ORIGINAL ARTICLES

An Economic Study of the Current Situation of Cotton in Egypt

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ABSTRACT

In spite of the importance of Cotton as a major crop of the Egyptian Agriculture, thus it suffered, through the last years of a critical status on the level of the cultivated area and production. The Cotton is no longer the crop that the farmers wish to cultivate, the cultivated area was about 933 thousand Feddan in he year 1990, it was declined to 284 thousand Feddan in the year 2009, also the total production of Cotton decreased from 5169 thousand Kantar in the year 1990 to about 1785 thousand Kantar in the year 2009. Regarding The problem of the study, The cultivated area and the total production of cotton has been following a gradually declining especially in recent years. This situation led to the decrease of the supply of Cotton and the increase of threads imports, and the lower importance of the Cotton crop on the individual and National levels. The study aimed at identifying the reasons that led to the decline of both the cultivated area and the production of the Egyptian Cotton. The methodology of the research depended on descriptive and statistical analysis methods, this was with the help of some statistical tools and methods also depending on using the dynamic model of Marc–Nerlove which is considered one of famous models in estimating the supply response models. The study discussed the recent status of the Cotton crop in Egypt as for the cultivated area, the productivity, the total production, the farm prices and the relative importance of the Cotton crop in the Egyptian Agriculture. Also, the study estimated the response equivalents for the Cotton crop according to four scenarios where the first scenario is the estimating of the factors affecting the changes of the Cotton areas, as independent variables such as, the farm price, the feddan productivity, the production costs of the Feddan and the feddan net revenue. It occurred that the farmer respond more to the net feddan revenue towards the increasing of the cultivated area of Cotton, that is according to the elasticity of supply, from one side, and the rising of the value of adjusted coefficient of determination ($R^2$) from the other side. The Second scenario included the estimation of the affect of the response of the area of Cotton to the change of the farm prices in its absolute and relative forms, it was found the farmer respond more to the relative price between the Cotton and the summer rice, while the third scenario, is the measuring of the affect of the response of the area of Cotton to the change of the production costs of the Cotton crop in its absolute and relative form, where it was found that the farmer was more respond to the net relative production costs between the Cotton and the summer rice. The fourth scenario, is studying the affect of the response of the area of the cotton to the change of the net relative revenue of cotton in its absolute and relative form. The farmer was respond more to the net relative revenue between the cotton and Rice, then between the cotton and summer maize. These Results, according to ($R^2$) and the estimated elasticities of supply response in short and long terms. The study recommended the necessity of to provide the adequate finance for the farmers owing to the raise of the production costs, and that for keeping the role of this crop in covering the domestic demand and responding the needs of the foreign market. In this frame, it should be noticed that the importance of the role of cooperatives in providing the need, of the agricultural production in adequate prices also, allowing the easy loans for the farmers, activating the role of agricultural extension, and the national campaigns to rise the productivity of Cotton crop and working on encouraging the farmers to adopt high productivity varieties with the guarantee to the farmer to have a farm price that stimulates them to the expansion in cultivating the Cotton crop.

Key words: The Egyptian Cotton, the cultivated area of Cotton, the total production of Cotton, the supply response, the farm prices, the Marc. Nerlove model, Elasticities of supply response.

Introduction

In the last hundred years, Egyptian farmers called cotton "White Gold". Cotton is one of the oldest and the strategic crops in Egypt. Before the 1960’s, it was under the leadership of the private sector. Beginning of the 1960’s, The Egyptian government nationalized the cotton industry. Beginning of 1960’s the government spent efforts to have it back under the leadership of private sector. However, the cotton cultivated area and production
was decreasing since the nationalization era. This affected the Egyptian cotton markets. In addition, Egyptian started to import cotton.

The Egyptian cotton is considered one of the most important crops in Egypt, this position refers to its importance in the national economy on different levels, where the cotton is considered the commodity that is basic for the industry of weaving and textile in Egypt also, the industries of oils, soap and feed that is based on Cottonseed, in spite of its importance as a main crop in Egyptian Agriculture, the cultivated area of Cotton has decreased from about 933.0 thousand feddan in the year 1990 to about 284.0 thousand feddan in the year 2009 with a change rate readied about -71.4% in the year 2009 comparing with the year 1990. Reduction of the cultivated area led to reduction in the local production of Cotton from about 5169.0 thousand kentar in the year 1990 to about 1785.0 thousand kentar in the year 2009 with a change rate reached about -65.5% correlated with the decrease of the local production of Cotton, as the export capacity of the Egyptian Cotton and Egypt has lost some of its foreign markets, so the loss of a part of the decreasing of the foreign currency that is necessary for accelerating the economic development. As the statistics of the Egyptian Cotton showed that it was fluctuated through the last two decades where it reduce in the year 1990 about 39.0 thousand ton, then increased to about 112.0 thousand ton in the year 1995, after that, it decreased to about 81.0 thousand ton in the year 2001, then it reached its maximum rate in the year 2003 to about 197.0 thousand ton, then decreased to about 97.0 thousand ton in the year 2005, finally the decreasing continued to reach about 35.0 thousand ton in the year 2009.

The Problem Of The Study:

In spite of the relative importance of the Egyptian Cotton and its products, it suffered in the last years from many problems related generally with its supply, domestically and in world market, whether these problems was related to the decrease of its cultivated area or the decrease of the productivity of its some chosen varieties and the decline of its price on the level of the farmer which led that most of the farmers avoid its cultivation. This was followed by some problems connected with the ginning industry then with spinning and weaving domestically, moreover, the exporting problems and its status in the world markets.

The problem of this study is determined in several economic sides, it was presented in the decreasing of production resulted of the decreasing of the cultivated area from one hand, and the decreasing of the feddan productivity from the other hand.

This led to the decline of the Cotton supply and obliged to the weaving imports, that means that the decline of the importance of Cotton was not at the level of the Egyptian farmer only, but also at the national level, so the matter forced to study the reasons that led to the declining of its economic position and the loss of its status on the domestic and national levels.

The Research Objectives:

The research aims essentially at identifying the reasons that led to the decrease of the cultivated area and the production of the Egyptian Cotton, and trying to overcome the obstacles facing the Egyptian cotton in the last period and to motivate the farmers to cultivate the Cotton and increasing its area, also determine the factors that led to the reduction of the cultivated area and production of cotton.

The Method And Frame Of The Research:

The research depends on the analytical method from the two sides, the qualitative and quantitative, hence it was achieved by the help of some statistical ways and methods such as the simple and multiple regression models for the most important productive and economic variables of the Cotton crop in Egypt during the period (1990-2009). Also depending on using the dynamic model of (Mark – Nerlove) as the most famous model of the response of supply for its easy estimation and the possibility of using more independent variables in the indication of the response of supply, thought its shortage that appear in its usage only in the case of the Annal crops so its disability in estimating the response of supply of the perennial crops. The model formulates as follow (Nerlove, Marc, 1956; 1958; 1979).

\[ Y_t = \alpha + \beta X_{t-1} + \mu_t \]  

But it can be noticed that the desired acreage in the present year \( Y_t^* \) in a variable that is not seen so in this case we can not estimate the formula (1). Thus Nerlove assumed that it is always the Actual Acreage is less than the Desired acreage \( Y_t - Y_{t-1} \) usually is smaller than the change in the desired A ceraige \( Y_t^* - Y_{t-1} \), that is owing to the existence of economic or teleological strains leading to the nonequality of both, this assumption was called the name of "partial Adjustment Model" as follows:

\[ Y_t - Y_{t-1} = \lambda \ (Y_t^* - Y_{t-1}) \quad Y_t = \lambda \ Y_t^* + (1 - \lambda) \ Y_{t-1} \]
Substituting equation (1) into equation (2) we have the following equation of supply's response.

\[ Y_t = \alpha \lambda + \beta \lambda X_{t-1} + (1- \lambda) Y_{t-1} + \mu^*_t \]  

(3)

Where:

- \( Y^*_t \) = The desired acreage in the present year (t).
- \( Y_t \) = The actual acreage in the present year (t)
- \( Y_{t-1} \) = The actual acreage in the last year (t-1)
- \( X_{t-1} \) = The independent variables in the last year (t-1).
- \( \mu^*_t \) = Fault level of the equation \( \lambda \mu \)
- \( \lambda \) = Coefficient of Adjustment \( 0 \leq \lambda \leq 1 \)

The calculation the coefficient of supply as the equation No. (3) as follow:

\[ Y_t = \hat{\beta}_0 + \hat{\beta}_1 X_{t-1} + \hat{\beta}_2 Y_{t-1} + \mu^*_t \]  

(4)

And by the assist of the regression equations (3) and (4) the calculation of conversions as follows:

\{ \beta = \hat{\beta}_1 / \lambda, \alpha = \hat{\beta}_0 / \lambda, \lambda = 1 - \hat{\beta}_2 \}

The yearly response of the farmers (\( \lambda \)), also the time period that must be done to achieve the complete response is to be \( 1/\lambda \) starting from the next year of cultivation.

