versa.

* Numbers in parentheses are negative.

**Thirdly: Policy Analysis Matrix (PAM)**:

It can help indicating the level of protection given to maize producers, and to which extent the state is carrying responsibilities to support them. Whether that support was directed to the final product, or production supplies. Thus, it highlights distortions in both final product and production supplies markets, through estimating nominal protection coefficients, active protection coefficients, comparative advantage coefficients, and local resources cost coefficient. Crop costs and revenues estimated by common market prices are compared

with revenues of crop sales estimated by margin prices, which represents the lost opportunity cost of the commodity involved in international trade(Fang & Beghin, 2000; Nelson & Panggabean, 1991).

To build a costs matrix consists of tradable and non-tradable production entries which are called resources or local factors. And the revenue and both cost types mentioned here are calculated using all real prices referred to in the matrix as the special market prices. The reason is these prices are the ones used by market agents, while international prices are referred to in the matrix as the economic prices. Difference between special market prices and economic prices with conversions and the amounts of these conversions reflex the deviation of distorted real prices from competence prices(Adesina & Coulibaly, 1998; Pearson, Gotsch, & Bahri, 2003).

This is made through the study of maize production costs items, which involves production supplies costs (Seeds, local fertilizers, chemical fertilizers, and insecticides), and the study of local resources costs which includes labor wages, machinery costs, animals' wages, general expenses, in addition to cultivated land rent(El-Kholei, 2003; Mohanty, Fang, & Chaudhary, 2002).

**A- Financial and economic estimations of production cost items of one acre of maize in Egypt:**

Bu studying data listed in tables 6, 7 and 8, that indicate production cost items for one acre in local farms prices which are the market prices (Financial estimation), and production cost items for one acre in marginal prices (Economic estimation) for maize in Egypt. The study period has been divided into two periods, in order to compare first period (2000-2010) and the second period (2011-2019), it's clear that:

**1- Cost of local resources:**

- **Human labor wages**: It turned out that value of human labor wages in maize production in Egypt is higher when using market prices than when using marginal prices (Economic estimation) during the first period (2000-2010) and the second one (2011-2019). Average financial value for labor wags during the first and second periods has reached 569 and 1950 pounds for one acre of maize, respectively. While the average economic value has reached 427.1 and 1462.6 pounds in human labor wages during the first and second periods, respectively.
- **Wages of automated labor**: Data showed that estimation made using market prices for automated labor wages used in maize production were less than estimation made using marginal prices of these wages. As average financial value of automated labor wages used in production of one acre during the first and second periods has reached 242.1 and 760 pounds, respectively. While average economic value for automated labor used in producing maize acre has reached 271.2 and 851.2 pounds, during both study periods.
- **Overall local resources costs**: It turned out that estimation made using market prices of overall local resources used in maize production in Egypt during two study periods was less than estimation made using marginal prices of resources costs. As average financial values of overall local resource costs used in one acre production during the first and second period have reached 1693.1 and 4973 pounds, respectively. While average economic values of overall local resource costs used in one maize acre production have reached 1856.1 and 5277.2 pounds, during both study periods. Given the aforementioned information, it's clear that local prices of resources used in production of one acre of maize are low compared to international prices.

**Table 6**

The Financial And Economic Evaluation Of The Local Resource Costs Of The Maize Crop In Egypt During The First Period (2000-2010) And The Second (2011-2019) Value: (EGP / Acre)

