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The Interrelationship Between Controlled and Uncontrolled Factors Affecting The Percentage of Value Added of Wheat To GDP In Egypt

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Abstract ***Agriculture had been the essence of the Egyptian economy but recently it had been facing a major decline in its value-added GDP going from 30% to 12% in the year 2016. The cause of this was believed to be due to the agricultural policies that have focused on the production of the local market in the short-term and neglected the long-term aspects and dimensions. This had led the Egyptians to move towards urbanization, which has a growth rate of 22%. However, this shift had affected one of the major strategic crops in the country. This is the wheat agriculture whose importance shows through the wheat consumption-GDP ratio which was about 1.66%, making it the first among all other significant crops. On the other hand, it is noticed that there is a huge gap between the wheat production and wheat consumption in Egypt that is due to the large purchases of imported wheat where Egypt is considered the world's largest wheat importer. This affects both the trade balance as well as the foreign net reserves that the country possesses because of issues with wheat production and economic instability, A wheat production model using Econometrics is being prepared to assess whether the stated variables have a significant impact. Our assumption in this paper is based on the economic theory, we built the multiple regression model by first changing the verbal equation into a simpler, verbal error-free equation, we carried out the work by using the science of "Econometrics" to interpret the reality of the relationship of different variables we will determine in paper to wheat production. This is done by knowing the values of the parameters of each independent variable to be then known as coefficients.***

Keywords: Egypt, Agriculture, Wheat, Econometrics, Variables of wheat production, GDP, controlled and uncontrolled factors

I. INTRODUCTION

Previous research has highlighted some interesting, Khodeir and Abdelsalam (31) studied the production of what by increasing the cultivated area and focusing on the importance of agricultural investment to achieve higher production efficiency. This is done by using several factors such as technical cooperation, transfer of expertise, agricultural research, providing sustainable agricultural productivity and food security. Moving on, they also studied the process of importing wheat where they covered the gap between domestic supply and population needs and they stated that the yearly government spend was 50 million Egyptian pound per ton of wheat. In addition, they have suggested that there is a need for a factor such a political and economic stability of the local market to maintain sustainable development by managing the factors of price fluctuations as well as limiting imports.

Moving on, Fawaz and Soliman (10) reflected on the effect of climate change on the Egyptian crops especially in delta regions. They have found out that either the quantity of greenhouse gasses in Egypt which was equivalent to 197 million tons of carbon dioxide in 2014 or the effect of sinking or salinity of seal level might have possibility caused the loss of 15% of the high-quality agricultural lands. They also stated that climate change is expected to have negative impact on the field crops and that according to assessment and analysis of expected economic impacts of climate change by the year 2030, the projected cultivated areas will reduce to around 0.949 million acres which is equal to almost 6.25% of the total crop area in Egypt. This expectation considers no sinking of delta land as well as surplus in the Egyptian balance water by about 2.48 billion m^3.

In this case, the value of the Egyptian agricultural production will be reduced by almost 6.19 billion dollar and this is equal to 6.19% compared with the assumption taken that there would not be any sinking of delta land. However, if the sinking of 15% of delta lands occur then there will be a change of productivity as well as water consumption for most crops and this will result in a reduction in the cultivated area of about 0.94 million acres. Moreover, the cropped area will be reduced to around 1.39 million acres with deficit in the Egyptian balance water to about 4.74 billion m^3 compared to the considering that no sinking will occur. The cultivated area will be reduced to around 8.17% and the crop area will go down 6.18% along with the value of the Egyptian agriculture production that will shrink to 12.51%. this assumption is based on just sinking parts of the delta land to about 15%, therefore the impacts of climate change are not taken into consideration in this case. In addition, the cultivated area will raise to almost 0.06%, the cropped area will go up to around 0.08% and the value of the Egyptian agriculture will be reduced by almost 5,57%. (12,25)

Furthermore, Amin (39) found out that the maximum likelihood estimates of Battese and coelli (37) is 1992 specific for main governorates of wheat production in Egypt and that shows the coefficient of land is positive and significant according to the previous expectations.

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In addition, the coefficient of labor is positive and significant whereas the coefficient of machinery is negative and considered insignificant. This maybe be due to the average farm size in Egypt, which is about 0.6 Hectare. Later in 1995, the maximum likelihood estimates of Battese and Coelli (37) that was specific for the main governorate of wheat production in Egypt (3,5) showed that he lands coefficient was positive and highly significant according to previous expectations. Hence, it plays a major role in wheat production whereas the labor coefficient was positive and insignificant which could be due to the lack of training for labors. The machinery confident was negative and insignificant too while the technical change coefficient was positive and significant. This means that the result indicated a small technical progress over time corner of the paper.

II. LITERATURE REVIEW

To start with, we would like to reason the general importance of the agricultural sector and then move to its significance for the Egyptian economy. We will also explain and show some of the vital indicators related to the Egyptian economy and the agricultural sector therefore we would be focusing on wheat agriculture due to its strategic nature and the fact that Egypt is considered the world's larger importer of wheat (33). Moreover.

A. Wheat in Egypt

Throughout the years, wheat had always been one of the most important planted grains in Egypt. It has accounted for almost 10 % of total value of agricultural production and for 20% of all agricultural imports. (20), (24) Although Egypt can be self-sufficient for wheat, but due to many technical, political and economic inefficiencies, Egypt couldn't achieve this (30), (31).

Moreover, Egypt grows wheat throughout the country especially in the delta region and there are almost 529.2 Fadden (1260 HA) of wheat area are being harvested. Wheat is well suited for growth in the climate of Egypt and it considered one of the top-most crops in production. This can be an advantage if the country properly invests in it, but the real scenarios is that, Egypt's current export status of wheat is by 550 tons (29).

