

A STATISTICAL ANALYSIS OF THE RELATIONSHIP OF COOPERATIVE MARKETING AND COTTON PRODUCTION IN EGYPT

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INTRODUCTON

Before the twenty third of July 1952, agricultural products were bought and sold under the free market mechanism. But because farmers did not have complete information about the market for their crops, it was natural that they were subject to the exploitation of middlemen. Consequently, the government started after the revolution to organize and control agricultural prices for the main field crops. Cotton was one among others that has been subject to governmental control.

It is well known that cotton is considered one of the main cash crops for farmers in Egypt. It is produced in most governorates.

Also, cotton and its products are still considered the main exports of Egypt (Table 1). This means that cotton is the main source for foreign exchange required for Egypt's industrialization.

Therefore, governmental intervention was necessary in marketing of cotton. Such intervention aims to :

- 1—Protect producers from middlemen exploitation,
- 2—Guarantee fair prices for cotton producers,
- 3—Supply producers with guaranteed seeds, fertilizers and insecticides, and,
- 4—Establish and maintain good grades for cotton to meet the specifications of domestic and foreign demand.

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TABLE 1.—*Value of exported cotton as a percentage of Egypt's Exports, 1960 – 1969.*

YEAR	%
1960	80.9
1961	64.4
1962	70.5
1963	77.8
1964	62.2
1965	72.9
1966	73.9
1967	64.8
1968	70.4
1969	64.1

Source : The Central Agency for Public Mobilisation and Statistics

Objectives :

The general purpose of the study is to evaluate the impact of Co-operative marketing on cotton production by analyzing the direction and the magnitude of the effects of such marketing organization .

Specific objectives are to study the relationships of cotton production and certain factors in three different marketing periods. These factors include : cultivated land, yield per feddan and previous-year price.

Procedure and Methodology :

The procedure used in this study contains three parts. First, the magnitude of change in cotton production for three time periods is determined. Second, statistical relationships of cotton production response are developed for three time periods. Third, these relationships are used to evaluate the effects of co-operative marketing on cotton production.

The years 1940 through 1969 were divided into three time periods, A,B, and C. Period A indicates thirteen non-co-opera-

tive-marketing years from 1940 through 1952. Period B includes 12 years of partial co-operative marketing from 1953 through 1964. Cotton in this period was marketed co-operatively mainly in the agrarian reform areas. Cotton marketed co-operatively in this period represented nearly five percent of the annual cotton production. Period C includes five years from 1965 through 1969. In this period all produced cotton was marketed by co-operatives, (Table 2.).

Source of Data :

Data over thirty years were collected and calculated from two main sources : 1—Bulletins of agricultural economics, and 2—Bulletins of the Agency of Statistics and Census. Both sources of data were examined and utilized.

TABLE 2.—Cultivated land, yield per feddan, total production, price per cantar for cotton in Egypt, 1940 - 1969.

Marketing periods	Year	Cultivated land Feddans 000's	Yield per feddan in Cantar	Total pro- duction Cantars 000's	Price per Cantar L.E.
A. Free marketing	1940	1684	5.44	9170	3.085
	1941	1644	5.09	8374	3.550
	1942	706	6.00	4233	5.435
	1943	713	5.01	3569	6.935
	1944	853	5.44	4640	7.935
	1945	982	5.31	5221	7.487
	1946	1212	5.01	6066	8.434
	1947	1254	5.08	6370	12.320
	1948	1441	6.17	8900	11.046
	1949	1692	5.14	8704	14.930
	1950	1975	4.30	8500	25.144
	1951	1979	4.08	8076	18.243
	1952	1967	5.04	9922	12.282
	average	1393	5.16	7057	10.525

Continued Table 2.

Marketing periods	Year	Cultivated land Feddans 000's	Yield per feddan in cantars	Total pro- duction cantars 000's	Price per cantar L.E.
B. Partial Co-operative marketing	1953	1324	5.35	7082	11.990
	1954	1579	4.90	7749	12.472
	1955	1816	4.10	7347	14.214
	1956	1653	4.38	7230	17.030
	1957	1819	4.96	9021	14.792
	1958	1905	5.21	9925	13.633
	1959	1760	5.78	10175	14.971
	1960	1872	5.11	9564	16.900
	1961	1986	3.38	6713	14.400
	1962	1657	5.52	9147	15.800
	1963	1627	5.43	8834	15.600
	1964	1611	6.26	10081	16.700
Average	1717	5.03	8579	14.874	
C. Complete Co-operative marketing	1965	1900	5.48	10414	16.200
	1966	1859	4.89	9098	16.000
	1967	1626	5.37	8733	16.175
	1968	1464	5.87	8730	16.086
	1969*	1622	6.16	9994	16.972
	Average	1694	5.55	8994	16.287

Feddan = 1.038 acre

Cantar = 157.5 Kg.