The elasticity of price can be calculated in the short run (1) and in the long run (B) as follow (Nerlove, Marc., 1956).

\[ S.R.E = \beta \lambda \] 

\[ B.R.E = \beta \lambda \]

The Standard Problems Of The Models Of Response Of Supply:

There are several problems that face the analyses of the regression equations generally and that must be defined before discussing and explaining the results, that upon consequent its existence when efficiency estimated and gaining an estimations that are changed from the actual existence, the autocorrelation problem is considered one of the most important standard problems when estimating the equations of supply's response using the dynamic late distribution models, which include the dependent variables as one of the independent with a late period \( Y_{t-1} \) when the falt margin \( \mu_{t-1} \) is correlated whit the previous value also \( Y_{t-1} \) is correlated with \( Y_{t-1} \). So, there is an autocorrelation between \( \mu_{t-1} \) and \( Y_{t-1} \) with the variable \( \mu_{t-1} \).

So, the test ((Durben-Watson) test which is suitable with the nature of the dynamic late distribution that include the dependent variable as one of the independent variable with a late period \( Y_{t-1} \), where this test is a suitable choice for the (Durben-Watson) test as follows:

\[ h = \sqrt{ \frac{T \cdot V}{1-T \cdot V} } \]

Where:

- \( P \) = Autoregressive coefficient \([-1<P<1]\)
- \( T \) = Size of sample
- \( V \) = The variance of the standard error for the variable \( V=(\hat{\beta} / t)^2, (Y_{t-1}) \)

The quillance of the autocorrelation by using the estimated value of \( h \) and comparing it with the tablized (Z) in the one sided standard natural curve table in case of testing if there is an autocorrelation, while, if there is...
an existence of autocorrelation than, the double sided table is used, for there is no previous acknowledgment if
the autocorrelation is positive or negative, where the (h) test is a suitable alternative for the (Durbin-Watson)
test, which can not be sued in the molds that contain stochastic variables, also, the dependent variables that exist
with a delaying period (Y_{t-1}), and that is taken on the Durban (h) is that it reveal the autocorrelation from the
first degree only, and can not be used when the amount is \[(1-T.v.)\leq 0\], though it's value is equal to zero or
negative, that it can not be obtaining the square root to (h) test in this case though with the help of (Harvey LM)
test with be as follows:

\[ \text{LM}_h = P^2 \left\[ \frac{T}{(1-T.V)} \right\] \sim X^2_1 \]

As for the problem of the NonHomogeneity, the (ARCH) test was used, using for the original model to obtain
the limit of error then squaring it and using the regression,

\[ (\mu^2_{t-1}, \mu^2_{t-2}, \ldots, \mu^2_{t-m}) \]

to have the definition limit (R^2), and the (LM) test is

\[ \text{LM}_h = (T- m) R^2_m \sim X^2_m \]

Data and Information Sources:

Major data sources are the Ministry of agricultural and Land Reclamation, Economic of Fairs Sector (EAS),
Bulletin for statistics summer field crops, also Bull issued by the central Agency for public Mobilization &
Statistics (CAPMAS),in addition to the web site internet (Http:// www.capmas.gov.eg), and (FAO) web site
(http:// www.fao.org), also Scientific and research papers related the subject of study.

The Results Of Research And Its Discussions:

The Relative Importance Of The Cotton Crop In The Egyptian Agriculture:

By studying the importance of Cotton crop as for the total cultivated area with the summer crops, also its
importance that it represent of the total cultivated area at the level of the state, it occurred from table (1), that the
total cultivated area of the state level is estimated by 13.69 million feddan as an annual average for the period
(1990-2009), and that the total cultivated area of summer crops is estimated by about 5.59 million feddan as an
average for the same mentioned period, and represents about 40.89% from the total cultivated area. The total
area of cotton was estimated by about 700.58 thousand feddan as an annual average for the same previous
period, which represents about 12.51% of the total summer cultivations, this rate reached it maximum in the
year 1990 by 26.16% of the total cultivations of the summer season, while it reached its minimum in the year
2009 by 4.76% of the total cultivated area during the summer season for the same period. As for the relative
importance for the area of cotton crop from the total cultivated area on the state level, it occur from the same
table, that it represents about 5.12% of the total cultivated area on the same level during the same
prementional period, this rate reached its maximum in the year 1990 represents about 7.66% of the total
cultivated area, while it reached its minimum in the year 2009 representing about 1.84% of the total cultivated
area on the state level for the same year.

By estimating the trend equation of the relative importance of the cotton crop either for the summer season
or for the total cultivated area, it occurred that the relative importance is declining were about 0.68 thousand
feddan yearly as for the summer season and about 0.33 thousand feddan for the total area yearly. The statistical
significance of this declining was proved, that means that the cotton crop is faced with a great challenge from
the other challenging crops, and that the farmer became to perfer cultivating the other crops that are more
profitable than the cotton.

The Indicators Of Production Of Cotton Crop During The Period (1990-2009):

The Cultivated Area:

The annual average of the cultivated area of cotton during the period of study (1990-2009) reached about
700.58 thousand feddan, the cultivated area of cotton during the period of study is feedered of vibration, where
it reached its maximum in the year 1990 with about 993.0 thousand feddan, then it declined to about 518.0
thousand feddan in the year 2000, and raised to about 750.0 thousand feddan in the year 2006, and it reached its
minimum in the year 2009 by about 284.0 thousand feddan (Ministry of Agriculture, 1990- 2009).
Table 1: The relative importance of the cotton crop in Egypt during the period (1990-2009). Area: by thousand feddan.

<table>
<thead>
<tr>
<th>Years</th>
<th>Total area of cotton</th>
<th>Total summered cultivation</th>
<th>% for cotton from the summer season</th>
<th>The total cultivated area</th>
<th>% for cotton from the total area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>993.0</td>
<td>3795</td>
<td>26.16</td>
<td>12181</td>
<td>7.66</td>
</tr>
<tr>
<td>1991</td>
<td>861.9</td>
<td>4020</td>
<td>21.44</td>
<td>12405</td>
<td>6.94</td>
</tr>
<tr>
<td>1992</td>
<td>843.3</td>
<td>4048</td>
<td>20.83</td>
<td>12489</td>
<td>6.75</td>
</tr>
<tr>
<td>1993</td>
<td>884.3</td>
<td>5432</td>
<td>16.28</td>
<td>12779</td>
<td>6.92</td>
</tr>
<tr>
<td>1994</td>
<td>721.4</td>
<td>5566</td>
<td>12.96</td>
<td>13002</td>
<td>5.55</td>
</tr>
<tr>
<td>1995</td>
<td>710.2</td>
<td>5722</td>
<td>12.41</td>
<td>12800</td>
<td>5.54</td>
</tr>
<tr>
<td>1996</td>
<td>920.9</td>
<td>6009</td>
<td>15.32</td>
<td>12662</td>
<td>7.27</td>
</tr>
<tr>
<td>1997</td>
<td>858.3</td>
<td>5952</td>
<td>14.42</td>
<td>12776</td>
<td>6.72</td>
</tr>
<tr>
<td>1998</td>
<td>788.3</td>
<td>5800</td>
<td>13.60</td>
<td>12798</td>
<td>6.16</td>
</tr>
<tr>
<td>1999</td>
<td>645.4</td>
<td>5868</td>
<td>10.99</td>
<td>12832</td>
<td>5.03</td>
</tr>
<tr>
<td>2000</td>
<td>518.3</td>
<td>5757</td>
<td>9.00</td>
<td>13922</td>
<td>3.72</td>
</tr>
<tr>
<td>2001</td>
<td>731.1</td>
<td>6015</td>
<td>12.12</td>
<td>14027</td>
<td>5.21</td>
</tr>
<tr>
<td>2002</td>
<td>706.4</td>
<td>6103</td>
<td>11.57</td>
<td>14350</td>
<td>4.92</td>
</tr>
<tr>
<td>2003</td>
<td>535.1</td>
<td>6664</td>
<td>8.03</td>
<td>14474</td>
<td>3.69</td>
</tr>
<tr>
<td>2004</td>
<td>714.7</td>
<td>6193</td>
<td>11.54</td>
<td>14551</td>
<td>4.91</td>
</tr>
<tr>
<td>2005</td>
<td>656.6</td>
<td>5408</td>
<td>12.14</td>
<td>14920</td>
<td>4.40</td>
</tr>
<tr>
<td>2006</td>
<td>750.3</td>
<td>5449</td>
<td>13.77</td>
<td>14920</td>
<td>5.03</td>
</tr>
<tr>
<td>2007</td>
<td>574.6</td>
<td>6518</td>
<td>8.82</td>
<td>15176</td>
<td>3.78</td>
</tr>
<tr>
<td>2008</td>
<td>312.7</td>
<td>5684</td>
<td>5.50</td>
<td>15237</td>
<td>2.05</td>
</tr>
<tr>
<td>2009</td>
<td>284.4</td>
<td>5975</td>
<td>4.76</td>
<td>15491</td>
<td>1.84</td>
</tr>
<tr>
<td>Average</td>
<td>700.58</td>
<td>5598.8</td>
<td>12.51</td>
<td>13689.6</td>
<td>5.12</td>
</tr>
</tbody>
</table>