According to the Global Agriculture Information network held by the USDA Foreign Agriculture service, a grain report that was prepared states that Egypt is considered the world's largest importer of wheat (21). In addition to that, Egypt holds the world's single largest purchaser of wheat named as GASC (General Authority for Supply Commodities) as well as being recorded that the imports of the government for wheat in 2017 has reached 7.5 MMT while the Egyptian private sector imports have amounted to only 4.5 MMT, (20), (30). Egypt was once a large buyer of U.S. origin wheat, but now Egypt has widened its sources of purchases. Today its imports of wheat are primarily from European and Black Sea producers such as Russia, Ukraine and Romania and this to secure its wheat imports by having more than one source unlike what was in the past. This tells us that the wheat is a product of principal importance to Egypt and its policy is a priority for the government. As a result, Egypt induces a great burden on its trade balance; creating a large net trade deficit and affecting negatively on its foreign net reserves (12, 20). wheat has this significance in the domestic consumption, the domestic production levels are far below the domestic consumption levels; failing to meet the local demand thus resulting in high levels of wheat imports.

There were only few periods, that indicated positive movement in the economy where domestic production of wheat was exceeding the amount of wheat imported. These were in 3 periods; 1999-2000, 2005-2006 and in the year 2012. For that, we have focused on wheat and its productive indicators such as wheat area, productivity (yield) and production. To start with, we took a time span of 16 years in the beginning of the 21st century from the year 2000 until the year 2015 from the records of the Economic Affairs Sector in the Ministry of Agriculture and Land Reclamation (11).

According to the historical data of wheat, in 2000, wheat area was about 2.463,265 fed, the productivity (yield) was about 2.665 Ton/fed and the production reached 6.564,053 tons (20). Moving on, in 2015 the wheat area was about 3,468,864 feds, increased by 40.82%. The productivity (yield) was about 2.770 Ton/fed, increased by 3.94% and the production reached 9,607,735 tons, increased by 46.37% (9), (20). Major indications show that both production and wheat areas have been moving along whether they were decreasing or increasing between the years of 2000 and 2015. In addition, both the productivity (yield) and production have dramatically decreased in 2010 (22)

Because of the importance of the wheat crop in the country, the Egyptian government buys wheat from both imports and domestic production as well as subsidizes different supply chain products. An example of such products is as the fertilizers used in farming the wheat to produce what is known as the Baladi bread, which is considered the cheapest food (diet) for almost all Egyptians. This type is used heavily due to Egypt's social conditions since over more than 25% of Egyptians population are living under the poverty line. Due to that, the government introduced the Baladi bread program that is only now available to those sectors that are having smart provisioning card systems that allows special income citizens to buy the Baladi beard lower than its actual price even though it been rated at a fixes price since 1989, (28, 29, 32).

Every person who benefits from the government bread Baladi subsidy systems is allowed 150 louvers per months and the price of Baladi bread is sold at a subsidized price of EGP 0.05 per loaf ($0.01 per loaf) which is less than one tenth of its actual cost. In addition, the government also compensates bakeries for the difference in production cost (26, 29, 32). Moving on, the Baladi bread smart card system benefits those who consume less than the quota amount and rewards those who convert bread savings into points 100 point = 1 EGP (1 point = 0,01 EGP). These points can be spent on almost 44 different food products and used from 27,000 partnered private grocery stores and 5,000 state-owned consumer complexes. The government bears costs of about EGP 5.4 Billion (306$ million) annually on this point system (19, 32).

According to the United States Department of Agriculture record of wheat global production by each country in 2017, Egypt was ranked in the fourteenth place (where EU-27 that is accounted as a single country).

Egypt ranks 14th among the top countries in wheat production, which shows a negative indicator, compared to the other countries. Furthermore, the wheat has the highest net returns-costs ratio of about 0.8995 and that the second crop following the wheat was the sugar cane with a net return-cost ratio of approximately 0.8813. The third crop was the rice with a net return-cost ratio of nearly 0.7075, next was the maize came in the fourth place with a net return-cost ratio of about 0.6736 and in the fifth and final place was the cotton with a net return-cost ratio of approximately 0.5115. (38)

These indicate that wheat production is significantly profitable compared to the other major crops in Egypt and this could provide an incentive and motivation towards wheat agriculture instead of any other crop (16,26).

Therefore, we have a seriously problem in the aspects and details of wheat production itself. To thoroughly understand the wheat production issue, we have considered all the factors of its production. These factors of production are also known as the costs of production and they are classified into two types of costs; agricultural operation costs and production input costs including rent expenses in both categories. In the first type of wheat production costs, the agricultural operation costs are simply the costs of operations and processes that carried on producing wheat. Eight operations are including land preparation, seeding and planting, irrigation, fertilization, weeding, pest control, harvesting, transportation and other expenses. (10)

Land preparation is a combination of different operations including seeding and planting in the process of either slashing or rolling the weeds, clearing out the residues of old crop, applying herbicides to control weed growth and using of manure for the new crops to be planted.

Seeding usually refers to the process of continuous flow of seed as in the case of small cereals whereas planting refers to the process of precise placing of larger seeds. Moreover, the Irrigation process must be scheduled according to evaporation and needs as per the growth phase and the method of irrigation depends on the water availability as well as the available irrigation equipment. Fertilization is the way of enhancing the soil texture by applying beneficial minerals such as nitrogen, phosphorus and potassium while Weeding is the process of controlling the weedy plant fragments, which may reduce the food and feed value of wheat. Pest control is the identification of pests, which are of utmost importance to ensure that the appropriate control measure is being followed and is effective as well (4, 6, 10).

Moving on, Harvesting is done when wheat grains are dry, and it is better that only the fully ripened grains are to be harvested. Then, the transportation of wheat must be done to the silos after the harvest and this is done by using rail trucks and road trucks to transport wheat locally along with the use of ships for the exporting and importing purposes. Each of these operations has a certain amount of contribution each to the total cost of wheat production and according to the year 2015, rent expenses held the largest contribution, which was about 35% of total costs. In the second place came the harvesting, with a contribution of about 14% of the total costs and after it, the fertilization, which was about 13.7% of the total costs (10,15).

