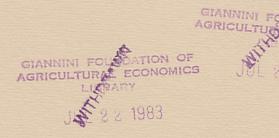# AGRICULTURAL DEVELOPMENT SYSTEMS
EGYPT PROJECT

UNIVERSITY OF CALIFORNIA, DAVIS

ECONOMIC EFFICIENCY OF COTTON PRODUCTION
AND GINNING IN EGYPT

By

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In Collaboration With Eric Monke, University of Arizona

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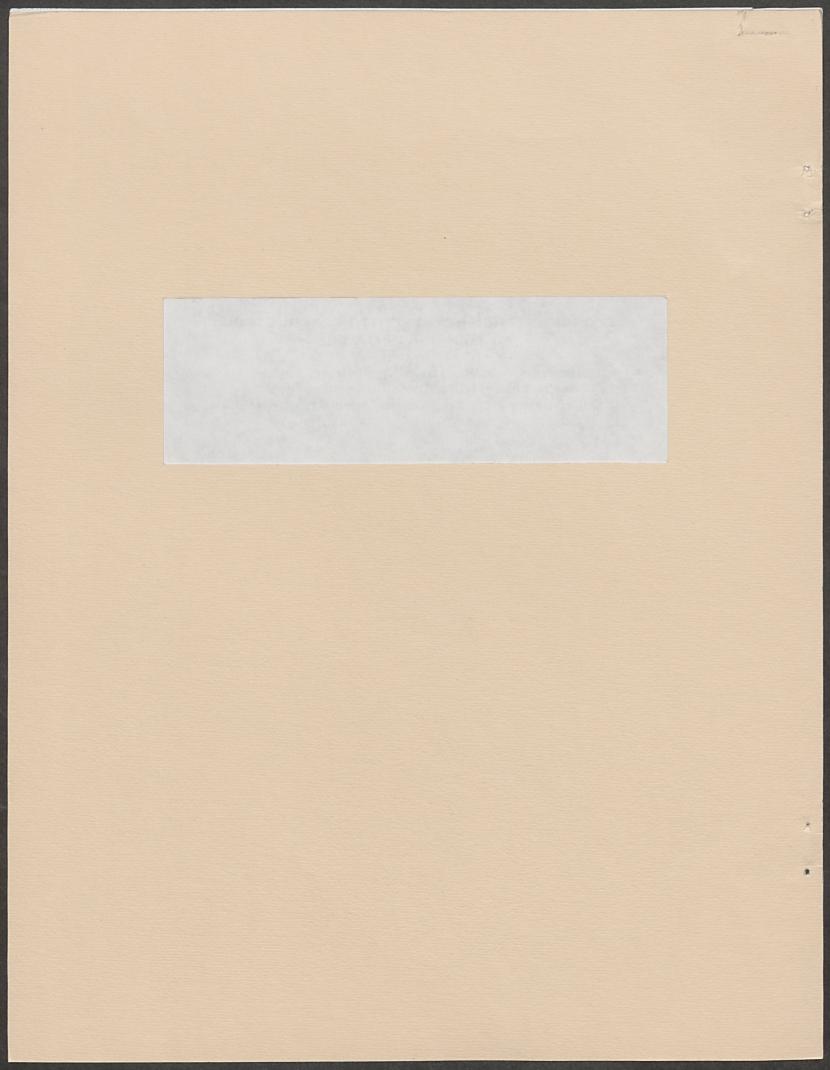**In Collaboration With Eric Monke, University of Arizona**

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Economic Efficiency of Cotton Production and Ginning
In Egypt

I - Introduction:

Cotton has dominated Egyptian agriculture over the last hundred years. Despite the recent debates about the significance of cotton production and processing in Egypt, it is still the only single crop representing 24 percent of the value of all field crops. It also remains the leading export crop whether as raw cotton or as cotton yarn and textiles. Annual production of some 100 thousand tons of cotton seed oil, representing about 85-90 per cent of the domestic production of vegetable oils, and some 650 thousand tons of cotton-seed cake makes cotton the major oil and feed crop in Egypt.

This paper is an attempt to address some major policy questions in the context of cotton production and ginning. In this respect detailed comparative advantage analysis using a set of the social profitability measures is conducted. Major criteria for comparing social profitability were cotton staple length, economics of different irrigation techniques, land preparation techniques and location. Assumptions underlying the calculation of the social profitability measures for cotton production have been subjected to some sensitivity analysis. Alterations in basic case assumptions have handled areas of land quality variation, likely errors in the estimation of the technical coefficients, and changes in shadow prices. Moreover,

sensitivity analysis has also been conducted for the assumptions underlying the estimation of the social profitability of the ginning industry.

II - Cotton Production Systems:

A) Crop Rotations: Two major cotton crop rotations are identified in the Egyptian agriculture. The crop rotation refers to the particular sequence of crops during the cropping seasons of the agricultural year (1) and during a definite number of successive years. The first is a three-year cotton rotation in which cotton is grown in one third of the land annually preceded by a catch crop clover. The second cotton rotation is a two-year rotation. Contrary to the three-year rotation where each block of land is planted to permanent clover one every three years, in the two-year cotton rotation clover occurs on the same block of land once every four years. This two-year rotation is consequently confined to the more fertile soil.

While these are the most common cotton rotations there are still several variations in each. In the rice belt in the northern part of the Delta, rice is unsually the summer crop that follows the winter cereals and legumes. Further south, sorghum replaces maize as the main summer crop. Still further south, sugar cane replaces cotton as the cash crop. In the vicinity of urban centers vegetables are included in the rotations as winter, summer and Nili crops. In sandy soils groundnuts and sesame replace cotton as the main summer crops.

Another practice carried in the fertile lands of the southern part of the Delta is intercropping. A secondary crop is grown simultaneously with cotton. This is rather common in the case of summer onion and garlic. The summer onion and garlic grown with cotton and are harvested in June, while cotton continues until September.

B) Institutional Set-Up and Government Intervention:

Governmental intervention in determining farm prices for major field crops has been the traditional approach for indirectly taxing the agricultural sector. Determination of farm prices for major crops at levels substantially lower than their shadow equivalents has resulted in a highly distorted price system. The role of the government in price determination has varied, however, from full intervention in the basic economic decisions as in case of cotton to a free market system as in the case of truck crops and fodder.

The varing degree of intervention has added to the distortion and resulted in directing resources from governmentally controlled crops to others left for the free market system. The government partially offsets the implicit taxes on the farmers through providing them with some subsidies. Major direct subsidy items are those on fertilizers, pestsides and capital. Indirect subsidies, however, are basically through importing some imputs (machinery, fertilizers, pesticides) at the official rate of foreign exchange. The government intervention in cotton production is not confined to the

determination of area but it is extended to cover the
determination of the varieties within each district, providing
the certified seeds, providing other inputs like fertilizers and
pesticides, conducting the chemical pest control operations and
subsidizing the farmer with the largest portion of their costs,
providing subsidized capital for cotton picking, and condusting
the cooperative marketing after determining the farm prices for
each variety. Cotton ginning, spinning and trade are conducted
through state agencies.

III - Theoretical Framework:

This section gives the theoretical background of the
criteria used for measuring the social profitability of cotton
in Egypt. In this respect measures such as the domestic resource
cost, net social profitability, nominal protection coefficient
and effective protection coefficient are discussed. Moreover,
some theoretical background about principles of shadow pricing
and second best alternatives are presented.

A) Social Profitability Measures:

1. Domestic Resource Cost (DRC): This is one of the main
measures used in the analysis of production efficiency. The DRC
is a ratio between domestic factor costs and value-added. This
measure, originally developed by Bruno in 1967 (3), uses cif or
fob prices to determine value-added at world prices. This DRC
ratio, as a consequence determines the cost to the economy of
earning foreign exchange. The DRC is calculated as follows:

$$DRC = \frac{\text{Cost of Non-Tradable Inputs (Opportunity Cost of Land + Capital + Labor)}}{\text{(Social Revenue)} - \text{(Cost of Tradable Inputs) at World Price}}$$

The values of DRC ranging above zero and less than unity indicate efficiency. Within this range, the less the value the more efficiency it indicates, since it means lower social costs to earn a given amount of foreign exchange. A DRC of unity provides a case of breaking even from the social prospective. Conversely, a DRC higher than unity indicates a status of inefficiency. The denominator of the DRC, and hence the DRC ratio itself, can be less than zero. This is presumably indicative of a stronger case of inefficienty resulting in negative value added.

2. Net Social Profitability (NSP): Net social profitability, like DRC, uses fob or cif prices in the measurement of output and tradable input prices. Essentially, DRC and NSP are equivalent.

3. Nominal Protection Coefficient (NFC): The NFC of any commodity is the ratio of its domestic producer price to its border price (4).

$$NPC = \frac{P_i^d}{P_i^b}, \quad \text{where:}$$

NPCi = Nominal Protection Coefficient of Commodity i;

P_i^d = Domestic Price of Commodity i;

P_i^b = Border Price of Commodity i, with the border price being its foreign price times the official rate of exchange.

The difference between domestic producer price and the border price of comparable product is the tariff rate. The Nomimal protection coefficient may be > 1, which indicates net subsidy, or it may be < 1, which indicates net tax. The NPC can also be expressed as a percentage difference between domestic and border prices, in which case it is called the nominal rate of protection NRP:

$$NRP_i = \frac{P_i^d - P_i^b}{P_i^b} \begin{array}{c} > \\ = 0 \\ < \end{array}.$$

4.4 Effective Protection Coefficient (EPC) (5): The effective protection coefficient measures the effects of productive measures not only on traded outputs but also on traded inputs or on value added. It is measured by the ratio of value added expressed in domestic market prices to value added expressed in border prices.

$$EPC_i = \frac{VA_i^d}{VA_i^b}, \quad where:$$

EPCi = Effective Protection Coefficient in Activity or Commodity i;

$$VAi^d = \text{Value Added Per Unit of Output in activity or Commodity i at Domestic Prices;}$$

$$VAi^b = \text{Value Added Per Unit of Output in activity or Commodity i at Border Prices.}$$

The previous ratio can be put in a percentage form,

$$ERPi = \frac{VAi^d - VAi^b}{VAi^b} \times 100$$

in which case it is called effective rate of protection (ERP). An EPC > 1 means that the protection measures provide positive incentives to produce the commodity under consideration. Conversely, EPC < 1 indicates that protective measures disfavor this commodity. EPC < o signifies an absolute loss of foreign exchange to the economy.

B) Shadow Pricing and Second-best Alternatives: There are major critical remarks to the previous criteria as measures of social profitability:

1. Non-stationarity or indeterminacy of shadow prices.

2. The possible inability of the estimation methods to provide shadow prices for non-tradable outputs.

3. The failure of the technique to introduce time and seasonality.

4. The problem of input substitution and the lack of empirical information on free trade input-output coefficients.

The estimation of DRC and NSF involves the use of some

budgets derived from a general equilibrum, free trade system.
Traditionally, empirical data are observed under distorted
market conditions. Distortion effects might induce some factor
substitution which is not in existence under perfect
competition. This problem can lead to inappropriate and
misleading calculations of shadow prices and hence erroneous
estimate of NSP and DRC (6).

IV - Factor Morkets and Shadow Prices of Tradable and
   Non-Tradable Inputs:

A) Factor Markets and Shadow Prices: Shadow pricing
non-tradeable goods is a tedious job that requires decomposing
them into their traded and non-traded elements. The traded
elements are directly valued at their border prices. Other
non-traded elements, however, should be valued as the quantity
weighted average of the values of the factor marginal
productivities. In practice, a representative or typical
activity is taken into account. The marginal value product of
the input factors are then revalued at their bordor price
equivalent values using some conversion factors. The following
discussion will focus on shadow pricing of labor, capital and
land.

1. Labor Market: The value of marginal product of labor
in the next best alternative use, measured at border prices has
been traditionally accepted as the shadow wage of labor. Under
the Egyptian farming system labor wages were assumed to reflect

shadow wages. The logic underlying this assumption stems from the fact that such wages are resultant of market forces. Moreover, government intervention in the agricultural labor market is nonexistant. Current observed wages, as a consequence, could consistently be considered a true reflection of the value of marginal product of this input.

