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I. Introduction

Interventions into the functioning of agricultural input and output markets have been major policy instruments resorted to by governments in developing countries such as Egypt and India. Such interventions have taken various forms including area requirements, imposition of price controls at the farm level, acquisition of part of production through compulsory deliveries, regional restrictions on the movement of products (India), concessional imports to augment domestic supplies, and distribution of grains at subsidized prices with or without rationing (India and Egypt). The basic objectives of these government interventions have been to achieve either specific welfare goals, such as maintenance of low food prices and insuring stable deliveries for low-income consumers (wheat and rice in India), or to augment exportable surpluses (export tax in Thailand), or both (rice in Egypt).

While theoretically effective, the actual implementation of these intervention policies has usually been problematical from the standpoint of achieving the original welfare objective of helping the poor. Thus, on the consumption side, the distribution of cheap food through government ration shops has been largely confined to the urban areas where it has been available to all residents. Since the average income of the urban population is higher than that of the rural population, the quota-cum-distribution scheme tends to result in a perverse income transfer from the poorer to the richer segments of the population. Furthermore, on the production side, quotas have not been

graded progressively according to the size class of farms and, where graded (as in India), have not been effectively enforced.[1]

There is now ample evidence to suggest that the area requirements and compulsory deliveries have affected adversely the income position of the agricultural sector as a whole. Thus, Cuddihy concludes that, "Despite the inexactness of some of the numbers involved, the orders of magnitude do indicate that the policy objective of equity between the rural and urban areas has not been achieved by price management. Incomes in agriculture have been depressed by policy instruments" (Cuddihy, p. 7). At the same time, analysts have drawn attention to the regressive impact of price interventions which resulted in a greater policy-induced inequity within the agricultural sector. Yet, few studies have assessed the quantitative impact of the land quotas and compulsory deliveries on producers' prices and incomes.[2] The objective of this study is to fill this gap. We assess the working of the quota-cum-distribution scheme for rice[3] as it <u>actually</u> operated in Egypt in recent years and examine the extent of income losses and gains sustained by different classes of producers in order to quantify the consequences of the scheme on income distribution <u>within</u> the rural sector.

We present a short description of the actual operation of the scheme and develop a simple model (within a partial equilibrium framework) to trace the effects of compulsory deliveries on producer prices and cash income. We then use plausible sets of parameters for the Egyptian economy to investigate, in particular, whether particular classes of farmers suffered any income loss owing to the operation of the compulsory levies. This is followed by an analysis of the impact of alternative cropping patterns for interregional and intersize class differences in income per feddan.

II. Compulsory Deliveries: A Short Description

Basically, the producer quota scheme is intended to enable the government to procure rice at prices lower than the equilibrium market prices for the purpose of distributing it to the low-income consumers through ration shops. In actual practice, however, the scheme contains many features which rendered the original intention of helping the poor less effective.[4] These features are briefly discussed below.

First, the upper limit to rice production is set by the government through area requirements. The cropping pattern is controlled by the agricultural cooperatives set up in 1952 which provide credit and inputs including fertilizers and seeds.[5] The area limits to delivery crops, such as cotton and rice, are arrived at through a process of ministerial consultations; and the cooperatives are expected to enforce the area requirements with fines for non-compliance.[6] In the case of rice, this is done through water allocation. As is well known, rice is a water-intensive crop that requires special provision of water on a four-day cycle as distinct from other crops such as cotton. From the planting stage on, crop-rotation schedules are enforced through water allocations by agricultural engineers who are attached to the cooperatives.

Second, having set the upper limit to rice production, the government then intervenes (at harvest time) by fixing the quota to be delivered at the government-fixed price. The quota is fixed in proportion to the area planted, with no progression according to size class of farms, so that all farmers large and small have to surrender to the government a fixed quantity of rice per feddan cultivated to the government. Rice is grown in seven governorates in Egypt which are more or less homogenous agroclimatically. There exists

little variation in yields per feddan across farm classes reflecting a relatively stable technology and intensity of labor use across farms and regions. In such a situation, rice production can be expected to increase only when more area is brought under cultivation. As such, although quota is fixed per feddan in actual practice, it approximately amounts to a constant proportion of output for all farms.

Third, since marketed surplus as a proportion of output may be expected to be higher on large farms, the quota as a proportion of marketed surplus may reach unity for small farms but declines as farm size increases. Thus, large producers operate in a dual market where part of the marketed surplus is sold to the government (cooperatives) at the quota price while the balance is sold in the residual market at higher (free-market) prices.[7]

Fourth, consumers also operate in a dual market where limited quantities of certain essential commodities can be bought at government subsidized prices in the ration shops and additional quantities can be bought at higher prices in the residual market. Of all the subsidized commodities, only bread is sold without any quantity limitation.[8] A limited quantity of rice is supplied at subsidized prices through ration shops (whenever available) while any quantity can be bought in the residual free market at higher prices.