The production input costs are defined as the costs of the tools used to perform the operations. The six tools are the use of labor (paying them wages), draft animals, Machinery, seeds, manure, fertilizers, insecticides and other expenses along with rent expenses. To start with, Labor is the human resource that is used for performing the agricultural operations while the draft animals and machinery helps labor by cutting down time consumed in work (4, 6).

Seeds are used by labor for planting wheat, manure, fertilizers are both used for nourishing the soil texture, and Insecticides are chemicals used to kill harmful insects. All of these tools have a certain amount of contribution each to the total cost of wheat production. According to the year 2015, rent expenses held the largest contribution which was about 35% of the total costs then in the second place came the Labor wage with a contribution of about 24% of the total costs and the third came from Machinery, about 15.9% of the total costs.

Both two types of production factors are interdependent to each other. We have assumed that production inputs are the main factor where the agricultural operations are carried-out because of the existence of these inputs. Therefore, these inputs are the ones that are considered necessary to the production of wheat (22,28).

B. Factors Affecting Wheat

Egypt has many inefficiencies in the value chain of wheat that can be classified as those controlled by the government (Health, Wheat Storage / distribution, Land Distribution, Water Waste and Country Economic, Political Status) and those uncontrolled by the government (Climate Change)

Furthermore, Egypt suffers from several problems, but its main issue is in the food and in losing the concept of food security that means the ability to provide food to citizens in all the different classes in society. Food in an important element that should be available throughout the year even during the difficult times as well as in all the different districts across the country either rich or poor and that food should be also healthy and in a good quality. It is very important to get safe food without endangering any other civilians. Moreover, consumer's preferences can be an issue if the food price does not fit with the PPP and national income, therefore, Egypt suffers a huge crisis in food and the most imported grain that causes deficits in the country dollar reserves is wheat (13, 19,20,23).

(i) Climate change

Climate change has a negative effect on the soil that may affect the land fertility. Since wheat is very sensitive crop, it needs special care to produce a highly efficient crop that will be manufactured in furthermore industries. Climate change would change the temperature of the earth, level of water, the rooting depth and nutrition and in Egypt's case, the water level will increase as well making the weather warmer. In addition, the wheat soil will have an increase in salt due to the rise of water, which could increase risks of soil degradation (3, 14, 11).

(ii) Inefficiency of Wheat Storage and Distribution

Another problem facing Egypt is the storage of wheat. Egypt suffers from the destruction of very large quantities of wheat due to lack of proper storage. Three major inland wheat storage agencies operated by the government. The GCSS (General Company for Silos and Storage) which operates silo storage by overseeing storing imported wheat.

The EHCSS (Egyptian Holding Company for Silos and Shona) operating silo storages like the GCSS, and the PBDAC (Principal Bank of Development and Agricultural Cost) which has the largest outdated storage capacity of wasteful Shona, plus it only accepts wheat in Shon (2).

(iii) Water Waste in Farming

Environmental challenges in growing wheat and a water intensive crop both present major challenges for the region. Water shortage remains a major issue for all nations in MENA and the region is the most water scarce in the world. As a result, it also has low levels of arable land and growing populations and climate change are placing more stress on critical resources such as water supply (20, 6).

(iv) Inefficient Policies

The Egyptian government is in continuous work towards dictating effective policies, but the problem circulates around the effectiveness of these policies on the real ground especially that the regulatory system also features inefficiency in its progress in the country (7).

(v) Economic Instability

After the 2011 revolution, Egypt faced many political, economic and social issues and then the civilians had become more aware of the country status afterward (8). One of the problems is t**he scarcity of land used in agriculture of wheat:** Egypt total area is 1,002,000 square kilometers (238,571,428 Feddan) and only 4% 40,080km2 (9,542,857) of its total area is used in agriculture where wheat total land area is about 3,468,864 Feddan (9). While the other one is the **health problem:** at that time, the result in local food practices was very negative for example: obesity, stunting and wasting and according to the World Health Organization (WHO), 35% of Egyptians suffer from obesity which indicates that Egypt is considered a country with one of the highest obesity rates Middle East region, where obesity rate is higher in women than men. (28).

III. THE RESEARCH PROPOSED MODEL

A. Model Variables

To solve the issue related to the wheat production, we considered considering the combination of the factors that influence the production of wheat to detect the real problem and find solutions for it. Thus, we have decided to study the relationship and impact between variables, the dependent variable will be the wheat production, while the other independent variables are as follows:

Wage: the payment that is given to the working force within the agricultural sector specialized in wheat industry. (20)

Machinery: used in enhancing work efficiency. Egypt is a labor-intensive country to produce wheat. There is labor difference between each farm size as small farms use more labor per 0.01 Km2 (HA). Most of the labor are family members and large farms use less labor per 0.01 Km2 (HA). Most of the labor is hired but adding to that farmers use tractors and water pumps to irrigate their wheat fields. (6,15) The agricultural machinery is primitive. Therefore, Egypt is a labor-intensive country focuses on labor forces rather than high technological machinery. (6,15)

Seeds: used as raw materials for growing crops before the liberalization of wheat, Egypt wheat was low yielding but after the liberalization, Egyptian framers were introduced to improvement of modern seeds farmer by higher yielding and more resistant to heat and pests. (6,10)

Fertilizers: used for soil enrichment. The Egyptian framers rely on inorganic fertilizers and crops rotation to maintain the land fertility. The most used inorganic fertilizers by Egyptian wheat farmers are urea, single super-phosphate and ammonium nitrate.