The data on cost of production published by the MOA tend traditionally to under-estimate reality. Some major conceptual problems are in part the reason for that downward bias, notably with respect to the way imputed costs for owned inputs and durable inputs are handled. Moreover, official prices of most of the inputs and official land rent (7 times the land tax) which are way below their shadow equivalents are the ones reported. Data on labor wages are not accurate the way they are reported by the MOA. A special questionnaire was designed to test how the MOA cotton production budgets deviated from the actual budgets of cotton production. Six governorates were selected for applying this questionnaire to get the labor wages by operation and region. The six governorates were selected in such a way that make them representative of the agricultural conditions within each region. Beheira, Dagahliya and Sharqiya were the governorates selected in lower Egypt; Faiyum and Beni-Suef in Middle Egypt, and Asyut in Upper Egypt.

2. Capital Market: In 1931 The Agricultural Credit Bank was established, with the authorization of granting short, medium and long term loans. Members of the agricultural cooperatives were charged a 3 per cent interest rate. In 1952

several policy changes were introduced. Farmers were enabled to
obtain bank loans solely on the security of their crops. This
was with the objective of extending loans to the large majority
of farmers. These loans were made available to the farmers
through the agricultural cooperatives.

In 1964 the General Organization For Agricultural and
Cooperative Credit was established. This organization is
responsible for the general credit policy and overall
supervision. As applied now, agricultural credit covers short
(up to 14 months) and medium (up to 10 years) term loans only;
long term loans (up to 20 years) have now been suspended. Short
term loans are either in cash or in kind to cover all
agricultural requisites such as seeds, fertilizers, pesticides,
pest control equipment, animal feed and bagging. Cash loans are
now almost confined to cotton, sugarcane, rice and orchards,
with minor amounts going to wheat, maize, onion and flax.
Medium term loans cover the purchase of farm machinery or
livestock, development of new orchards and land reclamation.

Besides supplying credit the Agricultural Credit Bank
provides some services such as transportation and distribution
of all agricultural inputs like seeds, fertilizers, pesticides
and animal feedstuffs. Moreover, when the cooperative marketing
of some export crops like cotton was started in the early
sixties, the Agricultural Cooperative Credit Bank took the major
role of receiving the crop, and of grading and transporting it.

With the relatively lower interest rates compared to their
commercial equivalents provided through the credit system and

with the diversity and accessibility of different kinds of
loans, one would argue that within the agricultural sector
capital is highly subsidized. The accounting interest rate is
useful to evaluate the opportunity cost of capital which differs
from the market rate largely as a consequence of government
fiscal and monetary policies. The shadow interest rate was 11
per cent, representing the short-term lending rates from the
Central Bank to commercial banks. Market interest rates at the
farm level were between 4 and 9 per cent depending on type of
loan.

3. Land Market: The total area of Egypt including the Nile
Delta and valley is 238 million feddans. According to the 1961
agricultural census, the cultivated area of the Nile Delta and
valley was 5.97 million feddans or 2.5 per cent of Egypt's total
area, of which 60 per cent was in the Delta and 40 per cent in
Middle and Upper Egypt. This previous land base has been liable
to some changes. New additions through land reclaimation and/or
some encroachments for cultivated land for off-farm usage were
continously changing the land base (7).

Encroachment on cultivated land approaches 40,000 feddans
annually. The subtraction of the land was mainly for building
purposes in the expansion of villages, towns, cities and
industrial plants and/or for public utilities and infrastructure
such as roads, irrigation and drainage projects.

Contrary to the situation before 1952 where land
reclaimation was a private effort, the government role in this
respect has substantially increased. By 1960 newly reclaimed

land reached 79,000 feddans. Real concerted action in land
reclamation, however, did not take place until the first
five-year development plan (1960/61 - 1964/65). In anticipation
of the additional water made available by the High Dam, total
new lands reclaimed reached 912,000 feddans in 1974/75 of which
742,000 feddans are the net area added to the agricultural land.

Land tenure has been regulated following 1952 by three
major Agrarian Reform Acts. The 1952 Act limited land ownership
to 200 feddans per owner, the 1961 Act lowered the ceiling to
100 feddans, and the 1969 Act again lowered the ceiling to 50
feddans per individual owner and to 100 feddans per family.
These Agrarian Reform Acts were not only promulgated for
redistributional purposes, but they were planned to regulate the
relationship between the owner and the tenants. A ceiling of
the rental value at 7 times the basic land tax was established.
The continual redistributional acts have resulted in a highly
fragmented pattern of holdings, whether operated by owners,
sharecroppers, or tenants (8).

Some attempts have been made in this respect for land
consolidation. This was primarly done to raise efficiency of
land use and to eradicate the inherent weaknesses of
fragmentation.

Agricultural land is rather limited in Egypt, it is
traditionally the binding factor for Egyptian agricultural
production. The last 15 years have observed substantial
increases in the value of land. The value of land is a
resultant of number of variables including soil fertility and

productivity, location and availability of appropriate infrastructure. Availability of water for irrigation has been taken for granted by the farmers as one of their basic rights which is expected to be readily available according to the needs of their crops. There are no direct charges for irrigation water in agriculture. The spectacular increase in the value of agricultural lands has made the official rental value far below the shadow equivalents. The discrepancy is not a minor one, since for some crops, notably with respect to those which are not directly controlled by the government, the market rental value can go as high as 3-5 times the official rent.

For the particular purpose of shadow valuing of land rental for the production of cotton, land prices were calculated on the basis of the best alternative crop rotation at the farm level. In this respect, short season berseem and cotton was used as the typical cotton rotation. Some alternative crop rotations were chosen for upper, middle and lower Egypt. Those rotations have ranked second to the cotton rotation within each region in terms of social profitability.

B) Other Inputs: The Ministry of Agriculture and other related institutions provide farmers with major inputs needed for agricultural production. Under this set of inputs come seeds, fertilizers, pesticides, and machinery which are delivered to the farmers at subsidized prices. Some of these inputs like fertilizers are delivered according to certain quotas as to the farmers that vary from one crop to another. The Agricultural and Cooperative Credit Banks at the

governorates' and districts' levels handle all aspects of

financing, purchasing, transporting and supplying most of these

inputs to the agricultural cooperatives and to the farmers.

The domestic pesticides industry is rather limited and most

of the pesticides are imported. The National Pest Control

Committee headed by the Minister of Agriculture sets annually

all matters concerning pest control operations. About 80-85 per

cent of the rest is applied to other crops. The two major pests

of cotton are the cotton leafworm and the bollworm.

Shadow pricing tradeable inputs in principle is much easier

a problem in comparison with the case of non-tradeables. Border

fob prices for exportable inputs and cif prices for import

substitutes can provide reasonable proxies to the shadow value

of such inputs after correcting for transportation and handling

at the farm level.

V - Private vs. Social Profitabilities of Cotton Production

Systems:

A) Major Criteria For Comparison: In view of the market

distortions and governmental intervention throughout the

different stages of cotton production, processing and trade, a

large discrepancy between private and social profitability is

expected to be the typical case. Some previous empirical work

(9) has revealed large discrepancies between private and social

profitabilities for different crop rotations. Profitability of

growing cotton either from the farmer's point of view or to the

economy is expected to vary according to four main criteria. These factors are location, technique of land preparation, technique of irrigation and staple length. Social and private profitability of producing cotton in different governorates using labor and/or capital intensive techniques for land preparation and irrigation for each staple length were calculated. The hypothesis to be tested was that such profitability would vary in accordance with these four factors. The objective of breaking down the analysis according to such criteria was to assess the efficiency and relevance of cotton production in Egypt.

1. Staple Length: Egyptian cotton varieties are categorized under three staple lengths: ELS which exceeds 1-3/8"; LS which ranges between 1-1/4" and 1-3/8"; and the MLS which ranges between 1-1/8" and 1-1/4". The Egyptian scale of measuring staple length is different from the international standard one. The latter considers the Egyptian LS as long staple and adds a third short staple category which is shorter than 1-1/8". Major Egyptian cotton varieties under ELS are Giza 70, 68 and 45. Major varieties of long staple length are Giza 67, 75, 69 and Dandara, whereas Giza 66, 72 and 82 varieties have medium long staple (MLS) length. There are, however, new varieties being tried which have shorter staple length and relatively shorter duration. The major varieties with short staple length are Macnare 220 and 235.

The Ministry of Agriculture is having a continual and dynamic program for replacing deteriorating cotton varieties

through the breeding of new varieties and selection of breeds with good yield, strength of lint, and resistance to pest damage characteristics.

Analysis of social and private profitabilities was conducted for each of the three main staple lengths. Moreover, some rough social profitability analysis was conducted for the new short staple varieties.

2. Land Preparation: Land preparation is the first step for the cultivation of any crop. It includes ploughing and farrowing, among other things. Unlike the unirrigated agricultural systems where the non-tillage practice prevails, proper land preparation before growing any crop is a rather key determinant of the crop yield. Two different techniques are distinguishable in land preparation. The first is the capital intensive technique that uses tractors which are either owned or rented. The second technique, however, uses traditional ploughs operated by draft animals.

Both techniques are applied in the Egyptian agriculture. The capital intensive technique, however, is becoming the typical practice for land preparation. More than 80 per cent of the farmers are using tractors in land preparation. The accessability of tractor service rental through the agricultural cooperatives has made it possible even for smaller scale farms to carry the land preparation mechanically (10).

3. Economics of Different Irrigation Techniques: Egypt has an extensive system of public water delivery canals bringing

water to every village. The use of water for irrigation is controlled by the availability of water in the canals as a result of following a system of irrigation rotations.

The irrigated lands in Upper and Middle Egypt lie on the sides of the river bank, except for Faiyum. The Delta area which starts just north of Cairo is generally divided into three areas: East, Middle and West. Water Control and distribution are managed by seven barrages on the main Nile and its two branches. These barrages were constructed to fulfill two main objectives; the first was to guarantee basin irrigation in low flood seasons and the second was to allow the conversion of basin irrigation to perrennial (11).

Irrigation is either conducted by free flow gravity in lower Egypt and a large part of Middle Egypt or through water lifting basically in Upper Egypt. Two different irrigation techniques have been identified--the traditional one which depends on draft for operating a "saquia," "shadouf," or any other traditional means for irrigation, and the modern one which uses diesel pumps with varying capacities. The mechanization of crop irrigation is increasing steadly within the Egyptian farming system, due to three factors, namely, the high labor wages, the tendency to release the animal of draft work and finally the subsidized low price of diesel.

4. Location: Cotton varieties are assigned to zones on the basis of their response both with respect to yield and quality in different environments. Usually, the finest cotton varieties are assigned to the extreme north, followed by the other extra

long staple varieties in the Northern and Central Delta.
Varieties of the category over 1-1/4" staple length are usually
assigned to the southern Delta, while those of the category over
1-1/8" staple length are assigned to Middle and Upper Egypt
(12).

Some empirical work under the same study has indicated that
location is not independent from staple length and varieties in
the context of estimating private and social profitabilities of
cotton. Some preliminary comparisons for the private and social
profitabilities for the cotton rotation and of its major
alternatives across governorates have been made. Table 1 shows
net private profitability for the cotton rotation and its major
substitutes across governorates. The ANOVA test indicates that
the private profitabilities of the different rotations vary
significantly among governorates at a 95% confidence level and
with 11.50<degrees of freedom. Moreover, the variance across
rotations has proved to be significant. The cross effect
between governorates and rotations was significant. Similar
findings were obtained through the analysis of social
profitabilities of different crop rotations, as apparent from
Table 2.

Seven different governorates have been selected as being
major cotton producers: Kafr El-Sheikh, Daqahliya, Sharqia and
Menofiya in Lower Egypt; Beni-Suef and El-Minya in Middle Egypt;
and Sohag in Upper Egypt. The selection of these governorates
is based on their representation of the different regions in

Table (1): Private Profitability For Different Crop Rotations By Governorates.