| year | Financial evaluation | | | | | | Economic evaluation | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Human labor wages | Wages for animal work | Automated wages | General expenses | Rent the land | Total resource costs | Human labor wages | Wages for animal work | Automated wages | General expenses | Rent the land | Total resource costs |
| 2000 | 328.1 | 2 | 193.7 | 77 | 499 | 1099.8 | 246 | 2 | 216.94 | 77 | 682 | 1224.1 |
| 2001 | 341.3 | 1 | 189.8 | 81 | 495 | 1108.1 | 256 | 1 | 212.58 | 81 | 677 | 1227.1 |
| 2002 | 359.0 | 1 | 184.0 | 81 | 500 | 1125.0 | 269.3 | 1 | 206.08 | 81 | 683 | 1240.7 |
| 2003 | 437.0 | 2 | 203.0 | 96 | 548 | 1286.0 | 327.3 | 2 | 227.36 | 96 | 749 | 1402.1 |
| 2004 | 459.0 | 3 | 206.0 | 104 | 588 | 1360.0 | 344.3 | 3 | 230.72 | 104 | 804 | 1485.6 |
| 2005 | 517.0 | 2 | 222.0 | 117 | 643 | 1501.0 | 387.3 | 2 | 248.64 | 117 | 879 | 1634.2 |
| 2006 | 543.0 | 2 | 237.0 | 126 | 685 | 1593.0 | 407.3 | 2 | 265.44 | 126 | 936 | 1736.9 |
| 2007 | 646.0 | 3 | 255.0 | 148 | 838 | 1890.0 | 484.5 | 3 | 285.60 | 148 | 1145 | 2066.5 |
| 2008 | 790.0 | 5 | 287.0 | 179 | 1126 | 2387.0 | 592.5 | 5 | 321.44 | 179 | 1539 | 2637.0 |
| 2009 | 810.0 | 6 | 322.0 | 177 | 1157 | 2472.0 | 607.5 | 6 | 360.64 | 177 | 1581 | 2732.5 |
| 2010 | 1033.0 | 6 | 364.0 | 208 | 1195 | 2806.0 | 774.8 | 6 | 407.68 | 208 | 1633 | 3029.8 |
| **Average** | 569.0 | 3 | 242.1 | 127 | 752 | 1693.1 | 427.1 | 3 | 271.2 | 126.7 | 1028 | 1856.1 |
| 2011 | 1216.0 | 8 | 417.0 | 231 | 1285 | 3157.0 | 912 | 8 | 467.04 | 231 | 1756 | 3374.4 |
| 2012 | 1205.0 | 11 | 504.0 | 244 | 1390 | 3354.0 | 903.8 | 11 | 564.48 | 244 | 1900 | 3623.1 |
| 2013 | 1454.0 | 16 | 542.0 | 274 | 1420 | 3706.0 | 1090.5 | 16 | 607.04 | 274 | 1941 | 3928.4 |
| 2014 | 1512.0 | 16 | 559.0 | 285 | 1475 | 3847.0 | 1134 | 16 | 626.08 | 285 | 2016 | 4077.1 |
| 2015 | 1694.0 | – | 636.0 | 310 | 1508 | 4148.0 | 1271 | – | 712.32 | 310 | 2061 | 4354.0 |
| 2016 | 1900.0 | 20 | 673.0 | 340 | 2525 | 5458.0 | 1425 | 20 | 753.76 | 340 | 3451 | 5989.9 |
| 2017 | 2388.0 | – | 956.0 | 448 | 2528 | 6320.0 | 1791 | – | 1070.70 | 448 | 3455 | 6765.0 |
| 2018 | 2932.0 | – | 1203.0 | 540 | 2525 | 7200.0 | 2199 | – | 1347.40 | 540 | 3451 | 7537.5 |
| *2019 | 3250.0 | – | 1350.0 | 443 | 2526 | 7569.0 | 2437.5 | – | 1512.00 | 443 | 3453 | 7845.0 |
| **Average** | 1950.0 | 14 | 760.0 | 346 | 1909 | 4973.0 | 1462.6 | 14.2 | 851.2 | 346.1 | 2609 | 5277.2 |
| **The overall average** | 1190.7 | 5.2 | 475.175 | 225.45 | 1273 | 3169.3 | 893.04 | 5.2 | 532.20 | 225.5 | 1740 | 3395.5 |

**Source**: Ministry of Agriculture, Economic Affairs Sector, Agricultural Crops Bulletin, various issues

*Note***:**

* Data were calculated from the 2019 study sample.

* The exchange rate in Egypt was completely liberalized on November 3-2016, its price at the time before the float was 8.83 pounds per dollar, and today 7/7/2020 was 16.03 pounds / dollar.

*The economic value(Ward, Deren, & D'Silva, 1991) was calculated using the transfer coefficients reached by the World Bank experts for Egypt in 2000, as these transactions were estimated according to the bank's rates (1.12 for seeds, 1.45 for chemical fertilizers, 1.09 for pesticides, 0.75 for the human labor component, 1.12 for machines). While the other items remained unchanged, as for the land, its alternative opportunity cost is the extent to which the producer can obtain a return from it without bearing the burdens of agricultural production risks, which is usually the economic rent (its rent to others for a full year (measured by how long the crop lasts on the land) 2000) (World Bank.