Insecticides: are materials that are used to kill harmful insects to reduce inefficiency of quantity of agricultural products. (6,10)

Rent: the payment paid to book a place or for storage given for landowners. Egypt's Wheat farms are small with 89% of land holdings smaller than 1.3Ha (3 Feddan) (FAO,2015), wheat plays a main role in framers' crop rotations because it is one of the most common winter summer rotations crops like wheat-maize(corn) and wheat-rice. (16)

Economic Instability: occurred due to the 2011 revolution and it shows how the agricultural sector had been affected due to such an event. (15)

B. Economic Assumption

The main assumption in this paper is based on the economic theory, which states that there is a positive relationship between production of wheat and machinery, seeds, fertilizers, insecticides and economic stability, while there is a negative relationship between production of wheat and wage and rent. Therefore, we came up with an economic assumption that is in the following verbal equation:

Production = Wage + Machinery + Seeds + Fertilizers + Insecticides + Rent + Economic Instability

After that, we built the multiple regression model by first changing the verbal equation into a simpler, verbal error-free equation form using symbols such as follows:

$$Q = a + bW + cMac + dS + eF + fI + gR + hEcoIn \quad (1)$$

Where:

Table I Variables Definitions

Parameter	Explanation
Q	Wheat (Dependent variable)
a	the constant value (the intercept)
b to h	The parameters of all the independent variables
W	Wage
Mac	Machinery
S	Seed
F	Fertilizers
I	Insecticides
R	Rent
EcoIn	Economic Instability

Using the science of "Econometrics" (1) an interpretation for the reality of the relationship of each variable we have mentioned above to wheat production will be discussed. Equation (1) replaced by the following verbal equation into an actual probability equation as follows:

$$Y = B_o + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + U \quad (2)$$

Where:

Table II Parameters Definitions

Parameter	Explanation	Comment
Y	Wheat production as the dependent variable	
B_0	production of wheat equal B_0	all explanatory variables equal to zero
B_1	Production decrement value when the wage increases by 1 unit	Negative relationship
B_2	Production increment value when the Machinery increases by 1 unit	Positive relationship
B_3	Production increment value when the seeds increase by 1 unit	Positive relationship
B_4	Production increment value when the fertilizers increase by 1 unit	Positive relationship
B_5	Production increment value when the insecticides increase by 1 unit	Positive relationship
B_6	Production increment value when the rent increases by 1 unit	Negative relationship
B_7	Production increment value when the economic stability increases by 1 unit	Positive relationship
U	The Error Term	'Disturbance Value

Historical data was collected about wheat production and the 6 factors of production, during the period 2000 - 2015, according to the latest updated records held by the Economic Affairs Sector in the Ministry of Agriculture and Land Reclamation. That in addition to the dummy variable i.e. the Economic Instability which is represented by 0 for the years before 2011 and 1 for the years from 2011 to 2015.
By using E-views (Version 9) the collected data was analyzed. In addition, the Cobb Douglas production equation

$$Q = AL^{\alpha}K^{\beta} \qquad (3)$$

is used which required the changing of the linear (1) to the corresponding nonlinear one (4).

$$\log Y = B_o + B_1 \log X_1 + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4 + B_5 \log X_5 + B_6 \log X_6 + B_7 \log X_7 + U \qquad (4)$$

By implementing the E-view the following results were obtained:

Table III Results of the Regression

Dependent Variable: LOG(PROD)
Method: Least Squares
Date: 06/10/18 Time: 20:13
Sample: 2000 2015
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.72352	0.775959	20.26333	0.0000
LOG(WAGE)	-0.754613	0.305127	-2.473112	0.0385
LOG(MACH)	0.067371	0.279361	0.241162	0.8155
LOG(SEED)	1.002479	0.316144	3.170956	0.0132
LOG(FERT)	-0.826338	0.272002	-3.037980	0.0161
LOG(INSECT)	0.354622	0.149286	2.375462	0.0449
LOG(RENT)	0.380321	0.277137	1.372320	0.2072
ECOIN	0.155300	0.079062	1.964270	0.0851

R-squared	0.944897	Mean dependent var	15.87392
Adjusted R-squared	0.896683	S.D. dependent var	0.137360
S.E. of regression	0.044151	Akaike info criterion	-3.095528
Sum squared resid	0.015595	Schwarz criterion	-2.709233
Log likelihood	32.76422	Hannan-Quinn criter.	-3.075746
F-statistic	19.59771	Durbin-Watson stat	2.344088
Prob(F-statistic)	0.000193		

(i) The economic significance:

The estimated results were presented in Table IV, and it is noticed that All the parameters are "coefficient - Inelastic" except B_3 is "coefficient - Unit Elastic". In addition, all the barometers are "Economically Significant" except B_1, and B_4 are "Economically Insignificant".

(ii) The statistical significance: T-test:

H0: Bi = 0 & H1: Bi ≠ 0, i = 0, 1,2, 3, 4, 5
The parameters interpretations are presented in table V.

(iii) The significance of the model:

- **Coefficient of determination:**

$R^2 = 0.944897$.
The coefficient of determination implies that 94 % of the change in production of wheat is explained by the regression (the change in wage, machine, seeds, fertilizers, insecticides, rent, and economic stability).