By studying the time trend for the development of the area of cotton in Egypt, the results mentioned in table (2), points to the trend of the total area of cotton is declining by a rate of about 24.82 thousand feddan, this decrease was proved to be statistically significant at the level of 0.01, and represents about 3.54% of the average area during the period of study.

The value of the adjusted determination coefficient (R²), that about 63% of the changes of the area are refered to time changing factors, and the remained changes are refered to an other factors which are not reflected by the time variables.

2-2 The Feddan Productivity:

The feddanic productivity was vibrated; it was about 5.21 Kentar/feddan in the year 1990, and increased to its maximum in the year 1993 by about 7.78 Kenton / feddan then decreased to about 6.28 Kentar / feddan in the year 2009. it reached its minimum in the year 1998 by about 5.05 Kentar /feddan, the average productivity during the period of study was about 6.50Kentar / feddan. By studying the time trend for the development of the feddanic productivity of the Egyptian cotton crop the results shown in table (2). Points to that it had an increasing trend by a rate of 0.04 Kentar / feddan yearly, and it represents about 0.62% from the average feddanic productivity during the period of study. This increase had proved statistically significance at the level of 0.05, the value of (R²) points that about 49% of the changes happened in the feddanan productivity of cotton, refer to time change factors, and the remain changes refer to another factors that are not reflected of the time variables.

The Total Production:

The change of production in considered a collection of the happened changes in the cultivated area and the feddanan productivity, so it was noticed the vibration of the total production of cotton because of the fluctuation of the cultivated area, the production of the year 1993 is considered the highest production during the period of study(1990-2009) where it was about 6878.1 thousand Kentar, while the lowest production was in the year 2009 and was 1785.3 thousand Kentar, the yearly average of production during period of study was about 4471.45 thousand Kentar

By studying the time trend for the development of the Egyptian cotton, the results of table (2) point to the decreasing in the production of cotton during the period study of a rate of about 144.76 thousand Kentar yearly, represents about 3.24% of the total production during period of study, the value of adjusted R² squared (R²) points to that about 56% of the changes of the total production of cotton crop refer to variables of time, and that the remain changes refer to other factors that are not reflected by the time variables.
Some Economic Indicators For The Cotton Crop During The Period (1990-2009).

The Farm Gate Price:

The farm gate price meaning is the price that the producer have as a price of his products at the farm gate price was about 263 pound/ Kentar in the year 1990 and raised to be about 806 pound / Kentar, while the average farm gate price of the Kentar of cotton during the period (1990-2009) about 496.27 pound/ Kentar (Ministry of Agriculture, 1990- 2009).

By studying the time trend for the development of the farm gate price for the Egyptian cotton, the results mentioned in table (3), the of the prices to increased and the annual rate reached to 25.19 pound/ Kentar, the significance was statistically proved the at the level 0.01, and represents 5.08 from the average farm price during the period of study, and the determination coefficient shows that about 68% of the changes in the farm price of the Egyptian cotton refer to factors that was affected by the time, and the remained changes due to other factors that is not reflected by the time variable.

Table 2: The results of the time trend for the parameters of production of the cotton crop in Egypt. (area – productivity – total production) during the period (1990-2009).

<table>
<thead>
<tr>
<th>Equation</th>
<th>$\beta_1$</th>
<th>$R^2$</th>
<th>F Test</th>
<th>Average</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Y_1 = 50318.40-24.82X_t$</td>
<td>-5.48</td>
<td>0.63</td>
<td>30.11</td>
<td>700.58</td>
<td>*</td>
</tr>
<tr>
<td>$Y_2 = 068.15+.0.4X_t$</td>
<td>2.15</td>
<td>0.49</td>
<td>4.62</td>
<td>6.50</td>
<td>**</td>
</tr>
<tr>
<td>$Y_3 = 293920.1-144.96X_t$</td>
<td>-4.94</td>
<td>0.56</td>
<td>24.41</td>
<td>4471.45</td>
<td>*</td>
</tr>
</tbody>
</table>

Where:
- $Y_1$ = the estimated value of the cultivated area in thousand feddan in the year (t) during the period (1990-2009).
- $Y_2$ = the estimated value of the feddan productivity in Kentar /feddan in the year (t) during the period (1990-2009).
- $Y_3$ = the estimated value of the total production in thousand Kentar in the year (t) during the period (1990-2009).
- $\beta_1$ = the value of estimated (T) for the Regression coefficient.
- $R^2$ = adjusted determination coefficient.
- * = Significant at level 0.01
- ** = Significant at level 0.05


The Total Feddanic Revenue:

The total feddanic revenue for the cotton crop reached about L.E. 1422.2 per feddan In the year 1990, its maximum was in the year 2006 with about L.E. 5654 per feddan while the annual average for the total feddanic revenue for the cotton crop during the period (1990-2009) was about L.E. 3340.64 per feddan.

The equation of the time trend for the development of the feddanic revenue of cotton table (3) shows that the total feddanic revenue had taken an increasing trend estimated by L.E. 182.54 per feddan represents about 5.46% of the total average revenue during the period of study, and this increase had proved that this increase was statistically significant at level of 0.01, the value of the adjusted determination coefficient ($R^2$) points that 69% of the changes happened in the total feddanic revenue were due to time varied factors, and the remained changes were due to another factors that are not reflected by there time variable.

The Total Feddanic Costs:

The average total feddan costs for the cotton crop was about 2055.89 pound/ feddan during the period (1990-2009) and the equation of the time trend table (3), showed that the total feddanic costs had an increased trend that was about 152.48 pound/feddan represents about 7.42% of the average total feddanic costs during the period of study. This increase had been statistically significant at the level of 0.01, the value of the adjusted R-Square ($R^2$) showed that about 88% of the changes in the total costs were due to factors that changes by time.

The Net Feddanic Revenue:

The net feddanic revenue is considered one of the effective factors on taking the producing decisions either on the individual level or the national level, it depends from the view of farmer on the market prices for each of the essential and secondary product, also the prices of the agricultural inputs never the less the feddan productivity. The net feddanic revenue reached about L.E.1206.85 per feddan during the period (1990-2009), the net feddanic revenue was increasing as its trend reached about L.E. 41.76 per feddan represents about 3.46% of the average of the period of study, this increase was statistically signified at the level 0.05, the value of the adjusted R. squared ($R^2$) shows that about 71% of the changes in the net feddanic revenue are refered to at a time
varied factors, and that the left changes refer to other factors which are not affected by the time variable table (3).

Table 3: Results of time trend for the most important economic indicators of the cotton crop in Egypt during the period (1990-2009).