(LE./Feddan)

Governorats	T. Clover + Cotton (1)	Wheat + Maize (2)	Wheat + Rice (3)	P. Clover + Maize (4)	P. Clover + Rice (5)	Broad Beans + Maize (6)	T. Clover + Soyabeans (7)	P. Clover + Potatoes (8)	Tomatoes + Maize (9)	P. Clover + Groundnuts (10)	Broad Beans + Sorghum (11)
Behira	165.43	83.87	82.49	159.42	160.72	70.44	165.45	330.71	569.62	-	-
Gharbia	199.08	115.14	98.94	-	155.54	-	110.80	-	-	-	-
Khaft El-Shek	178.63	73.96	91.67	199.12	216.84	-	-	-	-	-	-
El-Daquahliya	178.43	109.10	123.78	174.68	188.70	-	103.90	-	-	-	-
Sharqia	212.83	52.47	63.73	199.89	200.57	89.73	131.35	-	-	269.88	-
Menoufia	238.60	86.25	-	237.43	-	82.68	-	-	-	-	-
El-Qulubiya	279.33	108.68	-	-	-	-	-	-	438.00	-	-
Beni-Suef	104.10	81.39	-	-	-	-	-	-	-	-	53.36
Fayoum	111.43	-	-	-	-	-	-	-	-	-	105.28
El-Minya	77.18	-	-	210.40	-	-	-	-	-	-	-
Asuet	82.00	-	-	-	-	-	-	-	-	-	169.31
Sohag	129.02	104.90	-	193.42	-	-	-	-	-	-	149.56

Table (1): Private Profitability For Different Crop Rotations By Governorates. (Continue)

(LE./Feddan)

Governorats	Lintils + Sorghum (12)	Onions + Maize (13)	Wheat + Sorghum (14)	Onions + Sorghum (15)	Broad Beans + Soyabeans (16)	P. Clover + Sorghum (17)	Broad Beans + Maize (18)	Sugarcane + (19)	Lentils + Maize (20)	Lentils + Sesame (21)
Behira	-	-	-	-	-	-	-	-	-	-
Gharbia	-	-	-	-	-	-	-	-	-	-
Khafr El-Shek	-	-	-	-	-	-	-	-	-	-
El-Daquahliya	-	-	-	-	-	-	-	-	-	-
Sharqia	-	-	-	-	-	-	-	-	-	-
Menoufia	-	-	-	-	-	-	-	-	-	-
El-Quluhiya	-	-	-	-	-	-	-	-	-	-
Beni-Suef	-	103.93	56.20	72.81	77.58	196.08	-	-	-	-
Fayoum	-	139.20	84.26	132.26	-	212.35	112.22	-	-	-
El-Minya	-	-	120.12	38.83	90.13	226.60	111.77	56.73	-	-
Asuet	100.06	146.50	125.19	144.79	-	168.24	170.95	-	101.77	157.16
Sohag	-	164.21	93.01	152.32	-	181.53	161.46	-	-	-

* Data of both gross revenue and costs are at the farm level.
* Rent is included as a cost component.
* Crop profitabilities are averages of the period (1977-1979).
* ANOVA test among governorates (2.78) with (11.50) degrees of freedom,
  ANOVA test among rotations (14.07) with (20.50 degrees of freedom,
  ANOVA Across rotations and governorates (12.209) with 31,50 degrees of freedom.

Source: Compiled and computed from data of the Ministry of Agriculture, Dep. of
        Agricultural Economics.

Table (2): Social Profitability of Cotton Rotation and Alternative Crop Rotations by Governorate

Governorats	T. Clover + Cotton (1)	Wheat + Maize (2)	Wheat + Rice (3)	P. Clover + Maize (4)	P. Clover + Rice (5)	Beans + Mazie (6)	T. Clover + Soyabeans (7)	P. Clover + Potatoes (8)	Tomatoes + Maize (9)	P. Clover + Groundnuts (10)	Broad Beans + Sorghum (11)
Behira	678.22	282.63	660.48	281.31	655.99	244.33	236.75	634.98	2028.22	-	-
Gharbia	727.95	341.37	738.39	-	688.26	-	187.97	-	-	-	-
Khafr El-Sheik	692.60	286.65	699.13	312.46	735.30	-	-	-	-	-	-
El-Daqahliya	637.16	395.96	782.61	351.54	739.96	-	179.34	-	-	326.40	-
Sharqia	686.63	272.91	638.99	309.11	807.15	298.26	166.82	-	-	-	-
Menoufia	765.22	327.88	-	386.45	-	306.11	-	-	1547.93	-	-
El-Qulubiya	815.56	344.55	-	-	-	-	-	-	-	-	201.27
Beni-Suef	418.70	265.14	-	-	-	-	-	-	-	-	286.06
Fayoum	357.43	-	-	-	-	-	-	-	-	-	-
El-Minya	406.32	-	-	339.84	-	-	-	-	-	-	392.05
Asuet	511.83	-	-	-	-	-	-	-	-	-	325.34
Sohag	607.50	305.51	-	316.66	-	-	-	-	-	-	-

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Table (2): Social Profitability of Cotton Rotation and Alternative Crop Rotations by Governorate.
(Continue)

Governorats	Lintils + Sorghum (12)	Onions + Maize (13)	Wheat + Sorghum (14)	Onions + Sorghum (15)	Broad Beans + Soyabeans (16)	P. Clover + Sorghum (17)	Broad Beans + Maize (18)	Sugarcane (19)	Lentils + Maize (20)	Lentils + Maize (21)
Behira	-	-	-	-	-	-	-	-	-	-
Gharbia	-	-	-	-	-	-	-	-	-	-
Khafr El-Sheik	-	-	-	-	-	-	-	-	-	-
El-Daqahliya	-	-	-	-	-	-	-	-	-	-
Sharqia	-	-	-	-	-	-	-	-	-	-
Menoufia	-	-	-	-	-	-	-	-	-	-
El-Qulubiya	-	-	-	-	-	-	-	-	-	-
Beni-Suef	-	642.90	186.90	585.55	200.58	2609	-	-	-	-
Fayoum	-	838.52	213.81	1058.81	-	272.07	219.85	-	-	-
El-Minya	-	-	274.40	498.32	257.70	300.74	305.73	483.39	-	-
Asuet	194.11	1037.05	241.11	1241.88	-	233.62	392.55	-	199.61	360.32
Sohag	-	1307.46	209.60	1491.00	-	252.57	352.70	-	-	-

* Data of both gross revenue and costs are expressed in internationa prices.
* Rent is not included as a cost component.
* Crop Yields are averages of the period (1977-1979).
* Cost of prodcution for different crops was estimated as the farm level cost
  for non-tradeables and the international equivalent for tradeables (Fertilizers +
  pesticidies + seeds).
* Estimated F-statistic among governorates (1.733) with (11,50) degrees of freedom,
  F-statistic among rotations (13.175) with (20,50) degrees of freedom,
  F-statistic across rotations and governorates (11.060) with (31,50) degrees of freedom.

Source: Compiled and Computed from the data of the Ministry of Agriculture, Dep. of Ag.
         Econ. & CAPMAS.

terms of yield standards, staple length, and typical crop
rotations competing with cotton.

   B) Major Sources of Divergence Between Private and Social
      Profitabilities:

   1. Subsidies on Inputs: Most of the inputs are
subsidized to the cotton producers. Data of Table 3 show the
subsidies on inputs per MT of lint. The value of the subsidies
vary among different production techniques. LS cotton producers
in Sohag who use traditional techniques for both land
preparation and irrigation are shown to be the least subsidized,
whereas those producing similar staple lengths in El-Minia using
the mechanized techniques for both land preparation and
irrigation get the highest subsidy. The value of the subsidy
per MT has ranged from L.E. 22.23 to L.E. 117.18 as shown in
column 2 of Table 3. Generally, subsidies for the producers
using non-mechanized technologies have proved to be much less
than for those using modern techniques.

   The effect of location and staple length on the level of
subsidy is originally a resultant of their influence on the
yields per feddan of cotton. Moreover, some governorates would
get larger input quotas compared to others based on soil
characteristics. Generally, governorates producing LS, which is
the highest yielding, get larger input subsidies on the average
compared to ELS producing governorates.

   2. Taxes (Direct and/or Indirect) On Outputs: The major
part of government revenues from agriculture comes from indirect

Table (3): Net Economic Transfers Per MT of Lint in 1980
For Cotton Production Techniques.

(LE./MT)

No.	Technology				Fob minus Domestic Price/MT of Lint (1)	Subsidies on Inputs Per MT of Lint (2)	Net Transfers (1) - (2)
	Governorate	Land Prep.	Irrig.	Staple Length			
1	Kafr El-Sheikh	Draft	Draft	ELS	1150.000	40.883	1109.117
2	Kafr El-Sheikh	Tractor	Pump	ELS	1150.000	91.057	1058.943
3	El-Dagahliya	Draft	Draft	ELS	1150.000	41.254	1108.746
4	El-Dagahliya	Tractor	Pump	ELS	1150.000	93.874	1056.126
5	El-Dagahliya	Tractor	Pump	LS	1018.500	75.289	943.211
6	El-Sharqia	Draft	Draft	LS	1018.500	29.693	988.807
7	El-Sharqia	Tractor	Pump	LS	1018.500	72.315	946.185
8	El-Monoufia	Draft	Draft	LS	1018.500	42.493	976.007
9	El-Menoufia	Tractor	Draft	LS	1018.500	58.416	960.084
10	El-Menoufia	Draft	Pump	LS	1018.500	72.226	946.274
11	El-Menoufia	Tractor	Pump	LS	1018.500	86.736	931.764
12	Beni-Suef	Draft	Draft	LS	1018.500	44.576	973.924
13	Beni Suef	Tractor	Pump	LS	1018.500	111.231	907.269
14	El-Minya	Draft	Draft	LS	1018.500	47.512	970.988
15	El-Minya	Tractor	Pump	LS	1018.500	117.175	901.325
16	El-Minya	Tractor	Pump	MLS	1205.400	100.226	1105.174
17	Sohag	Draft	Draft	LS	1018.500	22.226	996.274
18	Sohag	Draft	Pump	LS	1018.500	62.529	955.971
19	Sohag	Tractor	Draft	LS	1018.500	46.094	972.406
20	Sohag	Tractor	Pump	LS	1018.500	71.435	947.065
21	Beni Suef	Tractor	Pump	SS	693.800	89.645	604.155

Source: Compiled and Computed from the budgets of cotton production collected through a questionnaire from 7 governorates.

taxation through the price system. Direct taxes on land is a minor component compared to the taxes that come in the form of transfer as a result of pricing agricultural products at a substantially lower level compared to their shadow equivalents.

The government subsidizes inputs for cotton with the objective of partially offsetting the impact of the biased farm pricing policy. The first column of Table 3 shows the difference between the fob export price and the domestic price per metric ton of cotton lint for the different cotton production technologies. The large gap between the export price and the domestic price shows the large discrepancy between private and social profitabilities of cotton poroduction.

3. Net effect: The subtraction of the input subsidies (column 2) from the price differential (column 1) in Table 3 gives the net effect for the different cotton production technologies.

The data of table 4 show private vs. social profitabilities and economic surplus per MT of lint in 1980 for different cotton production techniques. Net social and private profitability per MT of lint are presented in the first two columns for different production techniques. The estimated ratio between the two, given in the third column, has ranged between 1.78 and 3.64. This means that farmers are getting between 27% and 56% of the social profit per metric ton of lint depending on the production technique. The share of the farmer in the social profitability for the short staple varieties is 79%. These varieties, however, are still on an experimental scale. The economic

Table (4): Private VS. Social Profitabilities and Economic Surplus per MT
of Lint in 1980 for different cotton Production Techniques.