Fifth, subsidized distribution of essential commodities is largely confined to ration cardholders in the urban areas so that much of the rural population faces the residual market where prices are usually higher than the ration prices (Abdel Fadil). In recent years, however, the rural areas have increasingly gained access to food subsidies as well (Alderman, von Braun, and Sakr).

What is the likely impact of the above-mentioned quota-cum-area requirements on the prices received by different classes of farmers? For the sake of simplicity, let us assume that consumers are classified into "rich" and "poor" and producers, into "large" and "small."

Although compulsory deliveries apparently reduce the price level received by farmers, the price in the residual free market is pushed upward by government procurement thus partially or totally compensating the larger farmers for the low quota price. This is because, first, quotas reduce the quantity available to private trading channels constituting the residual market (Dantwala; Subbarao, 1978). Second, "quota takes a certain portion of the supply, and gives it to the lower income consumers with the more price-elastic demand. The free market is then left to those consumers with higher incomes with inelastic demand. The effect is then to concentrate the shortages among the consumers with inelastic demand. The higher the allocation to the poor, the greater will be this effect" (Mellor, p. 34).

In the Egyptian context, Abdel Fadil explicitly recognized the possibility of such an increase in the residual free market in rural areas. As he argued: "It is wrong to assume that compulsory deliveries exert no influence on the equilibrium prices in the free market in rural areas. . . . Since a fixed proportional quantity of grain is to be delivered to government, small farmers are forced to be in a deficit position and are obliged to buy back a certain amount of grain on the village free market at higher prices. . . . The decrease in marketable surplus in rural areas, and the increase in the demand for grain from deficit farmers results in an excessive upward pressure on the grain prices" (Abdel Fadil, p. 22).

It needs to be stressed that the Dantwala-Mellor argument for a rise in the price in the residual market seems to hold true in Egypt not only in the short run (typically the zero elasticity after-harvest case) but also in the medium run. This is because, as already pointed out earlier, all farmers in Egypt are subjected not only to compulsory deliveries but also to area requirements and water allotments which severely restrict the freedom of farmers to respond to prices thus rendering the supply curve fairly inelastic in the medium run as well.[9]

III. Compulsory Deliveries: An Analytical Framework[10]

In order to establish whether or not a farmer controlling a particular farm size is hurt or benefited by the scheme of forced deliveries, we need to determine two variables. The first is the equilibrium price level, P_0, that would prevail on the domestic market in the absence of a scheme of forced deliveries. The second is the threshold in the scale of farm sizes beyond which the cash income received from sales is greater with the scheme of forced deliveries and residual free sales than it would be with a fully free market system.

1. Determination of the equilibrium market price

   To simplify the analysis, we assume that government exports are fixed amounts which are not responsive to price and income levels. The supply, Q_0, we deal with is, consequently, that for domestic use

$$Q_0 = Q - E = S + F$$

   where Q is total output, F is the sum of home consumption by farmers and sales on the free market, S is subsidized consumption, and E is

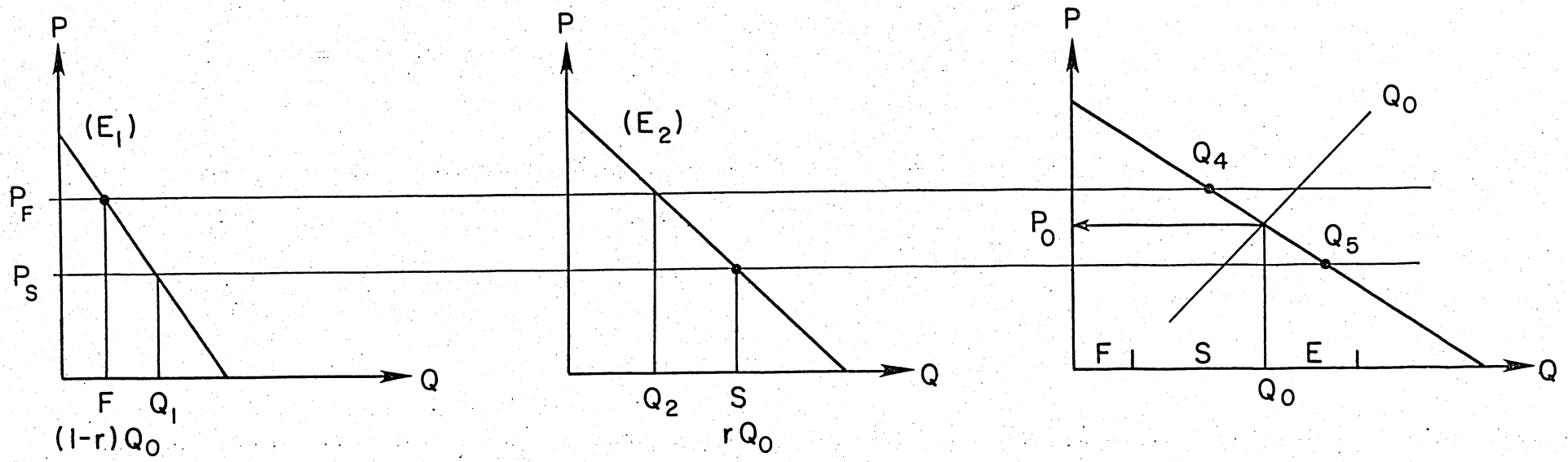
government exports. E is thus treated as a lump-sum tax. What this implies is that the free-market alternative we simulate is one where government maintains forced deliveries for its export program and where P_0 is determined by the supply and demand on the domestic market including the demand for home consumption.