* Preliminary data

Sources : 1—Agricultural Economics Bulletins, Miscellaneous, Agency of Agricultural Economics and Statistics, Ministry of Agriculture.

2—Agency of Statistics and Census. The annual General Statistics, 1960, 1961, Cairo, 1962, p. 252.

PRODUCTION CHANGES

Table 3 displays production changes for cotton in three time periods. The average cultivated land was 1393, 1717 and 1694 thousand feddans for A, B and C periods respectively. The

average for the whole period was 1573 thousand feddans. Probably the difference in cultivated land between period B and C was due to changes in agricultural rotation or due to the rise of new cash crops in some areas.

The average yield per feddan for A, B and C periods was 5.16, 5.03 and 5.55 Cantars respectively. The average for the whole period was 5.18 Cantars per feddan, (Table 3.).

When total production per year was examined, it was found that total production on the average was 7057 thousand Cantars for period A, 8579 for period B and 8994 for period C. The average production per year for 1940-1969 period was 7899 thousand Cantars.

Total production per year for period C exceeded total production for period B due to the increase in the yield per feddan. But total production for period B exceeded total production for period A due to the fact that the cultivated land in period B exceeded the cultivated land in period A, (Table 3.).

TABLE 3.—*Cultivated land, yield per feddan
and total production of cotton in Egypt
(averages)*

Period	Cultivated land Feddans 000's	Yield per feddan in Cantars	Total production Cantars 000's
A	1393	5.16	7057
B	1717	5.03	8579
C	1694	5.55	8994
All periods	1573	5.18	7989

Sources : Table 2.

Production Trends

First A—Free marketing, 1940-1952.

1—Cultivated land

During 1940-1952 there was a positive trend in the cultivated land for cotton. The trend equation shows that the annual increase was 80 feddans per year during that period, (Table 4.).

2—Yield per feddan

The yield per feddan tended to decrease at a rate of .07 Cantar per year during the period. The average yield per feddan was 5.16 Cantars. The decline in the yield per feddan represented 1.4 percent of the average yield for the period.

3—Total production

During the free marketing period total production of cotton tended to increase. The annual increase, on the average was .25 million Cantars, or 3.5 percent of the yearly average cultivated land for the period.

Second B—Partial co-operative marketing, 1953-1964.

1—Cultivated land.

Cultivated land tended to increase during 1953-1964 period. The annual increase represented 1.2 percent of the average cultivated land for the period.

2—Yield per feddan

The yield per feddan for B period was 5.03 Cantars. The annual increase was .08 Cantar per feddan or 1.6 percent of the average yield for period B.

3—Total production

Total production tended to increase at .095 million Cantars or 2.2 percent of the average production for the period.

Third C—Complete co-operative marketing, 1965-1969.

1—Cultivated land

During that period the cultivated land tended to decrease at six percent of the average cultivated land for the period.

2—Yield per feddan

Yield per feddan tended to increase by .23 Cantar per year or by four percent of the yield per feddan for the period.

3—Total production

Total production tended to decrease by 1.3 percent of the average production for 1965-1969 period.

TABLE 4.—Trend equations for cultivated land, yield per feddan and total production of cotton.

	Trend Equations	The rate of increase per year	The annual increase to period average
Cultivated land in thousand feddans	A $\hat{Y} = 1400 + 0.078 X$	0.08	6.0
	B $\hat{Y} = 1725 + 0.007 X$	0.01	1.2
	C $\hat{Y} = 1700 - 0.1 X$	-0.10	-6.0
Yield per feddan in cantars	A $\hat{Y} = 5.16 - 0.069 X$	-0.07	-1.4
	B $\hat{Y} = 5.03 + 0.036 X$	0.08	1.6
	C $\hat{Y} = 5.55 + 0.23 X$	0.23	4.0
Total production in million cantars	A $\hat{Y} = 7.06 + 0.247 X$	0.25	3.5
	B $\hat{Y} = 8.58 + 0.095 X$	0.095	2.2
	C $\hat{Y} = 9.38 - 0.12 X$	-0.12	-1.3

Where : X denotes years,

A denotes 1940-1952 period, 1964 is the original point

B denotes 1953-1964 period, the mid 58/1959 year is the original point.