(LE./MT)

No.	Technology				NSP/MT of Lint (1)	Private Profitability (2)	Ratio (1½)	Economic Surplus (1)-(2)
	Governorate	Land Prep.	Irrig.	Staple Length				
1	Kafr El-Sheikh	Draft	Draft	ELS	677.723	332.939	2.036	344.784
2	Kafr El-Sheikh	Tractor	Pump	ELS	749.864	387.081	1.937	362.783
3	El-Daqahliya	Draft	Draft	ELS	567.786	291.983	1.945	275.803
4	El-Daqahliya	Tractor	Pump	ELS	646.511	361.730	1.787	284.781
5	El-Daqahliya	Tractor	Pump	LS	753.708	359.339	2.097	394.369
6	El-Sharqia	Draft	Draft	LS	663.847	353.729	1.877	310.118
7	El-Sharqia	Tractor	Pump	LS	725.645	408.852	1.775	316.793
8	El-Menoufia	Draft	Draft	LS	514.410	258.791	1.988	255.619
9	El-Menoufia	Tractor	Draft	LS	592.184	309.767	1.912	282.417
10	El-Menoufia	Darft	Pump	LS	598.709	301.377	1.887	267.332
11	El-Menoufia	Tractor	Pump	LS	653.901	348.708	1.875	305.193
12	Beni-Suef	Draft	Draft	LS	704.908	293.426	2.402	411.482
13	Beni-Suef	Tractor	Pump	LS	765.324	362.937	2.109	402.387
14	El-Minya	Draft	Draft	LS	517.246	251.891	2.053	265.355
15	El-Minya	Tractor	Pump	LS	614.761	342.290	1.796	272.471
16	El-Minya	Tractor	Pump	MLS	671.621	202.538	3.316	469.083
17	Sohag	Draft	Draft	LS	767.998	211.047	3.639	556.951
18	Sohag	Draft	Pump	LS	754.397	228.138	3.307	526.259
19	Sohag	Tractor	Draft	LS	798.300	237.538	3.361	560.762
20	Sohag	Tractor	Pump	LS	798.378	253.808	3.146	544.570
21	Beni Suef	Tractor	Pump	SS	344.460	273.966	1.257	70.494

Source: Compiled and Comuted from the budgets of cotton production
callected through a questionnaire from 7 governorates.

surplus transferred ranges between L.E. 255.62 and L.E. 560.76 per MT of lint cotton in 1980. Economic surplus for short staple varieties is L.E. 70.49 per MT of lint.

Data of table 5 summarize the social profitability criteria and rates of protection per M.T of lint in 1980 for the different cotton production techniques. Net social profitability (NSP), nominal protection coefficient (NPC) on outputs, nominal protection coefficient on inputs, effective protection coefficient (EPC) and domestic resource cost ratio (DRC) for the different production techniques are presented. Moreover, the price that makes DRC equal to unity per MT of lint is also presented, which indicates the minimum price level below which cotton will be socially unprofitable. The general result shows that the modern techniques are economically more efficient and socially more profitable compared to the traditional ones.

Results of social profitability presented in table 5, notably with respect to DRC ratios across different techniques of land preparation, irrigation, governorates or staple length do not differ significantly. Variances of the DRC ratios for each individual technique have proved to be insignificant when checked against the Chi-Square test. Variances of all DRC ratios for the different production techniques were insignificant, which suggests that these DRC's are samples of the same population with an average of 0.598.

VI - Effect of Ginning Efficiency on Previous Results:

To single out the effect of ginning on the efficiency of

Table (5): Social Profitability Criteria and rates of Protection Per M.T. of Lint In 1980

No.	Technology				Net Social Profit	Nominal Protection Coeff. output	Nominal Protection Coeff. Input	Effective Protection Coefficient	Domestic Tecource Cost	Price that Makes DRC=1
	Governorate	Land Prep.	Irrig.	Staple Length	NSP	NPC	NPC	EPC	DRC	LE./MT
1	Kafr El-Sheikh	Draft	Draft	ELS	677.723	0.468	0.808	0.413	0.635	1496.709
2	Kafr El-Sheikh	Tractor	Pump	ELS	749.864	0.468	0.677	0.430	0.590	2025.149
3	El-Daqahliya	Draft	Draft	ELS	567.786	0.468	0.827	0.400	0.687	2280.569
4	El-Daqahliya	Tractor	Pump	ELS	646.511	0.468	0.704	0.418	0.638	2159.281
5	El-Daqahliya	Tractor	Pump	LS	753.708	0.490	0.704	0.452	0.556	1259.658
6	El-Sharqia	Draft	Draft	LS	663.847	0.490	0.841	0.431	0.612	1348.828
7	El-Sharqia	Tractor	Pump	LS	725.645	0.490	0.718	0.448	0.570	1289.354
8	El-Menoufia	Draft	Draft	LS	514.410	0.490	0.833	0.418	0.688	1499.286
9	El-Menoufia	Tractor	Draft	LS	592.184	0.490	0.788	0.428	0.642	1415.542
10	El-Menoufia	Draft	Pump	LS	568.709	0.490	0.753	0.433	0.654	1442.122
11	El-Menoufia	Tractor	Pump	LS	653.901	0.490	0.701	0.447	0.606	1358.116
12	Beni-Suef	Draft	Dract	LS	704.908	0.490	0.816	0.411	0.561	1310.724
13	Beni-Suel	Tractor	Pump	LS	765.423	0.490	0.680	0.438	0.512	1247.502
14	El-Minya	Draft	Draft	LS	517.246	0.490	0.809	0.411	0.677	1496.673
15	El-Minya	Tractor	Pump	LS	614.761	0.490	0.665	0.442	0.608	1391.555
16	El-Minya	Tractor	Pump	MLS	671.621	0.370	0.701	0.280	0.554	1262.086
17	Sohag	Draft	Draft	LS	767.998	0.490	0.882	0.417	0.544	1244.436
18	Sohag	Draft	Pump	LS	754.397	0.490	0.786	0.425	0.539	1259.921
19	Sohag	Tractor	Pump	LS	798.300	0.490	0.816	0.426	0.522	1209.330
20	Sohag	Tractor	Pump	LS	798.378	0.490	0.762	0.430	0.513	1209.315
21	Beni-Suef	Tractor	Pump	SS	344.460	0.468	0.681	0.393	0.643	973.789

The analysis is carried for 20 different technologies plus one for the short staple varieties.

Source: Compiled and computed from the data of farm budgets collected through a questionnaire.

producing lint, five major ginning companies were studied. Both
Misr and El-Wady gin only LS cotton, whereas El-Nile, El-Arabia
and El-Delta gin both LS and ELS. The ginning mills of these
companies in El-Daqahliya were selected to hold constant the
effect of location. Only mechanized production techniques in
land preparation and irrigation using tractors and pumps were
selected to let results indicate only the effect of differences
in the ginning technology in cotton transportation, storage
handling and pressing for each staple length. Some of the
ginning mills use the traditional labor intensive approach,
while others use relatively modern capital intensive techniques,
notably with respect to the stage of cotton handling and
pressing after ginning.

Data of Table 6 show the net subsidies, discrepancy
between domestic and fob prices, and the economic surplus in
1980 per MT of lint. Net input subsidies for ginning per MT of
lint. of ELS cotton have varied from L.E. 92.47 in El-Nile to
L.E. 94.81 in El-Delta. Net input subsidies for ginning per MT
of lint of LS cotton have varied from L.E. 73.89 in El-Nile to
L.E. 77.15 in El-Wady. The economic surplus per MT of lint has
ranged between L.E. 624.75 to L.E.645.24 for ELS.

Table 7 presents some social profitability measures per
MT of lint in 1980 for different ginning technologies. The net
social profitability (NSP) per MT of lint of LS cotton is higher
than its equivalent for ELS cotton across the ginning
technologies. The average across different ginning technologies
per MT of LS lint was L.E. 757.082, compared to L.E. per MT of

Table (6): Net Subsidies, discrepancy between domestic and fob prices and economic Surplus in 1980 for the Ginning Technologies.

(LE./MT of lint)

No.	Technology				Ginning comp.	Net input Subsidies	Fob price minus Domestic Price	Economic Surplus Social-private Profitability
	Governorate	Land Prep.	Irrig.	Staple Length				
1	El-Daqahliya -	Tractor	Pump	LS	Misr	74.289	1018.500	623.682
2	El-Daqahliya -	Tractor	Pump	LS	El-Nile	73.889	1018.500	630.602
3	El-Daqahliya -	Tractor	Pump	LS	El-Arabia	75.289	1018.500	623.082
4	El-Daqahliya -	Tractor	Pump	LS	Al-Wady	77.149	1018.500	621.782
5	El-Daqahliya -	Tractor	Pump	LS	El-Delta	76.229	1018.500	621.982
6	El-Daqahliya -	Tractor	Pump	ELS	El-Nile	92.474	1150.000	645.236
7	El-Daqahliya -	Tractor	Pump	ELS	El-Arabia	93.874	1150.000	641.846
8	El-Daqahliya -	Tractor	Pump	ELS	El-Delta	94.814	1150.000	640.746

Table (7): Social Profitability Per M.T. of Lint Cotton in 1980 for different Ginning Technologies.

No.	Technology				Ginning Company	NSP	Output NPC	Input NPC	EPC	DRC	Price Makes DRC = 1 LE./MT
	Governorate	Land Prep.	Irrig.	Staple Length							
1	El-Daqahliya – Tractor	Pump		LS	Misr	755.308	0.490	0.705	0.452	0.555	1258.073
2	El-Daqahliya – Tractor	Pump		LS	El-Nile	765.118	0.490	0.710	0.452	0.555	1251.798
3	El-Daqahliya – Tractor	Pump		LS	El-Arabia	753.708	0.490	0.704	0.452	0.556	1259.658
4	El-Daqahliya – Tractor	Pump		LS	El-Wady	755.768	0.490	0.699	0.453	0.554	1257.563
5	El-Daqahliya – Tractor	Pump		LS	El-Delta	755.508	0.490	0.701	0.452	0.554	1257.044
6	El-Daqahliya – Tractor	Pump		ELS	El-Nile	653.791	0.468	0.709	0.418	0.635	1518.232
7	El-Daqahliya – Tractor	Pump		ELS	El-Arabia	646.511	0.468	0.704	0.418	0.638	1526.612
8	El-Daqahliya – Tractor	Pump		ELS	El-Delta	648.311	0.468	0.702	0.419	0.637	1523.802

NSP = Net social profitability
NPC = Nominal protection coefficient
EPC = Effective protection coefficient
DRC = Domestic Resource Cost.

Source: Compiled and Computed from the annual budgets of the Ginning Companies through the period 197-80.

ELS of 649.538.

Values of DRC ratios across different ginning technologies indicate efficiency of the ginning process for both ELS and LS cotton. Value of the DRC has ranged between 0.55 and 0.56 for LS and between 0.635 and 0.638 for ELS. The nominal protection coefficient on both inputs and output which reflects the ratio of domestic and border prices and the effective protection coefficient which reflects the ratio of the value added at domestic and at border prices are also presented for different ginning technologies of LS and ELS cotton in Table 7. Reviewing these findings indicates that cotton production on the average is taxed since the EPC's are less than unity and NPC on output is lower than that on inputs.

VII - Sensitivity Analysis For Cotton Production and Ginning:

A) Effects of Changes in Shadow Prices of Tradable Inputs, Non-Tradable Inputs, and Outputs: Data of Table 8 indicate elasticities of NSP and DRC per one per cent change in the shadow price of the unskilled labor is less than unity. Techniques, however, which are capital intensive are less sensitive to the shadow prices of the unskilled labor.

Changing the shadow price of the skilled labor, on the other hand, has had very little effect on the value of the DRC and NSP. Moreover, these DRC and NSP estimates have shown low elasticities with respect to the changes in the shadow price of both land and capital across production techniques.