**2- Costs of production supplies:**

Data show that financial evaluation to the average costs of production supplies (Seeds, chemical fertilizers and insecticides) of maize in Egypt were less the its counterparts calculated based on economic evaluation during both study periods. Financial value of maize production supplies (Seeds, chemical fertilizers and insecticides) based on local prices during the first period has reached 133, 301, 37 pounds, respectively. While its economic value has reached approximately 148.81, 436.98, 40.76 respectively. As for the second period, the financial evaluation to maize production supplies (Seeds, chemical fertilizers, and insecticides) based on local prices has reached 318, 627, 10 respectively. While its financial value has reached 356.04, 908.99, 117.6, which concludes that the state has assumed responsibility to supports production costs of that crop to encourage its cultivation and production expansion.

**Table 7**

The financial and economic evaluation of the items of production input costs for the maize crop in Egypt during the first period (2000-2010) and the second (2011-2019) Value: (EGP / acre)

| year | Financial evaluation | | | | | Economic evaluation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | The cost of seeds | The cost of municipal compost | The cost of chemical fertilizers | The cost of the pesticides | Total production requirements | The cost of seeds | The cost of municipal compost | The cost of chemical fertilizers | The cost of the pesticides | Total production requirements |
| 2000 | 94.2 | 53.9 | 158 | 24.2 | 330.3 | 105.50 | 53.9 | 229.10 | 26.38 | 414.88 |
| 2001 | 96.3 | 69.5 | 171 | 27.0 | 363.8 | 107.86 | 69.5 | 247.95 | 29.43 | 454.74 |
| 2002 | 101.0 | 68.0 | 162 | 24.0 | 355.0 | 113.12 | 68.0 | 234.90 | 26.16 | 442.18 |
| 2003 | 102.0 | 77.9 | 212 | 31.1 | 423.0 | 114.24 | 77.9 | 307.40 | 33.90 | 533.44 |
| 2004 | 117.0 | 100.0 | 238 | 31.0 | 486.0 | 131.04 | 100.0 | 345.10 | 33.79 | 609.93 |
| 2005 | 141.0 | 125.0 | 249 | 39.0 | 554.0 | 157.92 | 125.0 | 361.05 | 42.51 | 686.48 |
| 2006 | 145.0 | 166.0 | 272 | 30.0 | 613.0 | 162.40 | 166.0 | 394.40 | 32.70 | 755.50 |
| 2007 | 152.0 | 162.0 | 375 | 45.0 | 734.0 | 170.24 | 162.0 | 543.75 | 49.05 | 925.04 |
| 2008 | 174.0 | 163.0 | 534 | 39.0 | 910.0 | 194.88 | 163.0 | 774.30 | 42.51 | 1174.70 |
| 2009 | 162.0 | 154.0 | 461 | 54.0 | 831.0 | 181.44 | 154.0 | 668.45 | 58.86 | 1062.80 |
| 2010 | 177.0 | 177.0 | 483 | 67.0 | 904.0 | 198.24 | 177.0 | 700.35 | 73.03 | 1148.60 |
| **Average** | 133.0 | 120.0 | 301 | 37.0 | 591.3 | 148.81 | 119.66 | 436.98 | 40.76 | 746.2 |
| 2011 | 209.0 | 173.0 | 496 | 47.0 | 925.0 | 234.08 | 173.0 | 719.20 | 51.23 | 1177.50 |
| 2012 | 249.0 | 200.0 | 491 | 46.0 | 986.0 | 278.88 | 200.0 | 711.95 | 50.14 | 1241.00 |
| 2013 | 263.0 | 199.0 | 498 | 69.0 | 1029.0 | 294.56 | 199.0 | 722.10 | 75.21 | 1290.90 |
| 2014 | 281.0 | 222.0 | 493 | 84.0 | 1080.0 | 314.72 | 222.0 | 714.85 | 91.56 | 1343.10 |
| 2015 | 272.0 | 224.0 | 538 | 86.0 | 1120.0 | 304.64 | 224.0 | 780.10 | 93.74 | 1402.50 |
| 2016 | 286.0 | 211.0 | 590 | 93.0 | 1180.0 | 320.32 | 211.0 | 855.50 | 101.40 | 1488.20 |
| 2017 | 399.0 | 299.0 | 775 | 162.0 | 1635.0 | 446.88 | 299.0 | 1123.75 | 176.60 | 2046.20 |
| 2018 | 482.0 | 326.0 | 866 | 189.0 | 1863.0 | 539.84 | 326.0 | 1255.70 | 206.00 | 2327.60 |
| *2019 | 420.0 | 46.0 | 895 | 195.0 | 1556.0 | 470.40 | 46.0 | 1297.75 | 212.60 | 2026.70 |
| **average** | 318.0 | 211.0 | 627 | 108.0 | 1264.0 | 356.04 | 211.11 | 908.99 | 117.6 | 1593.7 |
| **The overall average** | 216.13 | 160.82 | 447.85 | 69.12 | 893.9 | 242.06 | 160.82 | 649.38 | 75.34 | 1127.60 |