<table>
<thead>
<tr>
<th>The Equation</th>
<th>$\hat{\beta}$</th>
<th>$R^2$</th>
<th>F</th>
<th>Average</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y4 = 49886.8 + 25.19Xt</td>
<td>6.19</td>
<td>0.68</td>
<td>38.32</td>
<td>496.27</td>
<td>*</td>
</tr>
<tr>
<td>Y5 = 361646 + 182.54Xt</td>
<td>6.45</td>
<td>0.69</td>
<td>41.68</td>
<td>3340.64</td>
<td>*</td>
</tr>
<tr>
<td>Y6 = -302830 + 152.48t</td>
<td>12.13</td>
<td>0.88</td>
<td>147.16</td>
<td>2055.89</td>
<td>*</td>
</tr>
<tr>
<td>Y7 = -82286.9 + 41.76X^2</td>
<td>2.09</td>
<td>0.71</td>
<td>4.37</td>
<td>1206.85</td>
<td>**</td>
</tr>
</tbody>
</table>

Where:

- $Y_4$: The estimated value of the farm price in pound/Quintar in the year (t) during the period (1990-2009).
- $Y_5$: The Estimated values of the total feddnic revenue in L.E. per feddan in the year (t) during the period (1990-2009).
- $Y_6$: The Estimated value of the total feddnic costs in L.E. per feddan in the year (t) during the period (1990-2009).
- $Y_7$: The Estimated value of the Net feddnic revenue in the year (t) during the period.

$\hat{\beta}$: the Estimated value of (T) for the regression coefficient.

$R^2$: adjusted determination coefficient.

* = Significant at level 0.01
** = Significant at level 0.05.


The Varieties Of Cotton That Are Cultivated In Egypt Now:

All the Egyptian kinds refers to the barbadnce kind, there kinds are chaactvized with its long staple and smoothness which increase the demand for it, to produce textiles with high quality also used in productions that demand high strength. Some countries try to cultivate the Egyptian cotton that is famous world wide, but the success was limited except Sudan that cultivate it in a wide sphere some countries had imported some kinds of cotton from Egypt like the united States of America, and process it in breeding and selection, and produced kinds of their own, but kept the commercial name as the American Egyptian cotton, the Egyptian cotton on the level of world commerce means was known by the high quality cottons known about the cotton produced in Egypt. The cultivated now in Egypt according to the length of its staple to two essential parts as follows:

Extra Long Staple Cotton (ELS):

The length of the staple beings from $\frac{3}{8}$ inch and more that include the Extra long staple cottons*, the most important species that are now-cultivated in Egypt: Giza 70, Giza88, Giza 87, Giza 45.

Long Staple Cotton (LS):

The length of the staple is $\frac{1}{4}$ inch to $\frac{3}{8}$ inch, the most important varieties cultivated now in Egypt: Giza 80, Giz, 83, Giza 85, Giza 86, Giza 89, Giza 90.

The data mentioned in table (4), the area and production of species of the Egyptian cotton cultivated now in Egypt, where it occurred that the total area of the Extra long cotton varieties (over $\frac{1}{2}$ inch) reached about 126.27 thousand feddan represents about 24.48% of the total area cultivated with cotton on the level of the state which is about 515.73 thousand feddan, while the total production of these varieties 819.81 thousand kentar represents about 25.81% of the total production on the level of the state which is 3176.75 thousand kentar, this as an annual average during the period (2005-2009). The Giza 70 is considered the most long staple cotton variety cultivated in Egypt during that period, its area reached about 61.11 thousand feddan representing about 11.85% of the total cultivated area of cotton with a feddan productivity reaching about 5.84 kentar/feddan, its total production was about 356.88 thousand kentar represents about 11.23% of the total production of cotton on the level of the state during the mentioned period, followed by Giza 88, Giza 87 and Giza 45. With cultivated area represents about 11.06%, 0.89% and 0.68% of the total area of cotton respectively, and with a feddan productivity about 7.29, 6.72 and 4.63 kentar/feddan for these varieties respectively, while the rate of production from these varieties about 13.09%, 0.98% and 0.51% of the total production on the level of the state respectively during the average for the same period, while the general average of the rate of for these varieties reached about 110.35% also from the same table, it show that the total area for the varieties of the long staple cotton over $\frac{1}{4}$ inch and less than $\frac{1}{2}$ inch reached about 76.03% of the total area cultivated with cotton, its quantity of production was about 2346.55 thousand kentar represents about 73.87% of the total production of cotton, while the feddan productivity for the long staple varieties was
about 6.064 kentar / feddan, that as an annual average during the period (2005-2009), the Giza 86 is considered the most cultivated varieties in Egypt where its area was about 231.52 thousand feddan represents about 44.89 of the total area of cotton in Egypt, and with a quantity of production was about 1449.80 thousand kentar represents about 45.64 of the total quantity of production of cotton during the average of the same mentioned period, with a feddan productivity of about 6.26 kentar /feddan, it is followed by the varieties Giza 90, Giza 80, Giza 85, Giza 89 and Giza 83, where the cultivated area of these varieties was about 123.33%, 9.65% 4.70%, 3.35% and 0.11% of the total area at cotton respectively, the quantity of production from these varieties represents was about 12.12%, 8.91%, 3.93%, 3.18% and 0.09% of the total of production quantity on the level of state for each respectively, while the estimation of the feddan productivity of these varieties respectively about 6.06, 5.69, 5.15, 5.85 and 4.91 kentar /feddan, the general lint average to the rate of for these varieties about 118.40% during the average period of study (2005-2009), in addition of other varieties and experiments in area about 2.51 thousand feddan represents about 0.49% of the total area of cotton, with a quantity of production reached about 10.29 thousand kentar represents about 0.32% of the total quantity of production of cotton during the mentioned period.

Table 4: The relative importance of cultivated area and total production? cotton varieties in Egypt during the period (2005-2009).

<table>
<thead>
<tr>
<th>State</th>
<th>Cultivated area &quot;thousand feddan&quot;</th>
<th>% from total of state</th>
<th>Feddnic productivity kentar /feddan</th>
<th>Total production &quot;thousand kentar&quot;</th>
<th>% from the total of state</th>
<th>Lint %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extra long staple over 1 inch</strong> varieties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Giza 70</td>
<td>61.11</td>
<td>11.85</td>
<td>5.84</td>
<td>356.88</td>
<td>11.33</td>
<td>114.4</td>
</tr>
<tr>
<td>Giza 88</td>
<td>57.02</td>
<td>11.06</td>
<td>7.29</td>
<td>415.67</td>
<td>12.09</td>
<td>117.3</td>
</tr>
<tr>
<td>Giza 87</td>
<td>4.63</td>
<td>0.89</td>
<td>6.72</td>
<td>31.11</td>
<td>0.98</td>
<td>104.9</td>
</tr>
<tr>
<td>Giza 45</td>
<td>3.51</td>
<td>0.68</td>
<td>4.63</td>
<td>16.25</td>
<td>0.51</td>
<td>104.8</td>
</tr>
<tr>
<td>Total</td>
<td>126.27</td>
<td>24.48</td>
<td>6.49</td>
<td>819.91</td>
<td>25.81</td>
<td>110.35</td>
</tr>
</tbody>
</table>

| **Long Midrum staple varieties over 1 and less than 3 inch** | | | | | | |
| Giza 80        | 49.878                           | 9.65                  | 5.69                               | 283.15                            | 8.91                     | 121.7  |
| Giza 83        | 0.57                             | 0.11                  | 4.91                               | 2.79                              | 0.09                     | 110.9  |
| Giza 85        | 24.23                            | 4.70                  | 5.15                               | 124.72                            | 3.93                     | 121.2  |
| Giza 86        | 231.52                           | 44.89                 | 6.26                               | 1449.80                           | 45.64                    | 1221.1 |
| Giza 89        | 17.7                             | 3.35                  | 5.85                               | 101.02                            | 3.18                     | 117.7  |
| Giza 90        | 63.58                            | 12.33                 | 6.06                               | 385.07                            | 12.12                    | 119.8  |
| Total          | 386.95                           | 75.03                 | 6.064                              | 2346.55                           | 73.87                    | 118.9  |
| Other Varieties and experiment | 2.51                             | 0.49                  | 4.10                               | 10.26                             | 0.32                     | 118.4  |
| Total state    | 515.73                           | 100                   | 6.16                               | 3176.75                           | 100                      | 115.88 |

Source: Collected calculated from: Ministry of agriculture and land reclamation. Economic affairs Sector, central administration for Agricultural Economics, Bulletins for Statistics, summer field crops, Various issues.