- **F- Test:**

P=0.000193
F* = 19.59771
H_0: $B_0 = B_1 = B_2 = B_3 = B_4 = B_5 = B_6 = B_7 = 0$
H_1: $B_0 \neq B_1 \neq B_2 \neq B_3 \neq B_4 \neq B_5 \neq B_6 \neq B_7 \neq 0$

As P < 0.1, we will accept H_1 and reject H_0, therefore this model lies in (alpha) area. This implies that the model is statistically significant, and it has strong explanatory variables. In addition, the "Multicollinearity" problem has suspected the occurrence. This occurs is when there is a linear relationship between some or all the explanatory variables
The first indication was that Machinery and Rent were shown to be as insignificant to wheat production and coefficient of determination is very high. Thus, we made a correlation matrix between all the 7 independent variables to clarify if this problem is present or not. The results were as follows:

Table IV Parameters Interpretations (Regression – Eq (4)

Parameter	Parameter value	Comment	Wheat Production
B_0	15.72352	+ve	15.723 (when all independent variables equal to zero)
B_1	-0.754613	-ve relationship	Decreased by 0.754613 % (when wage increases by 1%)
B_2	0.067371	+ve relationship	Increased by 0.067371% (when machine increases by 1%)
B_3	1.002479	+ve relationship	Increased by 1.002479% (when seeds increase by 1%)
B_4	-0.826338	-ve relationship	Decreased by 0.826338 % (when fertilizers increase by 1%)
B_5	0.354622	+ve relationship	Increased by 0.354622% (when Insecticides increases by 1%)

B_6	0.380321	+ve relationship	Increased by 0.380321% (when Insecticides increases by 1%)
B_7	0.155300	+ve relationship	Increased by 0.155300% (when economic stability increases by 1%)

Table V Parameters Interpretations (T test – Eq (4))

Parameter	P	t * Parameter	Decision
B_o	0.0000	20.26333	As $p < 0.1$, we will accept H_1 therefore, B_o is significant
B_1	0.0385	-2.473112	As $p < 0.1$, we will accept H_1 therefore, B_1 is significant
B_2	0.8155	0.241162	As $p > 0.1$, we will accept H_0 therefore, B_2 is insignificant
B_3	0.0132	3.170956	As $p < 0.1$, we will accept H_1 therefore, B_3 is significant
B_4	0.0161	-3.037980	As $p < 0.1$, we will accept H_1 therefore, B_4 is significant
B_5	0.0449	2.375462	As $p < 0.1$, we will accept H_1 therefore, B_5 is significant
B_6	0.2072	1.372320	As $p < 0.1$, we will accept H_1 therefore, B_6 is significant
B_7	0.0851	1.964270	As $p < 0.1$, we will accept H_1 therefore, B_7 is significant

Table VI Correlation Matrix between the Independent Variables

Correlation							
	LOG(WAGE)	LOG(MACH)	LOG(SEED)	LOG(FERT)	LOG(INSECT)	LOG(RENT)	ECOIN
LOG(WAGE)	1.000000	0.994197	0.990507	0.944070	0.920697	0.977815	0.861058
LOG(MACH)	0.994197	1.000000	0.991387	0.950515	0.928425	0.978258	0.836095
LOG(SEED)	0.990507	0.991387	1.000000	0.968622	0.954400	0.985576	0.803946
LOG(FERT)	0.944070	0.950515	0.968622	1.000000	0.987404	0.981709	0.691384
LOG(INSECT)	0.920697	0.928425	0.954400	0.987404	1.000000	0.955848	0.635838
LOG(RENT)	0.977815	0.978258	0.985576	0.981709	0.955848	1.000000	0.783173
ECOIN	0.861058	0.836095	0.803946	0.691384	0.635838	0.783173	1.000000

Here, we have noticed that all the independent variables, except 'ECOIN', have relatively high degree of correlation to each other; as the range of the percentage of correlation is from 92% to 99%.

Therefore, this indicates that there is a problem of 'Multicollinearity'. The solutions to 'Multicollinearity' are as follows:

- **Collecting more data.**

We cannot use this solution to solve 'Multicollinearity' because the data available is unfortunately insufficient.

- **Transformation of variables**

We tried to transform the variables in many ways such as log(prod)/rent, log(prod)/match, etc. but at all trials many variables were insignificant, and coefficient of determination was very high. Therefore, we decided to use the third solution which is dropping highly correlated independent variables which are machinery and rent. Thus, our verbal equation became as follows:

Production = Wage + Seeds + Fertilizers + Insecticides + Economic Instability

The corresponding nonlinear form of the production formula is given by:

$$\log Y = B_o + B_1 \log X_1 + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4 + B_5 \log X_5 + U \quad (5)$$

After dropping the highly correlated variables, which are rent and machine, the problem of 'Multicollinearity', has been solved and all explanatory variables became statistically significant along with having a high value of coefficient of determination (R^2). This is shown in the following results as shown on E-views screen:

Table VII Results of Regression Model

Dependent Variable: LOG(PROD)
Method: Least Squares
Date: 06/10/18 Time: 20:19
Sample: 2000 2015
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	16.30850	0.630656	25.85956	0.0000
LOG(WAGE)	-0.613646	0.246894	-2.485466	0.0322
LOG(SEED)	1.074461	0.295694	3.633697	0.0046
LOG(FERT)	-0.534859	0.170214	-3.142280	0.0105
LOG(INSECT)	0.255759	0.128960	1.983250	0.0755
ECOIN	0.148771	0.077689	1.914949	0.0845

R-squared	0.931811	Mean dependent var	15.87392
Adjusted R-squared	0.897716	S.D. dependent var	0.137360
S.E. of regression	0.043930	Akaike info criterion	-3.132435
Sum squared resid	0.019299	Schwarz criterion	-2.842714
Log likelihood	31.05948	Hannan-Quinn criter.	-3.117598
F-statistic	27.33010	Durbin-Watson stat	1.682650
Prob(F-statistic)	0.000016		

(i) The economic significance:

The estimated results were presented in Table VIII, and it is noticed that All the parameters are "coefficient - Inelastic" except B_2 is "coefficient - Unit Elastic". In addition, all the barometers are "Economically Significant" except B_1, and B_3 are "Economically Insignificant".

(ii) The statistical significance:

T-test:

B_o B_1 B_2 B_3 B_4 B_5

H_0: $B_i = 0$ | H_1: $B_i \neq 0$, i = 0,1,2,3,4,5

Since $P < 0.1$, we will accept H_1 and reject H_o, Therefore, B_o, B_1, B_2, B_3, B_4, B_5 are significant and lie in (alpha/2) area.