C denotes 1965-1969 period, 1967 is the original point.

**THE RELATIONSHIP OF COTTON PRODUCTION AND CULTIVATED
LAND, YIELD PER FEDDAN AND PREVIOUS-YEAR PRICE.**

In this section the effect of cultivated land, yield per feddan and previous-year price on total production for the three time periods is examined. In other words, the question to be raised is : is there any significant effect of the indicated factors on the production of cotton during free marketing, partial co-operative marketing and complete co-operative marketing ?

First A—Free marketing, 1940-1952.

1—Total production and cultivated land

$$\hat{Y} = 1.32 + 4.1 X$$

The above regression equation indicates a positive relationship between cultivated land and cotton production. It also shows that an increase of cultivated land by one million feddans will result in 4.1 million cantars of cotton. The regression coefficient was statistically significant at both five and one percent levels. The calculated t was 5.6 while the tabulated t was 2.201 and 3.106 at five and one percent levels respectively.

The simple correlation coefficient was .92. The coefficient was highly significant. The calculated t was 7.78 while the tabulated t was 2.201 at 5 percent and 3.106 at one percent level.

Also, the coefficient of determination was .85 which means that 85 percent of the variation in total production of cotton was due to changes in cultivated land during the period (Table 5.).

2—Total production and yield per feddan

$$\hat{Y} = 6.794 + .52 X$$

The regression equation indicates that when the yield per feddan increases by one cantar, total production of cotton increases by .05 million cantars. However, the coefficient was

statistically insignificant. The calculated t was .07 while the tabulated t was 2.201 and 3.106 at both five and one percent respectively.

Likewise, the correlation coefficient was statistically insignificant. The coefficient was 0.02. Thus, only .0004 percent of changes in total production was due to changes in yield per feddan.

3—Total production and previous-year price

$$\hat{Y} = 5.575 + .154 X$$

There was a direct relationship between the previous-year price and total production of cotton. If previous-year price increases by L.E. 1, total production increases by .154 million cantars. Yet the regression coefficient was statistically insignificant. The calculated t was 1.5 and the tabulated t was 2.201 and 3.106 at five and one percent level respectively.

The correlation coefficient and the coefficient of determination were .47 and .22 respectively. Yet, the coefficient of correlation was statistically insignificant. Only 22 percent of changes in total production was due to changes in previous year price.

Second B—Partial co-operative marketing 1953-1964

1—Total production and cultivated land

$$\hat{Y} = 7.213 - .816 X$$

The regression equation indicates a negative relationship. In other words, when the cultivated land increased by one million feddans total production decreased by .816 million cantars. However, the regression coefficient was statistically insignificant.

Likewise, the correlation coefficient was only .07 and was insignificant. According to the coefficient of determination, only .005 percent of changes in total production was due to changes in cultivated land.

2—Total production and yield per feddan

$$\hat{Y} = 149.3 - 31.4 X$$

The regression equation indicates a positive relationship between yield per feddan and total production. The correlation coefficient between total production and the yield per feddan was .96. The coefficient was statistically significant. Also, the coefficient of determination was .92. This means that 92 percent of changes in total production of cotton was due to changes in the yield per feddan for the period, (Table 5.).

3—Total production and the previous-year price

$$\hat{Y} = 7.635 + .072 X$$

If the price increases by L.E. 1, total production increases by .072 million cantars. Yet, the regression coefficient was statistically insignificant.

In addition, the coefficient of determination was .0004. This means that less than one percent of changes in total production of cotton during 1953-1964 was due to changes in the previous-year price.

Third C—Complex co-operative marketing, 1965-1969

1—Total production and cultivated land

$$\hat{Y} = 5.88 + 2.07 X$$

Although the regression coefficient was positive, the coefficient was statistically insignificant. The coefficient of correlation was .48 and was statistically insignificant. According to the coefficient of determination, only twenty three percent of changes in total production was due to changes in the cultivated land during the 1965-1969 period.

2—Total production and the yield per feddan

$$\hat{Y} = 9.372 + .005 X$$

Although the above equation indicates a positive regression coefficient, the coefficient was statistically insignificant. Like-

wise, the coefficient of determination shows that only .0004 per cent of changes in total production was due to changes in the yield per feddan, (Table 5.).