**Source**: Ministry of Agriculture, Economic Affairs Sector, Agricultural Crops Bulletin, various issues

**Table 8**

The Financial And Economic Evaluation Of The Total Costs, Revenues And Net Returns Of The Maize Crop In Egypt During The First Period (2000-2010) And The Second (2011-2019) Value: (Pounds / Acre)

| year | Financial evaluation | | | Economic evaluation | | |
|---|---|---|---|---|---|---|
| | Total costs | Total revenue | Net return | Total costs | Total revenue | Net return |
| 2000 | 1430.1 | 2193 | 762.9 | 1638.93 | 2759.9 | 1156.37 |
| 2001 | 1471.9 | 2224 | 752.1 | 1681.85 | 2798.9 | 1140.00 |
| 2002 | 1480.0 | 2304 | 824.0 | 1682.91 | 2899.6 | 1248.99 |
| 2003 | 1709.0 | 2564 | 855.0 | 1935.56 | 3226.8 | 1295.97 |
| 2004 | 1846.0 | 3781 | 1935.0 | 2095.58 | 4758.4 | 2933.00 |
| 2005 | 2055.0 | 3876 | 1821.0 | 2320.72 | 4877.9 | 2760.20 |
| 2006 | 2206.0 | 4087 | 1881.0 | 2492.45 | 5143.5 | 2851.14 |
| 2007 | 2624.0 | 5675 | 3051.0 | 2991.52 | 7142.0 | 4624.58 |
| 2008 | 3297.0 | 5050 | 1753.0 | 3811.65 | 6355.4 | 2657.13 |
| 2009 | 3303.0 | 4914 | 1611.0 | 3795.28 | 6184.3 | 2441.89 |
| 2010 | 3710.0 | 6140 | 2430.0 | 4178.38 | 7727.2 | 3683.30 |
| **Average** | 2285.0 | 3892 | 1606.9 | 2602.26 | 4897.6 | 2435.7 |
| 2011 | 4082.0 | 6740 | 2658.0 | 4551.89 | 8482.3 | 4028.89 |
| 2012 | 4340.0 | 7560 | 3220.0 | 4864.05 | 9514.3 | 4880.75 |
| 2013 | 4735.0 | 7773 | 3038.0 | 5219.27 | 9782.3 | 4604.88 |
| 2014 | 4927.0 | 7848 | 2921.0 | 5420.24 | 9876.7 | 4427.53 |
| 2015 | 5268.0 | 7502 | 2234.0 | 5756.43 | 9441.3 | 3386.21 |
| 2016 | 6638.0 | 8661 | 2023.0 | 7478.12 | 10900.0 | 3066.38 |
| 2017 | 7955.0 | 9736 | 1781.0 | 8811.20 | 12253.0 | 2699.57 |
| 2018 | 9063.0 | 11248 | 2185.0 | 9865.08 | 14156.0 | 3311.94 |
| *2019 | 9125.0 | 9880 | 755.0 | 9871.74 | 12434.0 | 1144.40 |
| **average** | 6237 | 8550 | 2312.8 | 6870.89 | 10760.0 | 3505.6 |
| **The overall average** | 4063 | 5987.8 | 762.9 | 4523.14 | 7535.7 | 2917.16 |