Estimates of both DRC and NSP for the different cotton

Table (8): Elasticities' of NSP & DRC Per M.T. of Lint Cotton in 1980

No.	Technology				Shadow Price Unskilled Labor		Shadow Price Skilled Labor		Shadow Price Land		Shadow Price Capital		Yields	
	Governorate	Land Prep.	Irrg.	Staple Length	NSP	DRX	NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	-0.762	0.428	-0.022	0.013	-0.733	0.412	-0.262	0.147	3.401	-1.829
2	Kafr El-Sheikh	Tractor	Pump	ELS	-0.652	0.444	-0.049	0.033	-0.628	0.428	-0.140	0.095	2.974	-1.914
3	El-Daqahliya	Draft	Draft	ELS	-0.979	0.435	-0.027	0.012	-0.920	0.408	-0.326	0.145	4.263	-1.816
4	El-Daqahliya	Tractor	Pump	ELS	-0.808	0.449	-0.058	0.032	-0.766	0.425	-0.169	0.094	3.614	-1.899
5	El-Daqahliya	Tractor	Pump	LS	-0.604	0.473	-0.043	0.033	-0.507	0.396	-0.125	0.097	2.730	-2.015
6	El-Sharqia	Draft	Draft	LS	-0.722	0.447	-0.023	0.014	-0.630	0.391	-0.239	0.146	3.232	-1.913
7	El-Sharqia	Tractor	Pump	LS	-0.627	0.463	-0.045	0.034	-0.0548	0.404	-0.134	0.099	2.868	-1.998
8	El-Henoufia	Draft	Draft	LS	-1.018	0.449	0.029	0.013	-0.766	0.338	-0.453	0.200	4.474	-1.890
9	El-Henoufia	Tractor	Draft	LS	-0.821	0.447	-0.051	0.028	-0.632	0.345	-0.331	0.180	3.746	-1.939
10	El-Henoufia	Draft	Pump	LS	-0.952	0.492	-0.029	0.015	-0.690	0.356	-0.265	0.137	3.944	-1.937
11	EL-Henoufia	Tractor	Pump	LS	-0.769	0.490	-0.049	0.031	-0.570	0.363	-0.183	0.117	3.292	-1.979
12	Beni Suef	Draft	Draft	LS	-0.551	0.422	-0.023	0.017	-0.445	0.340	-0.288	0.221	2.926	-2.069
13	Beni Suef	Tractor	Pump	LS	-0.478	0.446	-0.055	0.051	-0.389	0.363	-0.149	0.139	2.613	-2.204
14	El-Minya	Draft	Draft	LS	-0.767	0.356	-0.031	0.014	-0.919	0.427	-0.437	0.203	4.414	-1.944
15	El-Minya	Tractor	Pump	LS	-0.598	0.376	-0.069	0.043	-0.733	0.461	-0.190	0.120	3.544	-2.071
16	El-Minya	Tractor	Pump	MLS	-0.498	0.392	-0.056	0.044	-0.562	0.442	-0.156	0.122	3.033	-2.189
17	Sohag	Draft	Draft	LS	-0.521	0.426	-0.02	0.017	-0.407	0.333	-0.273	0.223	2.714	-2.087
18	Sohag	Draft	Pump	LS	-0.541	0.452	-0.063	0.053	-0.414	0.345	-0.180	0.150	2.781	-2.157
19	Sohag	Tractor	Draft	LS	-0.461	0.412	-0.050	0.045	-0.373	0.333	-0.235	0.210	2.571	-2.143
20	Sohag	Tractor	Pump	LS	-0.471	0.437	-0.088	0.081	-0.372	0.345	-0.147	0.136	2.571	-2.204
21	Beni Suef	Tractor	Pump	SS	-0.879	0.469	-0.098	0.052	-0.604	0.322	-0.292	0.156	5.080	-2.541

Elasticities Show Percent Change in NSP or DRC Per One Percent Change in Some Parameters

production techniques have proved to be highly sensitive to changes in yields. A one percent change in the level of yields is accompanied with a range of 2.57% to 4.47% change in the value of the NSP per MT of lint of LS or ELS. A change, of one percent in the levels of yield of short staple varieties would result however in a 5.08 percent in change in the value of the NSP. The value of the elasticities of changing the ratio of the DRC per one percent change in the level of yield per feddan has ranged between 1.816 percent and 2.204 percent across the different production techniques. The elasticity of the DRC for the short staple cotton has amounted to -2.541 with respect to a change in yields of one percent.

B) Alterations on Basic Case Assumptions:

1. Land Quality Variation: In the previous analysis, treating land as a homogeneous input, a point estimate to the shadow price of land has been used. Agricultural land is a heterogenous input in terms of productivity. Agricultural land is divided into six different classes according to its fertility. A range of shadow prices to the land was used to see the effect of altering this shadow price on the values of DRC and NSP per MT of lint across different production techniques.

Data of Appendix Table 1 shows the sensitivity of the estimates to the shadow price of land. The starting value of the shadow price of land shows the ratio of the shadow to the market price of land. This ratio was put in a range starting from one half of its value and ending with doubling it. This

range is believed to cover all the likely changes in the shadow
price of land. The shadow price of land varies across different
technologies due primarily to changes of location. Value of
land varies from one governorate to another. A close look to
the values of the DRC and NSP across governorates in the
summary Table 9 shows that the estimates are highly sensitive to
the shadow price of land. However, DRC ratios remain less
than unity and NSP values remain positive even when almost
doubling the original shadow price of land.

2. Errors in Technical Coefficients: The previous
analysis is conditional on the technical coefficients used in
the budgets as well as on the set of world prices for outputs.
Moreover, it is conditional on the shadow prices of primary
factor inputs. Some sensitivity analyses have been conducted for
the shadow price of skilled labor, unskilled labor and capital.
Results of changing the shadow prices for these inputs through a
range starting from one half the original shadow prices and
ending with almost doubling them are presented in Appendix
Tables 2, 3, and 4.

Reviewing Appendix Table 2 reveals that the DRC or NSP per
MT of lint across different technologies has not varied
drastically in response to the change of the skilled labor
shadow price. The impact, however, is clearer in technologies
that use mechanical techniques in land preparation and
irrigation. This is contrary to the case of unskilled labor.
Results in Appendix Table 3 show that DRC and NSP per MT of
lint across different production technologies have varied

Table (9): Summary of the sensitivity analysis on the shadow
price of Land.

Governorate	50% One half of the shadow Price of Land		100% Original Shadow Price of Land		190% about Double Shadow Price of Land	
	NSP	DRC	NSP	DRC	NSP	DRC
Kaft El-Sheikh	961.981	0.488	704.657	.618	297.596	.851
El-Daqahliya	894.414	0.502	646.881	.632	250.771	.866
Sharqia	903.953	0.478	685.680	.596	340.365	.809
Menoufia	778.425	0.539	573.265	.653	250.273	.859
Beni-Suef	893.433	0.447	726.419	.542	470.234	.713
El-Minya	815.955	0.482	592.304	.619	222.598	.866
Sohag	937.405	0.519	770.215	.536	515.705	.694

Source: Computed from Appendix table (1).

drastically in response to the change of the shadow price of unskilled labor. Finally, results in Appendix Table 4 show that the social profitability criteria DRC and NSP per MT of lint across different technologies are less sensitive to the changes in the shadow price of capital.

C) Sensitivity Analysis of Ginning: Results of Table 10 show the percent change in the NSP or DRC per MT of lint cotton in 1980 across different ginning technologies. Sensitivity analysis and estimation of elasticities of the DRC and NSP have been calculated in response to changes in the shadow price of unskilled labor, the shadow price of skilled labor, the shadow price of land and yields. All dimensions of location, production technique of land preparation, and technique of irrigation were held constant to find the change in the values of the social profitability criteria attributable to the ginning technology for each staple length. Values of the DRC and NSP across different ginning techniques have proven to be inelastic to changes in the value of the shadow prices of unskilled labor, skilled labor, land and capital. These values, however, have proven to be highly elastic to changes in yields.

Results in Table 10 show that values of both DRC and NSP have not varied significantly across technologies when checked against the Chi-Square distribution. This implies that the ginning technology does not have a significant effect on the values of DRC and NSP. Results presented in Appendix Tables 5, 6, 7, and 8 show some sensitivity analysis on the shadow prices of land, skilled labor, unskilled labor, and capital. Values of

Table (10): Elasticities of NSP & DRC Per M.T. of Lint Cotton in 1980
Across different ginning technologies.

No.	Technology					Shadow Price Unskilled Labor		Shadow Price Skilled Labor		Shadow Price Land		Shadow Price Capital		Yields	
	Governorate	Land Prep.	-Irrig.	Staple Length	Ginning Comp.	NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC
1	El-Daqahliya-Tractor-Pump			LS	Misr LS	-0.603	0.473	-0.042	0.033	-0.506	0.397	-0.124	0.097	2.745	-2.032
2	El-Daqahliya-Tractor-Pump			LS	El-Nile LS	-0.606	0.480	-0.030	0.024	-0.502	0.397	-0.125	0.099	3.273	-2.468
3	El-Daqahliya-Tractor-Pump			LS	Arabia LS	-0.604	0.473	-0.043	0.033	-0.507	0.396	-0.125	0.097	2.730	-2.015
4	El-Daqahliya-Tractor-Pump			LS	El-Wady LS	-0.602	0.473	-0.040	0.031	-0.505	0.397	-0.126	0.099	2.742	-2.033
5	El-Daqahliya-Tractor-Pump			LS	Delta LS	-0.602	0.475	-0.040	0.031	-0.504	0.397	-0.123	0.097	2.641	-1.958
6	El-Daqahliya-Tractor-Pump			ELS	El-NileELS	-0.808	0.454	-0.043	0.024	-0.757	0.426	-0.170	0.095	3.597	-1.915
7	El-Daqahliya-Tractor-Pump			ELS	Arabia ELS	-0.808	0.449	-0.058	0.032	-0.766	0.425	-0.169	0.094	3.614	-1.899
8	El-Daqahliya-Tractor-Pump			ELS	Delta ELS	-0.805	0.450	-0.055	0.031	-0.762	0.426	-0.167	0.093	3.506	-1.852

Elasticities show Percent change in NSP or DRC Per One Percent change in Parameter

both DRC's and NSP's are presented per MT of lint across

different ginning techniques.

VIII- Conclusions and Policy Implications:

The previous analysis on the efficiency of cotton

production in Egypt can provide a set of conclusions and policy

implications which could be summarized in the following major

points:

1. Comparing the profitability of the typical cotton rotation

(T-clover and cotton) with that of other 20 major rotations

competing with cotton across governorates, both from the

economic and financial perspectives, it appears that the cotton

rotation is much more profitable to the economy than it is to

the farmers. This rotation, however, is highly profitable both

to the economy and the farmers compared to all the other

rotations, exclusive of the ones including horticultural crops.

This advocates giving support to this rotation through price

policy, and/or subsidy policy, to increase the incentive to the

producers. This conclusion is supported by the result showing

that the economic surplus transferred from the cotton producers

is sizable in comparison to other crops.

2. The previous conclusion is supported by calculating net

economic transfers per MT of lint, for different cotton

production techniques. This analysis indicates that despite the

net input subsidies that the farmers get ranging from L.E.

22.226 to L.E. 117.175 per MT of lint cotton, still there is a

substantial net transfer that is taken from cotton producers.
Those, however, who use the mechanical techniques both in land
preparation and irrigation get higher subsidies per unit of
output and are consequently taxed at a lower rate than other
producers.

3. The ratio of social to private profitabilities for cotton
production across different production techniques has ranged
from 1.78 to 3.64. This ratio varies according to four major
criteria, namely, location, land preparation, irrigation, and
staple length. The economic surplus has ranged from L.E.
272.471 to L.E. 560.762.

4. The price which makes DRC = 1 provides the average level
below which cotton production becomes unprofitable. This price
varies presumably across different production technologies.
Variables like a) location which determines yield, b) technology
of land preparation and irrigation which influences efficiency,
and c) staple length that determines the value of output jointly
determine the mininum price that makes cotton profitable to the
economy. The price per MT of ELS cotton lint that makes DRC = 1
across locations, techniques of land preparation and irrigation
is L.E. 1990.427. Equivalent prices for LS, and MLS
respectively are L.E. 1332.157, and L.E. 1262.086. These prices
vary as a result of any change in the price and cost structure
which necessitates calculating them regularly to be used as
guides in pricing cotton, notably with respect to LS and MLS
varieties in which Egypt's market share is relatively small and

in which trade Egypt has less monopoly power.