Comparison Of The Cultivated Area, Also The Net Feddanic Revenue Of The Cotton Crop And The Most Important Competitive Crops On The Cultivated Area Of Egypt:

This part deals with the comparison of the cultivated area also the feddanic revenue of the yield of cotton and the most important competitive crops on the agricultural area of Egypt during the period (2005-2009), that taking in consideration that the net revenue one of the effective factors on the farmer to take his production decision to cultivate a certain crop, where each of the summer rice crop, summer maize (white & certain) crop, summer Sorghum crop, summer potatoes crop and summer Tomato are of the important summer crops that are competitive with cotton on the cultivated area in addition to the corps of wheat and sugar Beet as winter crops but they also are competitive with cotton on the cultivated area, as for these two crops they remain in the agricultural land until the end of the month of may, while the cotton crop is cultivated during the month of march.

The data of table (5), show, that the area of cotton crop reached about 515.7 thousand feddan represent about 8.88% of the total summer crops area, which reached about 5806.9 thousand feddan as an average for the period (2005-2009), also the data of the same table, shows that the summer crops are competitive with the cotton crop on the cultivated area in the summer Erwa (season) which include summer rice, summer maize (white and cotton), summer Sorghum, summer potatos and summer tomato had included on about 75.78% of the total area cultivated in summer for the mentioned period, where the cultivated area with the summer maize about 1910.0 thousand feddan represents about 32.89% of the total area of the summer crops followed by the crops of: summer rice, summer Surghum, summer tomato and summer potatos , with areas reached about 1653.3, 359.3, 258.7 and 221.0 thousand feddan represents about 28.46%, 6.18%, 4.45% and 3.80% of the total
the cultivated area in the summer season of each respectively during the average of the mentioned period, as for the area of wheat, it reached about 2966.3 thousand feddan, and for the sugar beet it was about 211.6 thousand feddan for the average of the same period.

And by studying the net feddan revenue of the most important crops competitive with the cotton on the cultivated area/ table (5) shows that the summer tomato occupied the first station by about 6542 pound/ feddan followed by the summer potato by about 4595 pound / feddan, then the wheat by about 2587 pound / feddan, and sugar beet by about 2455 pound/ feddan, followed by the summer rice by about 2345 pound/feddan. End the summer maize by about 2072 pound/feddan, there comes the cotton crop in the seven station by about 1693 pound / feddan, and the summer Sorghum by about 1519 pound/ feddan, and that as an annual average during the period (2005-2009).

It occurred that the net feddan revenue of the cotton crop was lower than most of the summer crops except the summer Sorghum, that greatly contributed in most of the farmers of cultivating it in the last years.

Table 5: The cultivated area, farm price and the net feddanic revenue of the cotton crop and the most important competitive crops on the Egyptian cultivated area during the average period (2005-2009).

<table>
<thead>
<tr>
<th>Crop</th>
<th>Cultivated area &quot;thousand /feddan&quot;</th>
<th>% of the summer crops area*</th>
<th>Farm price**</th>
<th>Net revenue &quot;L.E. per feddan&quot;</th>
<th>Grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>515.7</td>
<td>8.88</td>
<td>760</td>
<td>1693</td>
<td>3</td>
</tr>
<tr>
<td>Wheat</td>
<td>2966.3</td>
<td>-</td>
<td>226</td>
<td>2587</td>
<td>4</td>
</tr>
<tr>
<td>Sugar beet</td>
<td>211.6</td>
<td>-</td>
<td>213</td>
<td>2455</td>
<td>3</td>
</tr>
<tr>
<td>Summer Rice</td>
<td>1653.0</td>
<td>28.46</td>
<td>1306</td>
<td>2345</td>
<td>2</td>
</tr>
<tr>
<td>Summar Maize</td>
<td>1910.1</td>
<td>32.89</td>
<td>183</td>
<td>2072</td>
<td>1</td>
</tr>
<tr>
<td>Summer Sorghum</td>
<td>359.3</td>
<td>6.18</td>
<td>188</td>
<td>1519</td>
<td>4</td>
</tr>
<tr>
<td>Summer Potatoes</td>
<td>221.0</td>
<td>3.8</td>
<td>1040</td>
<td>4595</td>
<td>6</td>
</tr>
<tr>
<td>Summer Tomato</td>
<td>258.7</td>
<td>4.45</td>
<td>665</td>
<td>6542</td>
<td>5</td>
</tr>
</tbody>
</table>

* The average of the total are of the summer Erwa (season) reached about 5806.9 thousand feddan during the period (2005-2009).

** The farm price for cotton (pound / kentar), for wheat (pound/ Ardab), for sugar-beet (L.E per Ton) for rice (L.E. per Ton), for maize and Sorghum (pound/ardab) for potato and tomato (L.E. per Ton)

Source: Collected calculated from: Ministry of agriculture and land reclamation, Economic affairs Sector, central administration for Agricultural Economic, Various issues of Bulletin.

The Estimation Results Of The Model "Marc-Ner Love" Of The Supply Response Of The Cotton Crop In Egypt:

The study could estimate some models of supply response for the farmers of cotton crop in Egypt during the period(1990-2009) by using the dynamic model (Marc - Nerlove), the study had assumed that the response of the cotton crop in the present year was affected by some changes with a period of delay for one year, these changes were represented in : the feddan productivity for the cotton crop, the real farm price for cotton, the real prices of the competitive crops in its absolute and relative forms, also the same as for to the net feddanic revenue, and the production costs of one feddan of cotton and of the competitive crops.

As it was mentioned, they were; the wheat, the sugar beet, the summer rice, the summer maize, the summer Sorghum the summer potato and the summer tomato, were the most important crop competing the cotton crop on the cultivated area, beside including the cultivated area of cotton with a delay period of one year (Yt-1) as one of the independent variables in the model four scenarios were processed to reach the most powerful variables affecting the response of the farmers to expand cultivating the cotton crop, these scenarios were represented as follows:

The First Scenario: Measuring The Impact Of Response For The Cotton's Area To The Variables Of The Same Crop Represented In Each Of: The Farm Gate Price, The Feddan Productivity, Costs Of Production Of Feddan, And The Net Feddan Revenue:

The results shown in table (6-1), explain the results of " Nerlove " model to measure impact of response of cotton area for the variables; the farm price, the feddanic productivity, the costs of production for feddan and the net feddanic revenue , where the equation (1) of the same table shows the response of the cultivated area with cotton, for the its farm price of the previous year (Plt-1), the adjusted determination coefficient (R ^ 2) that about 83% from the happened changes in the area of cotton refer to the change in farm price and the cultivated area in the previous year, and the remained changes refer to other factors not measured in the function, which was statistically signified at the level of 0.01 as the value of the measured (F) also the tests of Durbin "h", Harvey "LMa" and Engle "LMh" showed that there were no estimating problems as for the Autocorrelation and the Non-Homogeneity.

The results of estimation treated that the increase of the farm price of cotton by one L.E. per kentar, lead to the increasing of the cotton area by about 0.73% thousand feddan/ assuming the stability of the other factors at a certain level, and the elasticity of the supply response in each of the short and long runs. Was about 0.08, 2.34
respectively, which means that an increase by 1% in the farm gate price per ton leads to an increase of the cultivated area of it by a percentage of 0.08%, 2.34% respectively.

Also, the equation (2) in table (6-1) shows as a response of farmers of the cotton for the feddanic productivity where it occurred the response of the area of the feddanic productivity and the area of cotton cultivated in the previous year (DLt-1). The adjusted determination coefficient (R^2) shows that about 77% of the happened changes in the area of cotton refer to the change in these two factors, while the rest of the changes refer to other factors that were not estimated in the function, the significance was statistically proved at the level of 0.01 as the calculated (F).

The values of Durbin "h", Harvey "LMa" and Engl "LMh" shows that there were no estimating problems in the evaluated function.

The estimated results show that the increase in the feddanic productivity of cotton by Quintar per feddan leads to the increase the cultivated area with cotton by about 0.62 thousand feddan, assuming the stability of the other factors at a certain level, the elasticity of the supply response in each of the short and the long runs by about 0.11%, 2.16 %respectively, which mean that an increase by 1% in the feddanic productivity leads to an increase in the cotton area by 0.11%, 2.16% respectively.