**Source**: Ministry of Agriculture, Economic Affairs Sector, Agricultural Crops Bulletin, various issues

**B- Effect of agricultural policy on maize in Egypt:**

Data included in Table 9 that relates to policy analysis matrix of maize in Egypt during the first period (2000-2010) and the second period (2011-2019) shows that average total revenues calculated by financial value has reached 3892, 8550 pounds respectively. While its economic value has reached 4897.6, 10760 pounds respectively during both study periods. Thus, effect of agricultural policy has reached 1005.6, 2210 pounds during first and second periods. This points out that maize farmers in Egypt pay implied taxes estimated by 1005.6, 2210 pounds in average during the first and second periods respectively. Same table shows that maize farmers pay production supplies costs estimated by 591.3, 1264 pounds calculated by financial value for both study periods. While these costs of production supplies have increased to reach 746.2, 1593.7 pounds in economic value as an average for both study periods. Thus, effect of agricultural policy has reached 154.9, 3297 pounds during both study periods, which means that production supplies decreased by 154.9, 329.7 pounds during both study periods. And that's the amount of subsidies provided to maize producers in Egypt.

Maize farmers also pay implied taxes when they use labor item (As local supplier) that reached 114, 380.3 pounds in average for both study periods. Net revenue (That reflects what farmers pay in implied taxes and what they receive in implied subsidies) and data indicate that maize net revenue estimated by financial value has reached 1606.9, 2312.8 pounds, while the economic value has reached 2435.7, 3505.6 pounds. Thus, agricultural policy effect has reached 828.8, 11928 pounds during both study periods, respectively. This points out that maize farmers pay implied taxes estimated by 828.8, 1192.8 pounds as an average in first period (2000-2010) and in second period (2011-2019)(Finkelshtain, Kachel, & Rubin, 2011).

**Table 9**

Results Of The Policy Analysis Matrix For Maize Crop In Egypt As An Average For The First (2000-2010) And Second (2011-2019) Period Value: (EGP / Acre)

| Period | Items | Total revenue | Production Supplies (1) | The cost of local resources | | | Net return (3) |
|---|---|---|---|---|---|---|---|
| | | | | Work (2) | Rent | Total | |
| **First period (2000-2010)** | Financial evaluation | 3892.0 | 591.3 | 814.5 | 752.0 | 1566.7 | 1606.9 |
| | Economic evaluation | 4897.6 | 746.2 | 700.5 | 1028.1 | 1728.6 | 2435.7 |
| | Policy Impact (4) | (1005.6) | (154.9) | 114.0 | (276.1) | (161.9) | (828.8) |
| **The second period (2011-2019)** | Financial evaluation | 8550.0 | 1264.0 | 2718.0 | 1909.0 | 4627.1 | 2312.8 |
| | Economic evaluation | 10760.0 | 1593.7 | 2337.7 | 2609.4 | 4947.1 | 3505.6 |
| | Policy Impact (4) | (2210.0) | (329.7) | 380.3 | (700.4) | (320.0) | (1192.8) |

**Source**: compiled and calculated from the data of tables numbers (6, 7 and 8).

*Note:*

(1) Production requirements = seeds + municipal fertilizer + chemical fertilizer + pesticides.

(2) Labor = wages of workers + wages of animals + wages of machines.

(3) Net revenue = total revenues - (production requirements - total cost of local resources).

(4) Policy Impact = Financial Evaluation - Economic Valuation.

* Numbers in parentheses are negative.

C- **Economic indexes of agricultural policy analysis matrix**:

**1- Nominal protection coefficient (NPC):**

It measures the effect of agricultural policy on products and its supplies. In case of the products, effect is calculated through division of crop products of one acre (Financially evaluated based on market price) on crop products of one acre (Economically evaluated based on marginal price). While in case of production supplies, effect is calculated through division of financial production supplies on economic financial supplies. Calculation is made by subtraction of one from nominal protection coefficient in case of products and its supplies, and if the rate is equal to zero then that means farmer price and marginal price are equal, and the state isn't implementing any protection policies and imposes no taxes on product or consumer. But when the rate is less than zero, that means the state is imposing direct and indirect taxes on the product, while providing subsidies to the consumer.

- **Nominal protection coefficient of products**:

Table 10 data, related to the estimation results of agricultural policy analysis of maize in Egypt during the first period (2000-2010) and the second period (2011-2019), shows that nominal protection coefficient of maize crop productions during both study periods has reached approximately 0.79. Which highlights the absent of a fair production policy during both study periods, due to the having a value of that coefficient less than one, or low local maize prices compared to its international ones. That means maize farmers only get 79% of their production in international prices (That reaches 4897.6, 10760 pounds during both study periods), while paying

implied taxes. On the other hand, subsidies provided to consumers were estimated by 21% during both study periods.