5. Empirical testing has revealed that mechanization of some agricultural operations, notably with respect to land preparation and irrigation, drives towards more efficiency. Social profitability criteria NSP and DRC are indicating higher efficiency. Moreover, analysis of the economic surplus has revealed that such techniques are relatively more taxed compared to the traditional techniques.

6. The economic surplus transferred from the ELS producers across different production techniques has amounted to L.E. 317.038 per MT of lint compared to L.E. 378.139 for the LS cotton, and L.E. 469.083 for the MLS, respectively.

7- Mechanization of some agricultural operations is essential since the labor intensive techniques are less efficient. Some operations like cotton picking in particular if mechanized would reduce costs. This result is derived from conducting some

sensitivity analysis on the values of DRC and NSP with respect
to some changes in the shadow price of the unskilled labor which
presumably carry out the picking.

8. The introduction of short staple short duration varieties,
despite the fact that it has still been conducted on an
experimental scale, is economically profitable. The NSP per
MT of lint amounted to L.E. 344.460. The value of the DRC was
0.643. This experiment was a controlled one that uses
mechanical techniques for both land preparation and irrigation.
The price which makes DRC = 1 has amounted to L.E. 973.789 per
MT of lint.

    Connecting this result with the efficiency in the spinning
industry might suggest producing or expanding these varieties.
This recommendation has to be very cautiously taken since the
ginning technology has to be drastically changed to handle this
short category of staple lengths.

9. Values of NPC for inputs and outputs across different cotton
production technologies have been shown to be less than one,
which indicate that both inputs used in cotton production and
outputs are taxed. Moreover, EPC across different
technologies has proved to be less than unity. That means that
the protection measures provide negative incentives to produce
cotton.

10. Calculated values of NPC for inputs and outputs across
different ginning technologies were less than one, which
indicates net taxation for outputs and net subsidy for inputs.

The EPC across different technologies has proved to be less than unity. That means that the protective measures provide negative incentives to ginning.

11. Testing the hypothesis of the viability of cotton production and ginning should not be carried in an aggregate form at the national level through comparing private and social profitability. Detailed analysis has to be carried across locations, and production techniques. This approach would be more appropriate to help improve policies of cotton production and ginning. Recommendations of pricing cotton at the farm level and selction of the production mix should not be independent from consideration of location and degree of capital intensity in the production technologies.

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APPENDIX

No.	Governorate	Land Prep.	Irrig.	Staple Length	4.620 NSP	DRC	2.310 50% NSP	DRC	3.234 70% NSP	DRC	4.158 90% NSP	DRC	5.082 110% NSP	DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	668.850	0.640	932.290	0.508	834.243	0.561	736.197	0.614	638.150	0.667
2	Kaft El-Sheikh	Tractor	Pump	ELS	740.728	0.595	991.672	0.468	898.608	0.519	805.545	0.569	712.481	0.620
					(4.550)		(2.275)		(3.185)		(4.095)		(5.005)	
3	El-Daqahliya	Draft	Draft	ELS	558.665	0.692	833.747	0.551	730.980	0.608	628.214	0.664	525.447	0.721
4	El-Daqahliya	Tractor	Pump	ELS	637.390	0.643	899.337	0.506	801.700	0.561	704.063	0.616	606.426	0.670
5	El-Daqahliya	Tractor	Pump	LS	744.587	0.561	950.158	0.450	874.714	0.494	799.271	0.539	723.827	0.583
					(4.300)		(2.150)		(3.010)		(3.870)		(4.730)	
6	El-Sharqia	Draft	Draft	LS	654.781	0.617	878.273	0.497	795.722	0.545	713.171	0.593	630.620	0.642
7	El-Sharqia	Tractor	Pump	LS	716.579	0.575	929.632	0.459	851.158	0.505	772.684	0.552	694.210	0.598
					(4.160)		(2.080)		(2.912)		(3.744)		(4.576)	
8	El-Menoufia	Draft	Draft	LS	505.374	0.694	715.356	0.577	637.966	0.624	560.576	0.670	483.186	0.717
9	El-Menoufia	Tractor	Draft	LS	583.149	0.647	783.985	0.536	710.263	0.580	636.541	0.625	562.819	0.670
10	El-Menoufia	Draft	Pump	LS	559.673	0.659	769.080	0.542	691.889	0.589	614.699	0.636	537.508	0.683
11	El-Menoufia	Tractor	Pump	LS	644.865	0.611	845.279	0.500	771.743	0.545	698.210	0.589	624.678	0.633
					(1.870)		(0.935)		(1.309)		(1.683)		(2.057)	
12	Beni-Suef	Draft	Draft	LS	696.211	0.567	867.241	0.470	805.255	0.509	743.270	0.547	681.284	0.586
13	Beni-Suef	Tractor	Pump	LS	756.627	0.517	919.624	0.423	860.696	0.461	801.767	0.499	742.839	0.536
					(2.820)		(1.410)		(1.974)		(2.538)		(3.102)	
14	El-Minya	Draft	Draft	LS	508.341	0.683	758.066	0.537	664.590	0.596	571.115	0.654	477.639	0.712
15	El-Minya	Tractor	Pump	LS	605.855	0.614	843.709	0.472	754.843	0.529	665.978	0.586	577.113	0.642
16	El-Minya	Tractor	Pump	MLS	662.716	0.560	864.089	0.436	789.563	0.486	715.037	0.535	640.510	0.585
					(3.620)		(1.810)		(2.534)		(3.298)		(3.982)	
17	Sohag	Draft	Draft	LS	758.445	0.550	929.825	0.458	868.015	0.495	806.205	0.532	744.394	0.568
18	Sohag	Draft	Pump	LS	744.844	0.545	915.291	0.451	853.661	0.489	792.031	0.526	730.401	0.564
19	Sohag	Tractor	Draft	LS	788.747	0.528	952.592	0.440	893.741	0.475	834.889	0.511	776.036	0.546
20	Sohag	Tractor	Pump	LS	788.825	0.519	951.913	0.429	893.233	0.465	834.553	0.501	775.873	0.537
					(1.870)		(0.935)		(1.309)		(1.683)		(2.057)	
21	Beni-Suef	Tractor	Pump	SS	335.799	0.652	446.860	0.547	406.294	0.589	365.729	0.631	325.164	0.673

Appendix Table (1): Sensetivity Analysed on the Shadow Price of Land[*] (Continue)

No.	Governorate	Land Prep.	Irrig.	Staple Length	6.006 130%		6.930 150%		7.854 170%		8.778 190%	
					NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	540.104	0.719	442.057	o.772	344.011	o.825	245.964	0.878
2	kafr El-Sheikh	Tractor	Pump	ELS	619.418	0.671	526.354	0.722	433.290	0.773	340.227	0.824
					(5.815)		(6.825)		(7.735)		(8.645)	
3	El-Daqahliya	Draft	Draft	ELS	422.681	0.777	319.915	0.834	217.148	0.890	114.382	0.947
4	El-Daqahliya	Tractor	Pump	ELS	508.789	0.725	411.152	0.780	313.515	0.834	215.878	0.889
5	El-Daqahliya	Tractor	Pump	LS	648.383	0.628	572.939	0.672	497.495	0.717	422.052	0.761
					(5.590)		(6.450)		(7.310		(8.170	
6	El-Sharqia	Draft	Draft	LS	548.068	0.690	465.517	0.738	382.966	0.786	300.415	0.834
7	El-Sharqia	Tractor	Draft	LS	615.736	0.645	537.262	0.691	485.788	0.788	380.314	0.785
					(5.408)		(6.240)		(7.072)		(7.904)	
8	El-Menoufia	Draft	Draft	LS	405.796	0.764	328.406	0.811	251.016	0.858	173.868	0.905
9	El-Menoufia	Tractor	Draft	LS	489.097	0.714	415.374	0.759	341.652	0.803	267.930	0.848
10	El-Menoufia	Draft	Pump	LS	460.318	0.730	383.127	0.777	305.937	0.824	228.746	0.871
11	El-Menoufia	Tractor	Pump	LS	551.146	0.678	477.614	0.722	404.081	0.766	330.549	0.811
					(2.431)		(2.805)		(3.179)		(3.553)	
12	Beni-Suef	Draft	Draft	LS	619.298	0.625	557.313	0.663	495.327	0.702	433.342	0.740
13	Beni-Suef	Tractor	Pump	LS	683.911	0.574	624.982	0.611	566.054	0.649	507.125	0.686
					(3.666)		(4.230)		(4.794)		(5.358)	
14	El-Minya	Tractor	Draft	LS	384.164	0.770	290.688	0.829	197.213	0.887	103.737	0.945
15	El-Minya	Tractor	Pump	LS	488.247	0.699	399.382	0.755	310.517	0.812	221.651	0.869
16	El-Minya	Tractor	Pump	MLS	565.984	0.634	491.458	0.684	416.932	0.733	342.406	0.783
					(4.706)		(5.430)		(6.154)		(6.878)	
17	Sohag	Draft	Draft	LS	682.584	0.605	620.774	0.642	558.964	0.678	497.154	0.715
18	Sohag	Draft	Pump	LS	668.771	0.602	607.141	0.639	545.511	0.677	483.881	0.714
19	Sohag	Tractor	Draft	LS	717.187	0.581	658.335	0.616	599.484	0.651	54.632	0.687
20	Sohag	Tractor	Pump	LS	717.931	0.572	658.513	0.608	599.833	0.644	541.153	0.680
					(2.431)		(2.805)		(3.179)		(3.553)	
21	Beni-Suef	Tractor	Pump	SS	284.599	0.715	244.034	0.757	203.468	0.799	162.903	0.841

Appendix Table (1): Sensetivity Analyses on the Shadow Price of Land* (Continue)

* Starting Values of Shadow Price of Land Equal to 4.620 for Cases 1 & 2, 4.550 for Cases 3, 4, 5
  and 4.300 for cases 6, 7 and 4,160 for cases 8, 9, 10, 11 and 1.870 for steps 12, 13, 21 and
  2.820 for cases 14, 15, 16 and 3.620 for cases 17, 18, 19, 20.

* The starting value of the shadow price of land shows the ratio of shadow price to market price
  of land. These values vary by governorates.