(iii) The significance of the model:

Coefficient of determination:

R^2 = 0.931811. The coefficient of determination implies that 93 % of the change in production of wheat is explained by the regression (the change in wage, seeds, fertilizers, insecticides, and economic stability).

F- Test:

P= 0.000016 & F* = 27.33010

H_0: $B_0 = B_1 = B_2 = B_3 = B_4 = B_5 = B_6 = B_7 = 0$

H_1: $B_0 \neq B_1 \neq B_2 \neq B_3 \neq B_4 \neq B_5 \neq B_6 \neq B_7 \neq 0$

As P < 0.1, we will accept H_1 and reject H_0, therefore this model lies in (alpha) area. This implies that the model is statistically significant, and it has strong explanatory variables.

Table VIII Parameters Interpretations (Regression – Eq (5)

Parameter	Parameter value	Comment	Wheat Production
B_0	16.30850	+ve	16.30850 (when all independent variables equal to zero)
B_1	-0.613646	-ve relationship	Decreased by 0.613646% (when wage increases by 1%)
B_2	1.074461	+ve relationship	Increased by 1.074461% (when seeds increase by 1%)
B_3	-0.534859	-ve relationship	Decreased by 0.534859% (when fertilizers increase by 1%)
B_4	0.255759	+ve relationship	Increased by 0.255759% (when Insecticides increases by 1%)
B5	0.148771	+ve relationship	Increased by 0.155300% (when economic stability increases by 1%)

Then we have suspected the occurrence of a problem known as 'Autocorrelation', which refers to the correlation of error term in the present period with the error term in the previous period.

Detection of Autocorrelation: We have used the indicator of "Durbin-Watson" to check for the presence of Autocorrelation. The results have revealed that "Durbin-Watson stat" was calculated to be of 1.682650. At a Significance level of 0.01, considering the number of observations (n) and the number of independent variables (k), we have found from the table of "Savin and White" (36) the values of dL and du as follows and shown on the graph above (Fig 2).

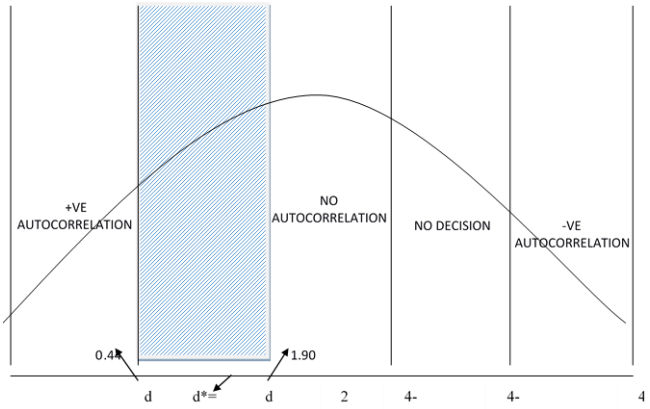

Figure 2: Durbin-Watson Graph of dU and dL

In the figure, it is noticed that d* lies in the "Indecisive area" that is between dL and du; precisely in the shaded area as shown on the above graph. Other than using the Durbin-Watson statistic test (36), we thought of using another test named as "Correlogram Q statistic" to accurately check if there is truly a presence of 'Autocorrelation' in this case. The results were as follows as shown on the E-views screen.

Table IX Autocorrelation and Partial Correlation

Date: 06/11/18 Time: 00:40
Sample: 2000 2015
Included observations: 16

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.047	-0.047	0.0429	0.836
		2	0.013	0.010	0.0462	0.977
		3	-0.058	-0.057	0.1215	0.989
		4	-0.131	-0.137	0.5304	0.970
		5	-0.171	-0.188	1.2999	0.935
		6	-0.104	-0.137	1.6105	0.952
		7	-0.169	-0.223	2.5266	0.925
		8	0.072	-0.020	2.7131	0.951
		9	-0.028	-0.118	2.7449	0.974
		10	0.098	-0.024	3.2049	0.976
		11	0.103	0.004	3.8109	0.975
		12	0.013	-0.071	3.8236	0.986

In the table above, the AC and PAC values are near to zero and the Q-statistics are all insignificant at all lags, indicating insignificant serial correlation in the residuals.

IV. CONCLUSION

Before the Egyptian revolution at 2010, Egypt has been straggling and still straggles with the issue of the wheat that can be summarized into The excess quantity demand on the quantity supply that causes a shortage in the market therefore Egypt had to fulfill the gap with in the supply and demand by importing wheat from foreign countries, By importing wheat and the recent economic decision of fully devaluating the currency that effected the price of Egyptian pound against the US Dollar from 8.8 EGP to 13 EGP According to central bank of Egypt on 3rd November 2016. Since then currency fluctuations as occurred to reach 17.80 on 11th June 2018 therefor the cost of wheat had been affected either as imported wheat or as the input of production of wheat "Seeds, Machinery, Land and etc."

both of those has been effected by Egyptian devaluation even after the devaluation there are many disadvantages such as inflation increased more and raised the prices of goods and services that caused more social and financial pressure on the citizens (34), (35).

Then, we concluded that in wheat production in Egypt econometrics model. The coefficient of wage is negative and significant according to the previous assumptions. The coefficient of machine in positive and insignificant this may be due to the insufficient size of farms in Egypt or the lack of required information to use machines or lack of efficiency in the potential machines. The coefficient of seed is positive and significant. The coefficient of fertilizers is negative and significant, this may be due to the less subsidization by government, its low quality, and it has a bad effect on wheat. The coefficient of insect is positive and significant. The coefficient of rent is positive and insignificant this may be due to the high rent imposed by landowners, so farmers took a decision to plant vegetables and fruits with high prices rather than planting wheat with low market price. The coefficient of economic stability is positive and significant.

V. RECOMMENDATIONS

Referring to what we have concluded from the data and facts that we have collected and analyzed recently, we have come up with some recommendations within our own personal perspective to enhance wheat production in Egypt.