**Table 10**

Nominal And Effective Protection Factor Indicators And Comparative Advantage Of Maize Crop In Egypt During The First Period (2000-2010) And The Second (2011-2019):

| No. | Statement | **First period (2000-2010)** | **The second period (2011-2019)** |
|---|---|---|---|
| 1 | The nominal protection factor of the production | 0.79 | 0.79 |
| 2 | Nominal protection factor for production requirements | 0.79 | 0.79 |
| 3 | Effective protection factor | 0.80 | 0.79 |
| 4 | Domestic resource cost factor (comparative advantage) | 0.42 | 0.54 |

**Source**: collected and calculated from the data of Table No. (9).

*Note*:

1- Nominal protection factor for production = total revenue per acre financially / total revenue per acre economically.

2- Nominal protection factor for production requirements = the financial value of production inputs / economic value of production inputs.

3- The effective protection factor = (the value of the financial revenues - the value of the production inputs financially) / (the total economic revenue per acre - the value of the economic production requirements).

4- The cost factor of local resources (comparative advantage) = the total economic value of the local resources / (the total revenue per acre economically - the value of economic production requirements).

- **Nominal protection coefficient of supplies**:

Measurement results in the previous table have shown that nominal protection coefficient of production supplies of maize in Egypt during the first and second period is lower than one. Which reflects a decrease in production supplies prices provided to maize producers compared to its international prices, as its value has reached 0.79 during both study periods. This refers to subsidies given to maize farmers that reached approximately 21%, and refers also to a decrease in this subsidy ratio provided to maize farmer which goes in line with agricultural policies that aim at gradual cancellation on production supplies until prices are proportional to the economic cost and international prices.

That means economic liberation policy of maize crop has achieved only a limited subsidy to farmers of that crop, compared to production supplies. Reduction in subsidies may be attributed to Egypt involvement in several international accords aiming at trade liberalization, easing access to foreign markets and fulfilling criteria of these accords with regard to protection procedures. Many of these accords relate to agriculture and agricultural subsidies, thus, agricultural policies connected to subsidies reduction are justified. In contrast, government has adopted smart policies by converting these subsidies to labor and land through prices lower than economic prices. This should achieve equity in distributing added value on production elements. Also, slashing subsidies provided to production inputs is necessary in order to achieve more efficiency in its use. So, these policies must be reconsidered in a positive way, not a negative one. Despite being consistent with liberalization policies, Egypt agricultural policies managed in maintaining a certain level of local production of maize.

**2- Effective protection coefficient:**

This coefficient takes in consideration both production supplies and products together. Thus, it's a more efficient criteria to measure the effect of local economic policy on production markets and its supplies. If that coefficient was equal to one, that means locally producing this commodity adds to the national economy by an amount that's equal to all what is added by its counterparts through marginal prices. While when coefficient is more than one, that means commodity is being producing under state's protection. And when coefficient is less than one, it indicates that state is imposing direct or indirect taxes on that commodity producers, or provides subsidies to what is being imported of it.

Table 10 shows that effective protection coefficient during both study periods is less than one, which points out that maize farmers paying implied taxes and subsidies provided to consumer during first and second study periods. Effective protection coefficient as an average during first and second periods has reached 0.80, 0.79. Which means that taxes rate paid by maize farmers has reached 20%, 21% respectively for both study periods. In other words, added value reduction of maize crop in local prices compared to its international counterparts. Thus, the crop didn't receive any protection during both study periods, and this is an indication on taxes imposed by the state on producers of that crop. These taxes could be direct or indirect, or it supports what's being imported from it.

**3- Domestic resources costs (DRC) coefficient (Comparative advantage coefficient):**

It can be calculated by division of local resources value in economic evaluation on net revenue per acre in economic evaluation. If the coefficient is less than one, that means country has a comparative advantage in producing the crop. But if the coefficient is over one, that means there's no comparative advantage in producing the crop and it's better to switch to producing other crops. International prices (Represented in marginal prices) can represent the real direct costs of the alternative opportunity that the country pays benefits from with regard to agricultural commodities that are involved in international trade. So, marginal prices have been estimated based on exporting prices (FOB) of commodities being exported. While importing prices (CIF) of commodities being imported after modification are being estimated based on exchange rates in free market, transportation costs and other promotional margins(Minh, Trang, & Chen, 2016).