Appendix Table (2): Sensitivity Analyses on the Shadow Price of Skilled Labor

No.	Governorate	Land Prep.	Irrig.	Staple Length	1.000 NSP	1.000 DRC	0.500 NSP	0.500 DRC	0.700 NSP	0.700 DRC	0.900 NSP	0.900 DRC	1.100 NSP	1.100 DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	668.586	0.640	694.644	0.636	691.656	0.638	688.668	0.639	685.680	0.641
2	Kafr El-Sheikh	Tractor	Pump	ELS	740.728	0.595	776.992	0.585	769.801	0.589	762.609	0.593	755.417	0.597
3	El-Daqahliya	Draft	Draft	ELS	558.665	0.692	584.319	0.688	581.324	0.690	578.328	0.692	575.333	0.693
4	El-Daqahliya	Tractor	Pump	ELS	637.390	0.643	673.740	0.633	666.342	0.637	658.944	0.641	651.546	0.645
5	El-Daqahliya	Tractor	Pump	LS	744.587	0.561	777.443	0.552	771.085	0.555	764.727	0.559	758.370	0.563
6	El-Sharqia	Draft	Draft	LS	654.781	0.617	679.303	0.613	676.340	0.615	673.377	0.617	670.414	0.618
7	El-Sharqia	Tractor	Pump	LS	716.579	0.575	749.710	0.566	753.205	0.569	736.699	0.573	730.194	0.577
8	El-Menoufia	Draft	Draft	LS	505.374	0.694	529.268	0.689	526.313	0.691	523.359	0.693	520.404	0.695
9	El-Menoufia	Tractor	Draft	LS	583.149	0.647	614.589	0.638	608.625	0.642	602.662	0.645	596.698	0.649
10	El-Menoufia	Draft	Pump	LS	559.673	0.659	584.294	0.654	581.018	0.656	577.742	0.658	574.466	0.660
11	El-Menoufia	Tractor	Pump	LS	644.865	0.611	677.118	0.602	670.849	0.605	664.579	0.609	658.309	0.613
12	Beni-Suef	Draft	Draft	LS	696.211	0.567	720.177	0.652	717.017	0.654	713.857	0.566	710.697	0.568
13	Beni-Suef	Tractor	Pump	LS	756.627	0.517	793.062	0.504	784.759	0.509	776.455	0.515	768.151	0.520
14	El-Minya	Draft	Draft	LS	508.341	0.683	532.277	0.678	529.117	0.680	525.957	0.682	522.797	0.684
15	El-Minya	Tractor	Pump	LS	605.855	0.614	542.304	0.601	634.001	0.606	625.697	0.611	617.393	0.617
16	El-Minya	Tractor	Pump	MLS	662.716	0.560	696.366	0.548	688.929	0.552	681.492	0.557	674.055	0.562
17	Sohag	Draft	Draft	LS	758.445	0.550	783.258	0.545	780.074	0.547	776.891	0.549	773.708	0.551
18	Sohag	Draft	Pump	LS	744.844	0.545	784.847	0.531	775.395	0.536	765.942	0.542	756.490	0.548
19	Sohag	Tractor	Draft	LS	788.747	0.528	825.127	0.516	817.262	0.521	809.396	0.526	801.531	0.531
20	Sohag	Tractor	Pump	LS	788.825	0.519	839.797	0.498	825.963	0.506	812.129	0.514	798.296	0.523
21	Beni-Suef	Tractor	Pump	SS	335.799	0.652	361.918	0.635	355.329	0.642	348.741	0.649	342.152	0.655

Appendix Table (2):   Sensitivity Analyses on the Shadow Price of Skilled Labor

(Continue)

No.	Governorate	Land Prep.	Irrig.	Staple Length	1.300 NSP	1.300 DRC	1.500 NSP	1.500 DRC	1.700 NSP	1.700 DRC	1.900 NSP	1.900 DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	682.691	0.643	679.703	0.644	676.715	0.646	673.727	0.648
2	Kaft El-Sheikh	Tractor	Pump	ELS	748.225	0.601	741.034	0.605	733.842	0.609	726.650	0.613
3	El-Daqahliya	Draft	Draft	ELS	572.337	0.695	569.342	0.697	566.346	0.698	563.351	0.700
4	El-Daqahliya	Tractor	Pump	ELS	644.148	0.649	636.750	0.653	629.351	0.658	621.953	0.662
5	El-Daqahliya	Tractor	Pump	LS	752.012	0.567	745.655	0.570	739.297	0.574	732.939	0.518
6	El-Sharqia	Draft	Draft	LS	667.450	0.620	664.487	0.622	661.524	0.623	658.561	0.625
7	El-Sharqia	Tractor	Pump	LS	723.689	0.581	717.184	0.585	710.678	0.589	704.173	0.593
8	El-Menoufia	Draft	Draft	LS	517.449	0.697	514.495	0.698	511.540	0.700	508.585	0.702
9	El-Menoufia	Tractor	Draft	LS	590.735	0.653	584.771	0.656	578.807	0.660	572.844	0.663
10	El-Menoufia	Draft	Pump	LS	571.190	0.660	567.914	0.664	564.638	0.666	561.362	0.668
11	El-Menoufia	Tractor	Pump	LS	652.040	0.617	645.770	0.620	639.501	0.624	633.231	0.628
12	Beni-Suef	Draft	Draft	LS	707.536	0.570	704.376	0.572	201.216	0.574	698.056	0.575
13	Beni-Suef	Tractor	Pump	LS	759.848	0.525	751.544	0.531	743.240	0.536	734.937	0.541
14	El-Minya	Draft	Draft	LS	519.637	0.686	516.476	0.688	513.316	0.690	510.156	0.692
15	El-Minya	Tractor	Pump	LS	609.090	0.622	600.786	0.627	792.482	0.632	584.179	0.638
16	El-Minya	Tractor	Pump	MLS	666.618	0.567	659.181	0.572	651.744	0.577	644.307	0.582
17	Sohag	Draft	Draft	LS	770.525	0.553	767.341	0.555	764.158	0.557	760.975	0.559
18	Sohag	Draft	Pump	LS	747.037	0.554	737.585	0.559	728.132	0.565	718.680	0.571
19	Sohag	Tractor	Draft	LS	793.666	0.535	785.800	0.540	777.935	0.545	770.070	0.549
20	Sohag	Tractor	Pump	LS	784.462	0.531	770.629	0.540	756.795	0.548	742.962	0.557
21	Beni-Suef	Tractor	Pump	SS	335.564	0.662	328.875	0.669	322.387	0.676	315.798	0.683

* Ratio of shadow wage of the skilled labor to the market wage was initially

assumed to be unity.

Appendix Table (3): Sensitivity Analyses on the Shadow Price of Unskilled Labor [*]

No.	Technology				1.000		0.500		0.700		0.900		1.100	
	Governorate	Land Prep.	Irrig.	Staple Length	NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	668.586	0.640	941.983	0.503	840.059	0.558	738.136	0.613	636.212	0.668
2	Kafr El-Sheikh	Tractor	Pump	ELS	740.728	0.595	1000.485	0.463	903.896	0.516	807.307	0.568	710.719	0.621
3	El-Daqahliya	Draft	Draft	ELS	558.665	0.692	850.280	0.542	740.900	0.602	631.520	0.662	522.141	0.723
4	El-Daqahliya	Tractor	Pump	ELS	637.390	0.643	912.783	0.499	809.768	0.556	706.752	0.614	603.737	0.672
5	El-Daqahliya	Tractor	Pump	LS	744.547	0.561	986.481	0.428	896.508	0.481	806.535	0.534	716.562	0.588
6	El-Sharqia	Draft	Draft	LS	654.781	0.617	908.283	0.479	813.728	0.535	719.173	0.590	624.618	0.645
7	El-Sharqia	Tractor	Pump	LS	716.579	0.575	958.178	0.442	868.286	0.495	778.393	0.549	688.501	0.602
8	El-Menoufia	Draft	Draft	LS	505.374	0.694	779.144	0.538	676.239	0.600	573.334	0.663	470.429	0.725
9	El-Menoufia	Tractor	Draft	LS	583.149	0.647	838.997	0.502	743.270	0.560	647.543	0.618	551.817	0.676
10	El-Menoufia	Draft	Pump	LS	559.673	0.659	842.478	0.497	735.928	0.562	629.379	0.627	522.829	0.692
11	El-Menoufia	Tractor	Pump	LS	644.865	0.611	909.440	0.461	810.242	0.521	711.043	0.581	611.845	0.641
12	Beni-Suef	Draft	Draft	LS	696.211	0.567	904.208	0.447	827.436	0.495	750.663	0.543	673.890	0.591
13	Beni-Suef	Tractor	Pump	LS	756.627	0.517	953.207	0.402	880.845	0.448	808.484	0.494	736.122	0.540
14	El-Minya	Draft	Draft	LS	508.341	0.683	719.244	0.561	641.297	0.610	563.350	0.659	485.403	0.707
15	El-Minya	Tractor	Pump	LS	605.855	0.614	802.624	0.498	730.192	0.545	657.761	0.591	585.330	0.637
16	El-Minya	Tractor	Pump	MLS	662.716	0.560	842.867	0.450	776.830	0.494	710.792	0.538	644.755	0.582
17	Sohag	Draft	Draft	LS	758.445	0.550	972.817	0.433	893.810	0.480	814.803	0.527	735.796	0.573
18	Sohag	Draft	Pump	LS	744.844	0.545	962.838	0.422	882.189	0.471	801.541	0.520	720.892	0.570
19	Sohag	Tractor	Draft	LS	788.747	0.528	987.431	0.419	914.644	0.463	841.857	0.506	769.070	0.550
20	Sohag	Tractor	Pump	LS	788.825	0.519	991.088	0.405	917.738	0.451	842.388	0.496	768.038	0.541
21	Beni-Suef	Tractor	Pump	SS	335.799	0.652	493.030	0.499	433.997	0.560	374.963	0.621	315.930	0.683

Appendix (3): Sensitivity Analyses on the Shadow Price of Unskilled Labor[*].

(Continue)

| No. | Technology | | | | 1.300 | | 1.500 | | 1.700 | | 1.900 | |
	Governorate	Land Prep.	Irrig.	Staple Length	NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	534.288	0.723	432.364	0.777	330.441	0.832	228.517	0.887
2	Kaft El-Sheikh	Tractor	Pump	ELS	614.130	0.674	517.541	0.727	420.952	0.780	324.363	0.833
3	El-Daqahliya	Draft	Draft	ELS	412.761	0.783	303.381	0.843	194.002	0.903	84.622	0.963
4	El-Daqahliya	Tractor	Pump	ELS	500.722	0.730	397.706	0.787	294.691	0.845	191.676	0.903
5	El-Daqahliya	Tractor	Pump	LS	626.589	0.641	536.616	0.694	446.643	0.747	356.670	0.800
6	El-Sharqia	Draft	Draft	LS	530.062	0.700	435.507	0.756	340.952	0.811	246.397	0.866
7	El-Sharqia	Tractor	Pump	LS	598.608	0.655	508.715	0.708	418.823	0.762	328.930	0.815
8	El-Menoufia	Draft	Draft	LS	367.524	P.787	264.619	0.850	161.714	0.912	58.809	0.974
9	El-Menoufia	Tractor	Draft	LS	456.090	0.734	360.363	0.792	264.636	0.850	168.910	0.908
10	El-Menoufia	Draft	Pump	LS	416.279	0.757	309.729	0.821	203.180	0.886	96.630	0.951
11	El-Menoufia	Tractor	Pump	LS	512.647	0.701	413.448	0.761	314.250	0.820	215.052	0.880
12	Beni-Suef	Draft	Draft	LS	597.118	0.638	520.345	0.686	443.573	0.734	266.800	0.882
13	Beni-Suef	Tractor	Pump	LS	663.761	0.587	591.400	0.633	519.038	0.679	446.677	0.725
14	El-Minya	Draft	Draft	LS	407.456	0.756	329.509	0.805	251.562	0.853	173.615	0.902
15	El-Minya	Tractor	Pump	LS	512.898	0.683	440.467	0.729	368.035	0.775	295.604	0.822
16	El-Minya	Tractor	Pump	MLS	578.717	0.626	512.680	0.670	446.642	0.713	380.605	0.757
17	Sohag	Draft	Draft	LS	656.789	0.620	577.782	0.667	498.775	0.714	419.768	0.761
18	Sohag	Draft	Pump	LS	640.243	0.619	559.594	0.668	478.945	0.717	398.296	0.767
19	Sohag	Tractor	Draft	LS	696.283	0.593	623.496	0.637	550.709	0.681	477.922	0.724
20	Sohag	Tractor	Pump	LS	693.688	0.587	619.337	0.632	544.987	0.677	370.637	0.723
21	Beni-Suef	Tractor	Pump	SS	256.869	0.744	197.863	0.805	138.830	0.866	79.796	0.927

* Ratio of Shadow Wage of the Unskilled Labor to the Market Wage was Initially assumed to be Unity.

Appendix Table (4):   Sensitivity Analysis on the Shadow Price of Capital.