(i) Supervision on Quality of 'Baladi' Bread for improvements

Due to the corruptions and unhygienic of the environment of the mills and bakeries, the subsidized wheat flour is mixed with small rocks and pieces of wood that is used to produce the 'Baladi' bread. The government should put punishment on those actions and on the other hand it should train, motivate and supervise existing workers to care for their job and improve the 'Baladi' bread food manufacturing.

(ii) Increase public awareness

The government must educate the people in schools, universities, and over the public media about the essence of agriculture to the country, especially wheat agriculture, to be aware of its importance. This will lead to the involvement of the civilian community to work thoroughly and sincerely towards this point.

(iii) Revamp Land reforms

Egypt should adjust land prices and regulate the land-renting system to provide a sustainable environment for a beneficial work process between land owners and land renters (farmers).

(iv) Land management

The government must imply a system that is like that relate to the products that we buy, quality control system. In this case it will be concerning lands to check how the crops are being planted during the seasons and to guide those who are not familiar with what is supposed to be done.

On the other hand, the government must apply fines on people who manage the land improperly. Improper land management costs the country a lot as it causes it to lose many of its agricultural lands because of such reason.

(v) Technology

As we are living in time of technology and speed, everything is in a never-ending pattern of change. Thus, Egypt must cope with such a change, especially in technology, to adapt with the changes that are happening now-a-day, introduce such technologies in the agricultural sector that are effective, and therefore be able to compete in the international markets.

(vi) Rural areas

For the fact that Egypt's population is more concentrated in the rural areas than in the urban areas, the government must prepare and plan for the development of these areas, specially concentrating on their infrastructures including all its types as in electricity, transportation, water supply, etc. This would provide motivation for the people living there to prefer staying and to work. Thus, they would be concentrating more on the agricultural sector.

(vii) R&D

One of the main factors that influence the emergence of great developments comes from the R&D sector in any association. Thus, this department is of major concern and there must be a great attention and emphasis towards such department. According to our discussion, we are pointing out towards the Agriculture Research Center to provide incentives for researches to prepare influential researches for the sector to benefit the country with ideas for development and enhancement.

(viii) Urbanization

Having a trend of urbanization in a country is not necessary a negative indicator. But, if the urbanization rate is more than the normal rates, it is a problem as what we have in Egypt. Besides that, the people in rural areas are changing their arable lands into lands for real estates. This has significantly decreased the arable lands available and thus, the government must move towards applying laws against those who use arable lands for other purposes than for agriculture.

(ix) Be aware of the upcoming crisis (The Nile River and the GRAND DAM)

The future consequences that may face Egypt from the water crisis is that the shortage in water supplies which is mainly from the Nile River. Due to such crisis, two of the most important crops, rice and sugar cane, that absorb large amounts of water are now being banned by the Egyptian parliament and will apply fines on those who break the law. This would motivate people to move towards growing wheat instead.

On the other hand, Egypt must reconsider further negotiations with Ethiopia to settle down the Nile-water conflicts as in the future as most of the reports have mentioned the major threat that is arising against Egypt from the building and future progress of the GRAND Ethiopian Dam, especially on the agricultural sector.

(x) Right allocation of resources

Few supports from government in machinery and fertilizers costs in the form of subsidies. The government doesn't support the agricultural sector enough and provides few subsidies on the very costly machinery that is required to be used on harvesting, weeding etc. Therefore, Egypt is a labor-intensive country rather than capital intensive due to lack support from the government.

Thus, it should provide subsidies for only the small farmers to provide incentives for growing wheat, as it is considered as a very important strategic crop and give opportunity for these farmers to be larger farmers in the future.

(xi) Should have available agricultural data (even for the foreigners)

There was a problem with collection of data where CAPMAS only has the data that relates to the sector, not into details. Therefore, for the leak of availability of numerical data of the internet and at CAPMAS, the numerical data that was collected from the Ministry of Agriculture and Land Reclamation. But there was another problem with the data available there. The data was with a limited time span that was from 2000-2015.

Thus, Egypt should focus/take into considerations that data must be available and the access to it must be in a modernized manner, i.e. through the internet, that would make the journey of data collection be easier. This would lead researches to prepare their researches and thesis will be made to analyze the agricultural sector to move forward and help the macro-economy and micro-economy of the country. On the other side, the fact that the data would be easily available for everyone would let foreigners have the incentive to invest in such sector as they would know everything about it in details. In return, that would be a way to drag in FDI and increase the inflow of foreign currency into the country.