The equation (3) in table (6-1), shows the response of the cultivated area of cotton to the change in the feddan production costs in the previous year, the adjusted Determination coefficient (R^2) that 81% of the happened changes in the area of cotton refer to the feddan production costs and the cultivated area of cotton in the previous year (Cl(t-1)) and the rest of the changes refer to other factors not estimated In the function, it was occurred that the statistical significance was at the level 0.01 as the value of calculated (F), and the values of Durbin "h", Harvey 'LMa' and Engl "LMh", show that there were no any estimating problems in the evaluated function.

The results of the first scenario to estimate the functions of the response of the cotton crop in Egypt as the farm gate price, the feddanic productivity, the costs of production of feddan and the Net feddanic revenue during the period (1990-2009).

Table 6-1: The results of the first scenario to estimate the functions of the response of the cotton crop in Egypt as the farm gate price, the feddanic productivity, the costs of production of feddan and the Net feddanic revenue during the period (1990-2009).

<table>
<thead>
<tr>
<th>No</th>
<th>Yt = α + β1 X1 t-1 + β2 X2 t-1 + (1 - λ) Yt-1</th>
<th>R^2</th>
<th>F Test</th>
<th>h Test</th>
<th>LMa Test</th>
<th>LMh Test</th>
<th>S.R.E</th>
<th>L.R.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yt = 705.4 + 0.92 Yt t-1 + 0.74 PLt t-1</td>
<td>0.83</td>
<td>1.65</td>
<td>2.07</td>
<td>0.061</td>
<td>0.08</td>
<td>2.34</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Yt = 15.9 + 0.54 Yt t-1 + 0.62 DLt t-1</td>
<td>0.77</td>
<td>1.57</td>
<td>1.19</td>
<td>0.001</td>
<td>0.11</td>
<td>2.16</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Yt = 419.6 + 0.109 Yt t-1 - 0.40 CLt t-1</td>
<td>0.81</td>
<td>0.45</td>
<td>1.63</td>
<td>0.051</td>
<td>0.46</td>
<td>2.25</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Yt = 257.8 + 0.78 Yt t-1 + 0.81 NLt t-1</td>
<td>0.85</td>
<td>1.32</td>
<td>0.71</td>
<td>0.025</td>
<td>0.37</td>
<td>3.08</td>
<td></td>
</tr>
</tbody>
</table>

Where : 
- Yt = The estimated cultivated area of Cotton in thousand feddan in the present year (t).
- Yt-1 = the cultivated area of cotton in thousand feddan in the previous year (t-1).
- PLt = the farm gate price of cotton in pound per kentar in the previous year (t-1).
- DLt = the feddanic productivity of cotton in kentar in the previous year (t-1).
- CLt = costs of production for feddan in L.E. per kentar in the previous year (t-1).
- NLt = net revenue fro cotton in L.E. per kentar in the previous year (t-1).

- The numbers between brackets under the regression coefficient indicates to the calculated (t).
- (*) Significant at Level 0.01, (**)Significant at Level 0.05
- R^2 = Adjusted Determination coefficient.
- F = Calculated value of the model
- h = The value of "Durbin test" of the Autocorrelation
- LMa = the value of "Harvey test" of the Autocorrelation
- LMh = The value of "Engle test" of the Non-Homogeneity
- S.R.E = Short run elasticity.
- L.R.E = Long run elasticity.

Source : Collected calculated from: Ministry of agriculture and land reclamation, Economic affairs Sector, central administration for Agricultural Economic, Various issues of agric. economic Bulletin.

The evaluation results show that the increase the production costs by one pound per Quintar lead to decreasing the cotton cultivated area by about 0.40 thousand feddan, assuming the stability of the other factors at a certain level, also the elasticity of supply response in each of the short and long runs was about - 0.46 and - 2.25 respectively, which mean that an increase by a percentage of 1% in the feddanic productivity leads to decreasing the area of cotton by a percentage of 0.46% and 2.25% for each of them respectively.

Also the equation (4) in table (6-1) shows the response of the cultivated area with cotton to the change in the net feddanic revenue in the previous year (NLt) adjusted Determination coefficient (R^2) shows that about 85% from the happened changes In the cotton area may refer to the change in the net feddanic revenue and the cultivated area of cotton In the previous year , and the rest of the changes refer to other factors that were not estimated in the function, the value of calculated (F) shows the significant of the function elasticity at the level of 0.01, the values of the Durbin "h", Harvey "LMa" and Engle "LMh" tests that is no estimating problems in the evaluated function.
The results of the evaluation show that the increase of the net revenue by one L.E. per kentar lead to the increasing of the cultivated area by about 0.81 thousand feddan, with assuming the stability of the other factors at a certain level, the elasticity of supply response in each the short and the long runs was about 0.37 and 3.08 respectively, which means that an increase of 1% in the net feddan revenue of cotton leads to an increase of the cultivated area of cotton by about 0.37% and 3.08% respectively.

The Second Scenario: Measuring The Impact Of The Response Of The Cotton Area To The Changes Of The Farm Gate Price Its Absolute And Relative Farms:

The second scenario shows the response of the cotton farmers in Egypt to the changes in farm gate prices in its farms, and the absolute and the relative, for each of cotton crop and its competitive crops, where the equation (1) in table (6-2) shows the results of the statistical estimation for the model of group of changes of the cotton and its competitive crops in the absolute form the equation points to the response of area cultivated with cotton to the absolute farm price of the summer rice in the previous year (PKt-1) also, the value of the Adjusted Determination coefficient (R²) shows that about 71% of the changes in the cotton area refer to the changed in the farm price of summer rice and the cultivated area of cotton in the previous year, the rest of the changes refer to other factors that are not included in the estimated function. The estimated (F) value shows the statistical significance at the level 0.01, also the tests of "h", "LMa" and "LMh", points that there are problems of estimation in the function concerning either the Autocorrelation or Non-Homogeneity the estimation results show that an increase in the absolute farm price of the summer rice by one pound per/ton, leads to decreasing the cultivated area with cotton by about 0.013 thousand feddan assuming the stability of the other factors at a certain level, also the elasticity of the supply response in each of the short and the long runs about – 0.31 and -3.77 respectively, and that show that an increase by a percent age of 1% in the absolute farm gate price of the summer rice crop, leads to decreasing of the cultivated area with cotton by a percentage by 0.31% and 3.77% respectively.

Also, the equation (2) in table (6-2) shows the response of the cotton area to the change of the relative farm gate price between cotton and summer rice in the previous year (PRt-1) also, the value of the Adjusted Determination coefficient (R²) shows that about 66% of the changes in the cotton area may refer to the change in the relative farm gate price between cotton, summer rice and the cultivated area with cotton in the previous year, while the remained changes refer to other factors which are not estimated in the function, also the elasticity of the supply response in each of the short and the long runs about – 0.31% and -3.77% respectively, and that show that an increase by a percent age of 1% in the absolute farm gate price of the summer rice leads to decreasing the cultivated area with cotton by about 0.37% and 3.08% respectively.

The results of the evaluation show that the increase of the net revenue by one L.E. per kentar lead to the increasing of the cultivated area by about 0.73 thousand feddan, with assuming the stability of the other factors at a certain level, also the elasticity of supply response in each the short and the long runs about 0.007 and 1.61 which mean that an increase by a percentage of 1% lead to increase the cultivated area of cotton by apercentages of 0.007% and 1.61% respectively.