3—Total production and previous-year price

$$\hat{Y} = 23 + 2.0 X$$

There was a positive relationship between total production and previous-year price as indicated by the above equation. Also, the coefficient was statistically significant. The correlation coefficient and the coefficient of determination were .7 and .49 respectively. This means that almost fifty percent of changes in total production was due to changes in previous-year price during 1965-1969 period.

TABLE 5.—Relationships of cotton production and cultivated land, yield per feddan and previous year price — Egypt 1940 - 1969.

Independent Factor X	Regression equations	r	r ²
Cultivated land	A $\hat{Y} = 1.32 + 4.1 X$	0.92	0.85
	B $\hat{Y} = 7.213 - 0.816 X$	0.07	0.005
	C $\hat{Y} = 5.88 + 2.07 X$	0.48	0.23
Yield per feddan	A $\hat{Y} = 6.79 + 0.05 X$	0.02	0.0004
	B $\hat{Y} = 149.3 + 31.4 X$	0.96	0.92
	C $\hat{Y} = 9.37 + 0.005 X$	0.02	0.0004
Previous year price	A $\hat{Y} = 5.575 + 0.154 X$	0.47	0.221
	B $\hat{Y} = 7.635 + 0.072 X$	0.02	0.004
	C $\hat{Y} = 23.9 + 2.0 X$	0.70	0.49

Where : \hat{Y} = total production of cotton
 X = the independent factor

Source : Table 1.

THE MONETARY VALUE OF PRODUCTION INCREASE AS A MEASURE OF THE EFFICIENCY OF CO-OPERATIVE MARKETING OF COTTON.

One way of measuring the efficiency of co-operative marketing of cotton is to estimate the production increase in terms of money. This will be accomplished in this section.

First :

- 1—Average total production per year after complete adoption of co-operative marketing8,994,000 cantars.
- 2—Average total production under free marketing ... 7057,000 cantars.
- 3—Difference per year due to co-operative marketing ...1,937,000 cantars.

Second :

- 1—Average price cantar after complete adoption of co-operative marketingL.E. 16.287
- 2—Average price per cantar under free marketing ... L.E.10.525
- 3—Price difference.....L.E. 5.762

Third :

The monetary value for production increase per year due to co operative marketing $1937000 \times 5.762 = \text{L.E. } 11,160,994.$

Possibility of Continuous increase in the efficiency of co-operative marketing of Cotton

It is possible also to estimate the monetary value of the expected increase in total production of cotton due to continuous adoption of co-operative marketing. This can be accomplished by multiplying the difference in yield per feddan under complete co-operative and free marketing by average cultivated land under co-operative marketing, assuming such area of land continues to

be the same. Then the difference in total production is multiplied by the difference in price.

Yield per feddan under co-operative marketing	5.55 cantars.
Yield per feddan under free marketing	5.16 cantars.
Difference in yield per feddan	.39 cantar
Annual cultivated land under co-operative marketing.	1694000 feddans.

The expected annual increase in total production $.39 \times 1694000$
 = 660660 cantars.

Price difference per cantar L.E. 5.672.

Monetary value of the annual expected increase in total pro-
 duction 5.672×660660 = L.E. 3,806,732

CONCLUSION

The study shows that under free marketing for cotton, the cultivated land was the main important factor affecting total production of cotton. This was indicated both by the correlation coefficient which was .92 and the coefficient of determination which was .85. This means that under free marketing for cotton, 85 percent of variation in production was explained by changes in cultivated land.

For partial co-operative marketing there was a strong relationship between the yield per feddan and total production. The correlation coefficient and the coefficient of determination were .96 and .92 respectively. This means that 92 percent of changes in cotton production during the period was due to changes in the yield per feddan.

Under complete co-operative marketing, previous-year price was the main factor affecting cotton production. For instance, the correlation coefficient was .7. Accordingly, 49 percent of changes in total production of cotton can be explained by changes in the previous year price.

In addition, the complete adoption of co-operative marketing of cotton has resulted in an increase of more than L.E. 11 million per year during 1965-1969 period. Also if the cultivated land which amounted to 1694 thousand feddans under complete co-operative marketing continue to be the same in the future, the expected annual increase in the value of cotton production will amount to L.E. 3.8 million.

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