Table 10 data shows that value of local resources cost coefficient for maize during the first and the second periods has reached approximately 0.42, 0.54. Which means there's a comparative advantage in production of that crop. Thus, it turns out that producing maize domestically is better than relying on exports from foreign countries(Hussain, Anwar, & Hussain, 2006; Javed et al., 2006).

**Fourthly: Effect of Corona pandemic on maize international prices**:

Effect of Corona pandemic on international monthly price of maize during first period before the pandemic (February 2019 – October 2019) and the second period after the pandemic (November 2019 – July 2020) has been discussed through studying monthly values and monthly change rate of maize international price during both periods.

Table 11 data show that monthly price of maize during the first period before the pandemic (February 2019 – October 2019) has reached the maximum level in June 2019, which was estimated by 127.26 dollar/ton, as shown in diagram 1.

**Figure 1**

Monthly Change In Maize Prices During The First Period Before The Pandemic (February 2019 – October 2019):

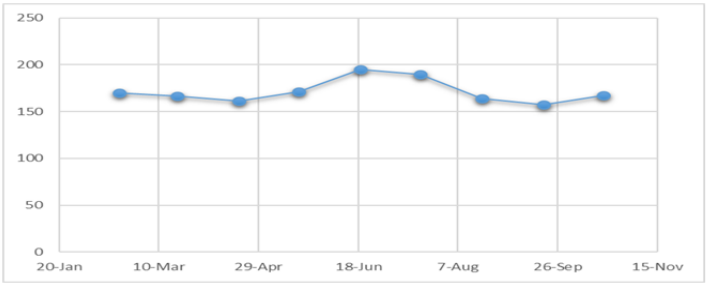


Table 11 data show that monthly change rate in maize prices for the first period before the pandemic (February 209 – October 2019) has reached its maximum level in June 2019 scoring around 14.03%, and hit the minimum level in August 2019, scoring around – 13.64%, as shown in diagram 2.

**Figure 2**

Monthly Change Rate In Maize Prices For The First Period Before The Pandemic (February 209 – October 2019)

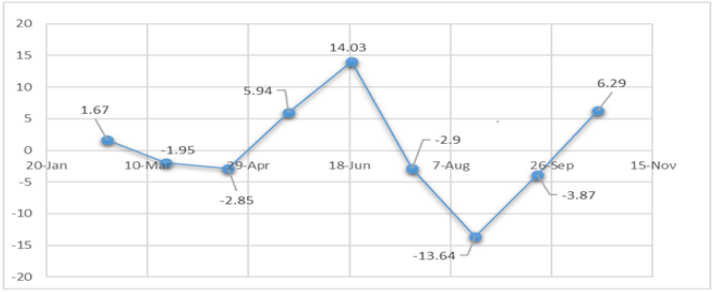

**Table 11**

The Values And Monthly Rate Of Change Of Global Prices Of Maize During The Two Study Periods (February 2019 - October 2019), (November 2019 - July 2020):

| Months | | Prices ($ / ton) | Monthly change rate (%) |
|---|---|---|---|
| First period (2000-2010) | Feb-19 | 169.52 | 1.67 |
| | Mar-19 | 166.22 | -1.95 |
| | Apr-19 | 161.49 | -2.85 |
| | May-19 | 171.08 | 5.94 |
| | Jun-19 | 195.08 | 14.03 |
| | Jul-19 | 189.42 | -2.90 |
| | Aug-19 | 163.59 | -13.64 |
| | Sep-19 | 157.26 | -3.87 |
| | Oct-19 | 167.15 | 6.29 |
| **Average** | | 171,20 | --- |
| The second period (2011-2019) | Nov-19 | 166.33 | -0.49 |
| | Dec-19 | 166.96 | 0.38 |
| | Jan-20 | 171.79 | 2.89 |
| | Feb-20 | 168.71 | -1.79 |
| | Mar-20 | 162.42 | -3.73 |
| | Apr-20 | 146.91 | -9.55 |
| | May-20 | 143.91 | -2.04 |
| | Jun-20 | 147.99 | 2.84 |
| | Jul-20 | 152.55 | 3.08 |
| **average** | | 158,62 | --- |
| The difference between the averages of the two periods | | 12,58 | |
| The difference significance (t) | | 2,25* | |

**Source**: Foreign Agricultural Service, **Official USDA Estimates.**

*Note*:

(*): Significant at the 0.05 level.