<table>
<thead>
<tr>
<th>No</th>
<th>( Y_t = \alpha + \beta X_{t-1}(1-\lambda) Y_{t-1} )</th>
<th>R²</th>
<th>( F ) Test</th>
<th>H Test</th>
<th>LMa Test</th>
<th>LMh Test</th>
<th>S.R.E.</th>
<th>L.R.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>( Y_t=1593.8+0.81 Y_{t-1}+0.013 PK_{t-1}+3.00 )</td>
<td>0.71</td>
<td>(67.0)*</td>
<td>-0.68</td>
<td>0.96</td>
<td>1.45</td>
<td>-0.310</td>
<td>-3.77</td>
</tr>
<tr>
<td></td>
<td>( (14.31)* )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>( Y_t=0483.7+0.34 Y_{t-1}+0.73 PR_{t-1} )</td>
<td>0.66</td>
<td>(75.1)*</td>
<td>-1.33</td>
<td>1.74</td>
<td>0.15</td>
<td>0.007</td>
<td>1.61</td>
</tr>
<tr>
<td></td>
<td>( (14.31)* )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>( Y_t=1041.0+0.58 Y_{t-1}+0.46 PC_{t-1}(-1.09) )</td>
<td>0.59</td>
<td>(141)*</td>
<td>-1.22</td>
<td>1.45</td>
<td>0.024</td>
<td>0.056</td>
<td>2.21</td>
</tr>
<tr>
<td></td>
<td>( (8.14)* )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Where:
- \( Y_{t} \) = the Estimated area cultivated with cotton in thousand feddan in the present year (t)
- \( Y_{t-1} \) = the cultivated area with cotton in the previous year (t-1).
- \( PK_{t-1} \) and \( PR_{t-1} \) = the absolute farm gate price of summer rice in pound per/ton and the relative farm gate price of summer rice in the previous year (t-1).
- \( PC_{t-1} \) = the relative farm gate price of (cotton/ Summer maize) in the previous year (t-1).
- \( \alpha \) = the coefficient of the constant term
- \( \beta \) = the coefficient of the variable
- \( \lambda \) = the coefficient of the lagged dependent variable
- \( \alpha + \beta X_{t-1}(1-\lambda) Y_{t-1} \) = the estimated model
- \( R² \) = Adjusted Determination coefficient
- \( F \) = Calculated value of the model
- \( H \) = The value of "Durbin test "of the Autocorrelation
- \( LMa \) = the value of " Harvey test" of the Autocorrelation
- \( LMh \) = The value of "Engle test " of the Non-Homogeneity
- S.R.E. = Short run elasticity.
- L.R.E. = Long run elasticity.
- (*) Significant at Level 0.01, (**)Significant at Level 0.05

Source: Collected calculated from: Ministry of agriculture and land reclamation, Economic affairs Sector, central administration for Agricultural Economic, Various issues of agric. economic Bulletin.
The equation (3) in table (6-2) shows the response of area of cotton to the change in the relative farm gate price between the cotton and the summer maize in the previous year (PC23,t-1), the adjusted Determination coefficient (R^2) shows that about 59% of the changes in the area of cotton may refer to the change in the relative farm gate price between the cotton and the maize, also the cultivated area of cotton in the previous year while the rest of the changes refer to other factors which are not estimated in the estimated function, also the calculated value of (F) showed the statistical significance of the function at the level of 0.01, also the values of the tests "h", "LMa" and "LMh" showed that there were no problems for autocorrelation or Non-Homogeneity at the estimation.

The results of increasing the ratio of price between the cotton and the summer maize by one unit lead to an increase in the cultivated area of cotton by about 0.46 thousand feddan, with the assumption of the stability of the rest of factors at a certain level, the elasticity of response of supply in each the short and the long runs readied about 0.056 and 2.21, which mean that an increase by 1% this leads to an increase of the cultivated area of cotton by 0.056% and 2.21% for each respectively, table (6-2).

The results show that the increase of the feddan costs for summer rice by one pound, leads to an increase in the cultivated area with cotton by about 8.70 thousand feddan assuming the stability of the other factors at a certain level, the elasticities of supply response in each of the short and the long runs by about 1.05 and 2.93 respectively, that mean that an increase by a percentage of 1% of the production costs of the cultivated area by 1.05% and 2.93% respectively. Also, the equation (2) in table (6.3) shows the response of the cultivated area of cotton to the absolute feddan costs of the summer maize in the previous year (CL17,t-1), and the adjusted determination coefficient (R^2) that about 75% of the changes in the area of cotton refer to the change of the feddanic costs of the summer rice and the cultivated area of cotton in the previous year. The calculated value of (F) shows the statistical significance of the function at a level 0.01, also the values of the tests "h", "LMa" and "LMh" show that there were no estimating problems in the estimated function either what is connected with the Autocorrelation or the Non-Homogeneity.

The results show that increasing the ratio of price between the cotton and the summer maize by one unit lead to an increase in the cultivated area of cotton by about 4.12 thousand feddan, assuming the stability of the other factors at a certain level, the elasticity of response of supply in each the short and the long runs were about 0.056 and 2.21 respectively, that mean that, an increase by 1% this leads to an increase of the cultivated area of cotton by 0.056% and 2.21% for each respectively, table (6-2).

The Third Scenario: The Impact Of The Response Of The Cotton Area For The Change In The Production Costs Of The Cotton Crop And The Most Important Competitive Crops In Its Absolute And Relative Forms:

To show the much the response of supply for the cotton formers to the changes in the foddan production cost in its forms, the absolute and the relative competitive to the cotton crop. The impact of response to these changes was estimated, where the equation (1) in table (6-3) shows the response of the cultivated area of cotton to the absolute foddan costs of summer rice in the previous year (CX,t-1), the adjusted Determination coefficient (R^2) that about 75% of the changes in the area of cotton refer to the change of the foddanic costs of the summer rice and the cultivated area of cotton in the previous year. The calculated value of (F) shows the statistical significance of the function at a level 0.01, also the values of the tests "h", "LMa" and "LMh" show that there were no estimating problems in the estimated function either what is connected with the Autocorrelation or the Non-Homogeneity.

The results show that increasing the foddan costs of summer maize by one pound leads to an increase in the cultivated area of cotton by about 8.70 thousand feddan assuming the stability of the other factors at a certain level, the elasticities of supply response in each of the short and the long runs by about 1.05 and 2.93 respectively, that mean that, an increase by 1% this leads to an increase of the cultivated area of cotton by 1.05% and 2.93% respectively. Also, the equation (2) in table (6.3) shows the response of the cultivated area of cotton to the absolute foddan costs of the summer maize in the previous year (CL17,t-1), and the adjusted determination coefficient (R^2) that about 68% of the happened changes in the area of cotton refer to the change of the foddanic costs of the summer maize and the cultivated area of cotton in the previous year, and the calculated area of cotton in the previous year, and the calculated value of (F) shows the statistical significance of the function at the level of 0.01, also the values of the tests "h", "LMa" and "LMh" show that there were no estimating problems in the estimated function.

The results show that increasing the foddan costs of summer maize by one pound lead to the increase of the cottons cultivated area by about 4.12 thousand feddan, assuming the stability of the other factor at a certain level. Also the elasticity of the supply response in each the short and the long runs were about 0.056 and 2.21 respectively, that mean that, an increase by 1% this leads to an increase of the cultivated area of cotton by 0.056% and 2.21% for each respectively.

<table>
<thead>
<tr>
<th>No</th>
<th>Y^t= αλ + βλ X t-1+(1- λ) Yt-1</th>
<th>R^2</th>
<th>F Test</th>
<th>H Test</th>
<th>LMa Test</th>
<th>LMh Test</th>
<th>S.R.E</th>
<th>L.R.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y t=21115.4+0.174Y t-1+ 8.70CX,t-1</td>
<td>0.75</td>
<td>(114)*</td>
<td>0.05</td>
<td>0.008</td>
<td>0.13</td>
<td>1.05</td>
<td>2.93</td>
</tr>
<tr>
<td>2</td>
<td>Y t=9217.1+0.814Y t-1+4.12 CL17,t-1</td>
<td>0.68</td>
<td>(216)*</td>
<td>-0.19</td>
<td>1.12</td>
<td>1.40</td>
<td>0.07</td>
<td>1.19</td>
</tr>
<tr>
<td>3</td>
<td>Y t=8101.7+0.94 Y t-1+ 6.42 CK23,t-1</td>
<td>0.62</td>
<td>(97)*</td>
<td>-1.08</td>
<td>1.45</td>
<td>1.90</td>
<td>-0.95</td>
<td>-3.18</td>
</tr>
</tbody>
</table>

Where:

Y^t  = the estimated area cultivated with cotton in thousand feddan in the present year (t)
Y t-1  = The cultivated area of cotton in thousand feddan in the previous year (t-1)
CX,t-1 = The absolute production costs of summer rice in pound per ton in the previous year (t-1).
CK23,t-1 = The absolute production of the summer maize in the previous year (t-1).