REFERENCES

1. D.A. Gujarati," Basic Econometrics", United States Military Academy, West Point McGraw-Hill Higher Education, 2003,.
2. F.,Khalil, H., Farag, , G. El Afandiand and S.Ouda,. "Vulnerability and Adaptation of Wheat to Climate Change in Middle Egypt", Thirteenth International Water Technology Conference, IWTC 13, Hurghada, Egypt, 2009
3. M., Kherallah, N.,Minot, P.Gruhn, "Adjustment of Wheat Production to Market Reform in Egypt", International Food Policy Research Institute (IFPRI) 1999.
4. P. H. BENT, "Agrarian change and industrialization in Egypt", 2015. pp. 1800-1950.
5. Y.Elasraag," Economics of wheat in Egypt ", Technical University of Madrid (Spain), Doctorate Degree, 2015.
6. B.Tate, "Egypt May Lose 1.4 Billion Pounds on Wheat Purchases in", GAIN Report, Global Agriculture Information Network,2018.
7. A.Wally M..Beillard, "Egypt's New Guidelines for Wheat Imports" United State Department of Agriculture, 2017. No. 48.
8. M.A. Semenov, P. Stratonovitch, F. Avlabari, M.J. Gooding, "Adapting wheat in Europe for climate change, Journal of Cereal Science", 2014, Jan.4
9. Nikos Alexandratos and Jelle Brunsman," WORLD AGRICULTURE TOWARDS 2030/2050, Food and Agriculture Organization of the United Nations", June 2012
10. A.,Gouell A.,El Miniawy" Food and agricultural policies in Egypt" (CIHEAM), 1994
11. "Agricultural Policies, Trade and Sustainable Development in Egypt", March 2017
12. M.Mahmoud Fawaz1, A.Sarhan Soliman ", The Potential Scenarios of the Impacts of Climate Change on Egyptian Resources and Agricultural Plant Production", journal from Scientific Research Publishing Inc., 27 April 2016
13. Ahmed Wally and J. Mariano Beillard, "Promoting Sustainable Investment in Egypt's Food Security 2017 Forum", 1st August 2018
14. R.Hassan El-Ramady, M.Samia El-Marsafawy, and N. Lowell Lewis "Sustainable Agriculture and Climate Changes in Egypt", 2013
15. Samiha Ouda, Tahany Noreldin and Khaled Abd El-Latif, "Water requirements for wheat and maize under climate change in North Nile Delta", Spanish Journal of Agricultural Research, 2 December 2014
16. Eng. Thoraya Seada, Dr. Ramy Mohamed,Mr. Tobias Fletscher ,Mr. Helmy Abouleish , Mr. Maximilian Abouleish-Boes and in cooperation with the Heliopolis University"The Future of Agriculture in Egypt "Comparative Full Cost Accounting Study of Organic and Conventional Food Production Systems in Egypt" , January 2016
17. Department: Agriculture, Forestry and Fisheries Republic of South Africa "PRODUCTION GUIDELINE FOR WHEAT", 2016
18. Salah Mansour "Wheat and Corn Production on the Rise" 4/2/2012
19. M.M. Ibrahim, S.A. Ouda, A. Taha, G. El Afandi and S.M. Eid" Water management for wheat grown in sandy soil under climate change conditions" Journal of Soil Science and Plant Nutrition, 2012
20. Julian McGill, Dmitry Prikhodko, Boris Sterk, Peter Talks "Wheat sector review", prepared under the FAO /EBRD Cooperation ,2015
21. Ahmed Wally "Egypt Streamlines Its Grain Import Procedures and Eases Import Regulations While Rice Exports Should Begin to Rebound Over the Coming Year" 3/15/2017
22. Yehia Mohamed Khalil, Eman Mohamed Ali, Heba Yassin Abd Elfatah, Karima Awad Mohamed Awad ," An economic analysis of the wheat crop wastes in Egypt" ,2016
23. N. T. Khan, J. Park and Y. B. Kim "AN INTEGRATED MODEL FOR FORECASTING WHEAT CONSUMPTION IN PAKISTAN: EMPHASIZING SOCIAL AND ECONOMIC FACTORS" The Journal of Animal & Plant Sciences, 28(1): 2018
24. S.Dawoud, D.Z.," Current Status and Future Perspective of Wheat Production and Consumption in Egypt", Journal of Agri-Food and Applied Sciences, 30 June 2017
25. J. Valizadeh a, S.M. Ziaei b, S.M. Mazloumzadeh "Assessing climate change impacts on wheat production" 26 February 2013
26. Ahmed Wally, Agricultural Specialist and Mariano J. Beillard, Senior Regional Agricultural Attaché "Egypt's Wheat and Corn Imports Hold Steady, Rice Exports Remain Restricted" 9/12/2017
27. A.Semerci1, K.Mazid, N. Amegbeto, M. Keser, A. Morgounov3, K. Peker4, A. Bagci4, M. Akin5, M. Kucukcongar5, M. Kan5, S. Karabak5, A. Altikat5 and S. Yaktubay "The Production Functions of Wheat Production in Turkey" November 2, 2011
28. Dr. Afaf Z. Othman, Dr. Nayera, Y. Solieman, Dr. Ahlam, A. Hassan "Study of the most important factors affecting the production of wheat crop in the new lands in Egypt (Nubaria Area)",2014
29. Nadine Elhakim, Arnaud Laillou, Anwar El Nakeeb, Rukia Yacoub, and Magdy Shehata," Fortifying baladi Bread in Egypt: Reaching More than 50 Million People through the Subsidy Program", Article in Food and nutrition bulletin · December 2012
30. Ibrahim Soliman, Zagazig University "AGRICULTURAL MECHANIZATION AND ECONOMIC EFFICIENCY OF AGRICULTURAL PRODUCTION IN EGYPT" OCTOBER 1992
31. H.Miral Khodeir (corresponding author), M.Hisham A. Abdelsalam" simulation model for wheat-related policies and food insecuritynin Egypt"2015
32. Moustafa Ibrahim,"مصر وتحدياتها االستراتيجية: القمح نموذجا " Egyption institute for studies,12 september 2017
33. A,Kasem, الكفاءة االنتاجية واالقتصادية ألهم أصناف القمح المزروعة في محافظة البحيرة). Economic and production efficiency of wheat agriculture in El-Beheira:at Available)., 2013
34. PwC (Price-Water-house-Cooper) Middle East "The EGP Devaluation: A new beginning" 2017
35. Central Bank of Egypt "Exchange rate of Egyptian currency historical Data" 12th June 2016-12 June 2018
36. https://docplayer.net/28513348-Durbin-watson-significance-tables.html
37. T.J. Coelli and G. Battese, "A Model for Technical Inefficiency Effects in a Stochastic Frontier Production Function for Panel Data", Empirical Economics, 1995, 20(2):325-32, February
38. S. Osama and M. Elkholy, "Optimization of the cropping pattern in Egypt" AEJ - Alexandria Engineering Journal, 2017. 56(4), May.
39. Y H. Amin, "Economics of Wheat in Egypt", Technical University of Madrid (Spain), PhD thesis, 2015.

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