Table 11 data show that monthly price of maize during the second period after the pandemic (November 2019 – July 2020) has reached its maximum level in January 2020 hitting approximately 171.79 dollar/ton, while reached its minimum level in May 2020 hitting around 143.91 dollar/ton, as shown in diagram 3.

**Figure 3**

Monthly Change In Maize Price During The Second Period After The Pandemic (November 2019 – July 2020).

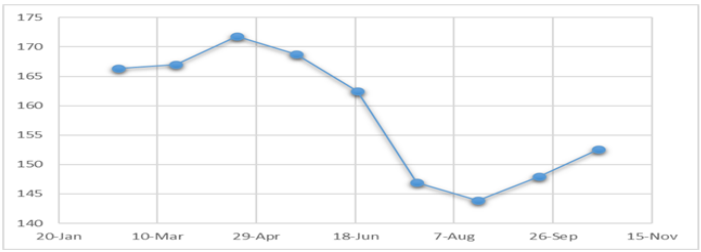


Table 11 data show that monthly change rate in maize prices for the second period after the pandemic (November 2019 – July 2020) has reached its maximum level in July 2020 scoring around 3.08%, and hit the minimum level in April 2020, scoring around – 9.55%, as shown in diagram 4.

**Figure 4**

Monthly Change Rate In Maize Prices For The Second Period After The Pandemic (November 2019 – July 2020)

Measuring significance of the difference between average monthly prices of maize during both study periods before the pandemic (February 209 – October 2019) and the second period after the pandemic (November 2019 – July 2020) that reached approximately 171.20, 158.62 dollar/ton for each period, respectively. That difference has been estimated by approximately 12.58 dollar/ton. Significance of that difference has been statistically proven at significance level of 0.05, which refers to the effect of the pandemic on international prices of maize.

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## SUMMARY

Food security is considered one of the most influencing matters on the national economic sector in recent times because of its great importance affecting human life in the Egyptian society. The definitions of food security vary, but it revolves around the community's ability to meet the needs of all its residents of adequate and healthy food over a period of time. The maize crop is one of the most important grain crops in Egypt, which plays a major role in food security for this crop for its use in human food and competes with it for animal food, and the research problem is Egypt's dependence on providing the bulk of the local consumption of human and animal food from maize through external import. With about 9.9 million tons, representing about 60% of the total domestic consumption, which is about 16.7 million tons in 2019, with the presence of global price fluctuations for the crop as a result of the global crises, this led to an increase in domestic prices as well as the impact of higher prices on the living standards of citizens, as it increased The burden on low-income families who have resorted to diverting more of their spending on non-food items to food spending.

It was possible to reach several results, the most important of which are the following: The total food security factor for the maize crop amounted to about 0.015, and its value during the study period ranged between a minimum of about 0.0003 in 2018, and a maximum of about 0.19 in 2013. These results indicate a decline in the value of the security factor. Food for maize in Egypt during the study period, with a policy analysis matrix for the maize crop in Egypt during the first period (2000-2010) and the second period (2011-2019) it becomes clear that the average total revenue in monetary value amounted to about 3892 and 8550 pounds, respectively, while its economic value reached about 4897.6 and 10760 pounds, respectively for the two study periods, and therefore the impact of the agricultural policy amounted to about 1005.6 and 2210 pounds during the first and second period, and this indicates that maize farmers in Egypt bear implicit taxes in the amount of 1005.6 and 2210 pounds as an average for the first and second period, respectively. The impact of the Corona pandemic on the global monthly price of maize during the first period before the pandemic (February 2019 - October 2019) and the second period after the pandemic (November 2019 - July 2020) were studied. By studying the monthly values and the monthly rate of change of the global price of maize during the two periods,

as the monthly price of maize crop during the first period before the pandemic (February 2019 - October 2019) reached its maximum in June 2019 at about $ 195.08 / ton and reached below In September 2019 at about $ 157.26 / ton, and the monthly rate of change in maize prices for the first period before the pandemic (February 2019 - October 2019) reached a maximum in June 2019 by 14.03%, and reached below in August 2019 by 13.64 -%.

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