No.	Governorate	Land Prep.	Irrg.	Staple Length	1.300 NSP	1.300 DRC	0.650 50% NSP	0.650 50% DRC	0.910 70% NSP	0.910 70% DRC	1.170 90% NSP	1.170 90% DRC	1.430 NSP	1.430 DRC
1	Kafr El-Sheikh	Draft		ELS	668.586	0.640	774.845	0.593	739.776	0.612	704.708	0.631	669.640	0.650
2	Kafr El-Sheikh	Tractor	Pump	ELS	740.728	0.595	810.800	0.567	790.085	0.578	769.370	0.589	748.656	0.601
3	El-Daqahliya	Draft	Draft	ELS	558.665	0.692	667.935	0.642	631.493	0.662	595.051	0.682	558.610	0.702
4	El-Daqahliya	Tractor	Pump	ELS	637.390	0.643	709.179	0.613	687.605	0.625	666.032	0.637	644.458	0.649
5	El-Daqahliya	Tractor	Pump	LS	744.587	0.561	807.908	0.534	789.364	0.545	770.820	0.556	752.277	0.566
6	El-Sharqia	Draft	Draft	LS	654.781	0.617	750.036	0.572	718.779	0.590	687.523	0.608	656.267	0.627
7	El-Sharqia	Tractor	Pump	LS	716.579	0.575	781.356	0.547	762.192	0.558	743.029	0.569	723.865	0.581
8	El-Menoufia	Draft	Draft	LS	505.374	0.694	636.429	0.624	590.610	0.652	544.791	0.680	498.972	0.708
9	El-Menoufia	Tractor	Draft	LS	583.149	0.647	696.135	0.589	657.553	0.612	618.971	0.636	580.389	0.659
10	El-Menoufia	Draft	Pump	LS	559.673	0.659	650.237	0.614	620.584	0.632	590.930	0.650	561.277	0.668
11	El-Menoufia	Tractor	Pump	LS	644.865	0.611	720.459	0.575	696.853	0.590	673.247	0.604	649.641	0.618
12	Beni-Suef	Draft	Draft	LS	696.211	0.567	812.647	0.504	772.499	0.529	732.351	0.554	692.203	0.579
13	Beni-Suef	Tractor	Pump	LS	759.627	0.517	828.799	0.481	806.201	0.496	783.602	0.510	761.004	0.525
14	El-Minya	Draft	Draft	LS	508.341	0.683	635.553	0.614	591.083	0.641	546.612	0.669	502.142	0.697
15	El-Minya	Tractor	Pump	LS	605.855	0.614	679.110	0.577	656.084	0.592	633.058	0.607	610.032	0.621
16	El-Minya	Tractor	Pump	MLS	662.716	0.560	729.300	0.526	708.689	0.539	688.079	0.553	667.468	0.567
17	Sohag	Draft	Draft	LS	758.445	0.550	878.811	0.489	837.704	0.513	796.002	0.538	754.596	0.562
18	Sohag	Draft	Pump	LS	744.844	0.545	828.069	0.504	801.328	0.521	774.587	0.537	747.845	0.553
19	Sohag	Tractor	Draft	LS	788.747	0.528	898.161	0.473	861.082	0.495	824.003	0.517	786.924	0.539
20	Sohag	Tractor	Pump	LS	788.825	0.519	863.012	0.483	839.892	0.497	816.772	0.512	793.653	0.526
21	Beni-Suef	Tractor	Pump	SS	335.799	0.652	394.479	0.601	374.866	0.621	355.253	0.642	335,640	0.662

Appendix Table (4):   Sensitivity Analysis on the Shadow Price of Capital.

(Continue)

No.	Governorate	Land Prep.	Irrig.	Staple Length	1.690		1.950		2.210		2.470	
					NSP	DRC	NSP	DRC	NSP	DRC	NSP	DRC
1	Kafr El-Sheikh	Draft	Draft	ELS	634.571	0.669	599.503	0.687	564.434	0.706	529.366	0.725
2	Kafr El-Sheikh	Tractor	Pump	ELS	727.941	0.612	707.226	0.623	686.512	0.635	665.797	0.646
3	El-Daqahliya	Draft	Draft	ELS	522.168	0.723	485.726	0.743	449.284	0.763	411.843	0.783
4	El-Daqahliya	Tractor	Pump	ELS	622.884	0.661	601.311	0.673	579.737	0.685	558.163	0.697
5	El-Daqahliya	Tractor	Pump	LS	733.733	0.577	715.189	0.588	696.646	0.599	678.102	0.610
6	El-Sharqia	Draft	Draft	LS	625.011	0.645	593.755	0.663	562.499	0.681	531.242	0.700
7	El-Sharqia	Tractor	Pump	LS	704.702	0.592	685.538	0.604	666.375	0.615	647.211	0.626
8	El-Menoufia	Draft	Draft	LS	453.152	0.735	407.333	0.763	361.514	0.791	315.695	0.819
9	El-Menoufia	Tractor	Draft	LS	541.807	0.682	503.225	0.706	464.642	0.729	426.060	0.752
10	El-Menoufia	Draft	Pump	LS	531.624	0.686	501.970	0.704	472.317	0.723	442.663	0.741
11	El-Menoufia	Tractor	Pump	LS	626.035	0.632	602.430	0.647	578.824	0.661	555.218	0.675
12	Beni-Suef	Draft	Draft	LS	652.055	0.604	611.907	0.629	571.759	0.654	531.611	0.679
13	Beni-Suef	Tractor	Pump	LS	738.405	0.539	715.807	0.553	693.209	0.568	670.610	0.582
14	El-Minya	Draft	Draft	LS	457.671	0.725	413.201	0.752	368.730	0.780	324.260	0.808
15	El-Minya	Tractor	Pump	LS	587.007	0.636	563.981	0.651	540.959	0.665	517.929	0.680
16	El-Minya	Tractor	Pump	MLS	646.858	0.580	626.247	0.594	605.637	0.608	585.026	0.621
17	Sohag	Draft	Draft	LS	713.192	0.587	671.788	0.611	630.383	0.636	588.978	0.661
18	Sohag	Draft	Pump	LS	721.104	0.570	694.363	0.586	667.622	0.602	640.881	0.619
19	Sohag	Tractor	Draft	LS	749.845	0.561	712.766	0.584	675.687	0.606	638.609	0.628
20	Sohag	Tractor	Pump	LS	770.533	0.540	747.414	0.554	724.294	0.568	701.175	0.582
21	Beni-Suef	Tractor	Pump	SS	316.027	0.682	296.414	0.703	276.801	0.723	257.188	0.743

*   The shadow price of Capital was initially assumed to be 1.3 times its market equivalent.

Appendix table (5): Sensitivity Analysis on the Shadow Price of Land[*]
Ginning Process.

No.	Technology		Ginning Comp.	2.275 50%		4.550 100%		8.645 1.99%	
	Governorate – Land – Irrig. – Staple Prep. Length			NSP	DRC	NSP	DRC	NDP	DRC
1	El-Dagahliya – Tractor – Pump – LS		Misr	951.774	0.449	746.034	0.560	423.221	0.761
2	El-Dagahliya – Tractor – Pump – LS		El-Nile	957.228	0.447	751.720	0.558	429.439	0.758
3	El-Dagahliya – Tractor – Pump – LS		El-Arabia	950.158	0.450	744.587	0.561	422.052	0.761
4	El-Dagahliya – Tractor – Pump – LS		El-Wady	952.011	0.449	746.507	0.560	424.095	0.760
5	El-Dagahliya – Tractor – Pump – LS		El-Delta	952.302	0.448	746.990	0.559	424.896	0.759
6	El-Dagahliya – Tractor – Pump – ELS		El-Nile	906.407	0.504	644.523	0.640	223.266	0.885
7	El-Dagahliya – Tractor – Pump – ELS		El-Arabia	899.337	0.506	637.390	0.643	215.878	0.889
8	El-Dagahliya – Tractor – Pump – ELS		El-Delta	901.481	0.505	639.793	0.641	218.722	0.887

* Shadow price of land equales 4.550 times as much as the market value

Appendix Table (6): Sensitivity Analysis on the Shadow Price of Skilled Labor[*]

Ginning Process

No.	Technology		Ginning Comp.	0.500 50%		1.000 100%		1.900 190%	
	Governorate – Land – Irrig. – Staple Prep. Length			NSP	DRC	NSP	DRC	NSP	DRC
1	El-Dagahliya – Tractor – Pump – LS		Misr	778.489	0.551	746.034	0.560	735.134	0.577
2	El-Dagahliya – Tractor – Pump – LS		El-Nile	780.141	0.551	751.720	0.558	748.196	0.570
3	El-Dagahliya – Tractor – Pump – LS		El-Arabia	777.443	0.552	744.587	0.561	732.939	0.578
4	El-Dagahliya – Tractor – Pump – LS		El-Wady	778.324	0.551	746.507	0.560	736.732	0.575
5	El-Dagahliya – Tractor – Pump – LS		El-Delta	778.811	0.551	746.990	0.559	737.178	0.575
6	El-Dagahliya – Tractor – Pump – ELS		El-Nile	676.438	0.632	644.523	0.640	637.210	0.654
7	El-Dagahliya – Tractor – Pump – ELS		El-Arabia	673.740	0.633	637.390	0.643	621.953	0.662
8	El-Dagahliya – Tractor – Pump – ELS		El-Delta	675.108	0.632	639.793	0.641	626.112	0.659

*   Shadow price of skilled labor Equals the market value.

Appendix Table (7):   Sensitivity Analysis on the Shadow Price of Unskilled Labor[*]

Ginning Process

No.	Technology		0.500 50%		1.000 100%		1.900 190%	
	Governorate - Land - Irrig. Staple Prep. Length	Ginning Comp.	NSP	DRC	NSP	DRC	NSP	DRC
1	El-Dagahliya - Tractor - Pump - LS	Misr	988.108	0.428	746.034	0.460	357.820	0.799
2	El-Dagahliya - Tractor - Pump - LS	El-Nile	996.480	0.424	751.720	0.558	358.786	0.799
3	El-Dagahliya - Tractor - Pump - LS	El-Arabia	986.481	0.428	744.587	0.561	356.670	0.800
4	El-Dagahliya - Tractor - Pump - LS	El-Wady	988.042	0.428	746.507	0.560	359.239	0.798
5	El-Dagahliya - Tractor - Pump - LS	El-Delta	988.915	0.427	746.990	0.559	358.991	0.798
6	El-Dagahliya - Tractor - Pump - ELS	El-Nile	922.781	0.495	644.523	0.640	193.792	0.902
7	El-Dagahliya - Tractor - Pump - ELS	El-Arabia	912.783	0.499	637.390	0.643	191.676	0.903
8	El-Dagahliya - Tractor - Pump - ELS	El-Delta	915.217	0.497	639.793	0.641	193.997	0.901

* Shadow price of unskilled labor equals the market value.

Appendix Table (8):   Sensitivity Analysis on the shadow Price of Capital[*]

Ginning Process.

No.	Technology		Ginning Comp.	0.650 50%		1.300 100%		2.470 199%	
	Governorate – Land – Irrig. – Staple Prep. Length			NSP	DRC	NSP	DRC	NSP	DRC
1	El-Dagahliya – Tractor – Pump – LS		Misr	809.156	0.533	746.034	0.560	679.933	0.609
2	El-Dagahliya – Tractor – Pump – LS		El-Nile	815.793	0.530	751.720	0.558	684.022	0.608
3	El-Dagahliya – Tractor – Pump – LS		El-Arabia	807.908	0.534	744.587	0.561	678.102	0.610
4	El-Dagahliya – Tractor – Pump – LS		El-Wady	810.362	0.532	746.507	0.560	679.064	0.610
5	El-Dagahliya – Tractor – Pump – LS		El-Delta	809.840	0.532	746.990	0.559	681.326	0.608
6	El-Dagahliya – Tractor – Pump – ELS		El-Nile	717.064	0.610	644.523	0.640	564.083	0.695
7	El-Dagahliya – Tractor – Pump – ELS		El-Arabia	709.179	0.613	637.390	0.643	558.163	0.967
8	El-Dagahliya – Tractor – Pump – ELS		El-Delta	711.111	0.612	639.793	0.641	561.388	0.695

*   Shadow Price of Capital Egual to 1.30 times the market value.