* Significant at Level 0.01, ** Significant at Level 0.05
\( R^2 \) = Adjusted Determination coefficient.
\( F \) = Calculated value of the model
\( h \) = The value of "Durbin test" of the Autocorrelation
\( LMa \) = the value of "Harvey test" of the Autocorrelation
\( LMh \) = The value of "Engle test" of the Non-Homogeneity
S.R.E = Short run elasticity
L.R.E = Long run elasticity

Source: Collected calculated from: Ministry of agriculture and land reclamation, Economic affairs Sector, central administration for Agricultural Economic, Various issues of agric. Economics Bulletin
The equation (3) in table (6-3) shows the response of the cotton area to the relative feddanic costs between the cotton and the summer rice in the previous year (C2t-1), also the adjusted determination coefficient ($R^2$) that about 62% of the happened changes in the cotton area refer to the changes in the relative costs (cotton/summer rice) and the cultivated area in the previous year, while the test of the changes to other factors which were not estimated in the function, and the calculated value of (F) shows the statistical significance at a level of 0.01, also the values of the tests "h", "LMa" and "LMh" that there were no estimating problems in the function.

The results show that an increase feddan costs ratio (cotton/summer rice) by one unit leads to a decrease in the cultivated area of cotton by about 34.0 thousand feddan, assuming the stability of the other factors at a certain level, and the elasticity of supply response in each the short and the long runs were about 0.95 and 3.18 respectively, that show that an increase by 1% in that relative costs cotton/summer rice) leads to a decrease in the cultivated area of cotton by about 0.95% and 3.18% respectively.

The Fourth Scenario: Measuring The Impact Of Response Of The Cotton Area To The Net Feddan Revenue In Its Absolute And Relative Forms:

The supply response of the farmers of cotton crop to the changes in the net feddanic revenue in its absolute and relative forms, the equation (1) in the table (6 -4) shows the response of the cottons cultivated area to the absolute net feddan revenue of the summer maize in the previous year (NLt-1), and the adjusted determination coefficient ($R^2$) that about 79% of the happened changes in the area of cotton refer to the change of the net feddan revenue of the summer maize crop and the cultivated area of cotton in the previous year, and the test of the changes refer to other factors which were not estimated in the function, also the calculated value of (F) shows the significance of the function, which was statistically estimated at the level 0.01, also the values of the tests of "h", "LMa" and "LMh" show that no estimating problems in the function related with the Autocorrelation and Non-Homogeneity.

The results showed that increasing the net feddan revenue of the summer maize by one pound lead to decreasing the cultivated area of cotton by about 2.42 thousand feddan, assuming the stability of the other factors at a certain level, also the elasticities of supply response reached about - 0.19 and -2.45 in each of the short run and the long run respectively, which mean that an increase by a percentage of 1% in the absolute net feddan revenue for the maize crop leads to a decrease in the cultivated area of cotton by about 0.19% and2.45% respectively.

The equation (2) in table (6-4) shows the response of the cultivated area with cotton to the absolute net feddan revenue of sugar-Beet crop in the previous year (N2t-1), the adjusted determination coefficient ($R^2$) shows that about 64% of the changes happened in the area of cotton refer to the change in the net feddan revenue of the sugar-beet and the cultivated area of cotton in the previous year, also the calculated value of (F) shows the significance of the statistically estimated function at a level 0.01 as the results of "h", "LMa" and "LMh" show that there were no estimating problems in the function.

The results show that an increase of net feddan revenue for suger-Beet by one pound leads to decrease the cultivated area of cotton by about 34.0 thousand feddan, with the assumption of stability of the other factors at a certain level, also the elasticities of supply response in each the short and the long runs about - 0.31,-8.46 respectively, that mean that an increase by a percentage of 1% in the net feddan it revenue for the sugar-Beet crop leads to decreasing the cultivated area of cotton by about 0.031% and 8.46% respectively. As for the estimation in the relative form, the equation (3) in table (6-4), that the most important independent variables that affect the cultivated area of cotton is the ratio between the net revenue of sugar-Beet crop and the cultivated area in the previous year, and the test of the changes refer to other factors which were not estimated in the function, also the values of the tests, "h", "LMa" and "LMh" showed that there were no estimating problems in the function. Also, the calculated value of (F), the significance of the function which was statistically estimated at a level of 0.01.

The results show that an increase of the feddan costs ratio (cotton/summer rice) by one unit, lead to increase the cultivated area of cotton by about 0.85 thousand feddan, assuming that the other factors were stable at a certain level, also, the elasticity of response of supply in each the short and the long runs were about 0.22 and 4.07 respectively, that show that an increase by a percentage of 1% in the net feddan revenue leads to increase the cultivated area of cotton by percentages of 0.22% and 4.07% respectively.

The equation (4) in table (6-4) shows that the most important independent variables that affect the cultivated area of cotton is the ratio between the net revenue of the cotton crop and the net revenue of the summer maize in the previous year (N4t-1) the adjusted determination coefficient ($R^2$) that about 59% of the happened changes in the cotton area refer to the change in the ratio between the net revenue of cotton and the net revenue of maize and the cultivated area of cotton in the previous year, the rest of changes refer to other factors which were not estimated in the function, the calculated value of (F) shows the significance of the
equation that was statistically estimated at the level 0.01, also the values of the tests "h", "LMa" and "LMh" show that there were no estimating problems in the function. The results show that increase in the ratio of feddan revenue between the cotton and the summer maize by one unit lead to increasing the cultivated area of cotton by about 0.42 thousand feddan, with assuming the stability of the other factors at a certain level the elasticities of supply response in each the short and the long runs by about 0.57 and 2.19 respectively, that show that an increase of 1% in the net feddan revenue between the cotton and the summer maize leads to the increase of the cultivated area of cotton by about 0.57% and 2.19% respectively.

Table 6-4: The results of the fourth scenario to estimate the equations of supply response of cotton crop in the absolute and relative the net feddan revenue of the competitive crops of cotton during the period (1990-2009).

<table>
<thead>
<tr>
<th>No</th>
<th>Y^t=α0+β0X t-1+(1-λ) Y t-1</th>
<th>R²</th>
<th>H Test</th>
<th>LMa Test</th>
<th>LMh Test</th>
<th>S.R.E</th>
<th>L.R.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Y^t=1169.71+0.145Y t-1– 2.42 N1t-1</td>
<td>0.79</td>
<td>(28.9)*</td>
<td>0.12</td>
<td>1.001</td>
<td>0.713</td>
<td>-0.190</td>
</tr>
<tr>
<td>2</td>
<td>Y^t=95.9+0.63Y t-1-0.34N2t-1</td>
<td>0.64</td>
<td>(33.4)*</td>
<td>1.97</td>
<td>0.025</td>
<td>0.001</td>
<td>-0.031</td>
</tr>
<tr>
<td>3</td>
<td>Y^t=682.4+0.75Y t-1+0.85N3t-1</td>
<td>0.72</td>
<td>(25.11)*</td>
<td>-1.75</td>
<td>1.21</td>
<td>0.08</td>
<td>0.22</td>
</tr>
<tr>
<td>4</td>
<td>Y^t= 528.1+0.112Y t-1 + 0.42N4t-1</td>
<td>0.59</td>
<td>(19.41)*</td>
<td>1.33</td>
<td>1.61</td>
<td>0.023</td>
<td>0.57</td>
</tr>
</tbody>
</table>

Where:
- Y^t = The estimated cultivated are of cotton in thousand feddan in the present year (t)
- Yt-1 = the cultivated area of cotton in feddan in the previous year (t-1).
- N1t-1 = the absolute net feddan revenue for maize pound/feedan in the pervious year (t-1).
- N2t-1 = the absolute net feddan revenue for sugar-Beet pound/feedan in the previous year (t-1).
- N3t-1 = the relative net feddan revenue (Cotton/summer rice) in the previous year (t-1).
- N4t-1 = the relative net feddan revenue (cotton/summer maize) in the previous year.

- (*) Significant at Level 0.01, (**) Significant at Level 0.05
- R² = Adjusted Determination coefficient.
- F = Calculated value of the model
- h= The value of "Durbin test "of the Autocorrelation
- LMa = the value of " Harvey test" of  the Autocorrelation
- LMh= The value of  "Engle test " of  the Non-Homogeneity
- S.R.E. = The Short run elasticity.
- L.R.E. =The Long run elasticity.


References

http://www.capmas.gov.eg