Considering the demand side of the market in figure 1, we have three pieces of information which we can use to derive the total demand for rice. One is the elasticities of demand--E_1 on the residual free market and E_2 on the subsidized market. Farmers' home consumption is included in free-market demand since the opportunity cost of their consumption is the free-market price. A second piece of information is knowledge of point $[P_F, F = (1 - r) Q_0]$ on the residual free market where $r = S/Q_0$ is the share of forced deliveries for domestic subsidies in the total supply for domestic use and P_F is the observed price in the residual free market. A third piece of information is point $(P_S, S = r Q_0)$ on the subsidized market demand where P_S is the consumer subsidized price.

From these three pieces of information, we can (1) estimate point (P_S, Q_1) on the residual free-market demand; (2) estimate point (P_F, Q_2) on the subsidized market demand and aggregate these two demands into the total domestic market demand function; and, once this is obtained, this last equation can be used to (3) estimate the equilibrium free-market price, P_0, corresponding to Q_0.

1. Free-market demand

$$\frac{F - Q_1}{Q_1} = E_1 \frac{P_F - P_S}{P_S} .$$



Free Market, F
(Home consumption, H, plus residual free sales, M)

Subsidized Market, S

Total Domestic Market, Q_0
(Total supply, Q, minus exports, E)

FIGURE 1. Formation of the Equilibrium Price for Rice

Hence,

$$Q_1 = \frac{(1 - r)\, Q_0}{A_1}$$

where $\alpha = P_F/P_S$ and $A_1 = 1 + E_1(\alpha - 1)$.

2. Subsidized market demand

$$\frac{Q_2 - r\, Q_0}{r\, Q_0} = E_2 \frac{P_F - P_S}{P_S} .$$

Hence,

$$Q_2 = r\, Q_0\, A_2,$$

where $A_2 = 1 + E_2(\alpha - 1)$

3. The total demand is, consequently,

$$\text{at } P_F, \qquad Q_3 = Q_0\, B_2$$

$$\text{at } P_S, \qquad Q_4 = Q_0 \frac{B_1}{A_1}$$

where $B_1 = 1 + r\, E_1(\alpha - 1)$, and $B_2 = 1 + r\, E_2(\alpha - 1)$.

Using these two points, the total demand equation can be estimated as

$$P = a + bQ$$

where

$$a = \frac{P_S A_1 B_2 - P_F B_1}{A_1 B_2 - B_1}$$

$$b = \frac{P_F - P_S}{F}\left[\frac{A_1}{A_1 B_2 - B_1}\right].$$

At Q_0, the corresponding price, P_0, is given by

$$P_0 = \frac{A_1(B_2 - 1) P_S + (A_1 - B_1) P_F}{A_1 B_2 - B_1}.$$

2. Determination of minimum share of free-market sales in the domestic marketed surplus.

Shifting now to farm-level data where the estimated P_0 becomes an exogenous variable, we can estimate the minimum share of free sales in the domestic marketed surplus of a particular farm that equates gains and losses from forced deliveries. More exactly, we want to determine the level, M/Q_0, where Q_0 is the total marketed surplus for domestic use decomposed in the sum of forced deliveries for domestic subsidies, S, and free-market sales, M, such that

$$\text{Gain} = (P_F - P_0)\, M \geq (P_0 - P_D)\, S = \text{Loss}.$$

This is obtained for

$$\frac{M}{Q_0} \geq \frac{\beta - \varepsilon}{\alpha - \varepsilon}$$

where $\beta = P_0/P_S$ as estimated above, $\alpha = P_F/P_S$ as observed, and $\epsilon = P_D/P_S$, the observed ratio of delivery quota farm price (P_D) to subsidized consumer price--both set by government.

IV. Specification of the Parameters

To calculate P_0/P_S, we need aggregate information on (1) the share of forced deliveries for the subsidized market in the total supply for domestic use

$$r = \frac{S}{\bar{Q} - E}$$

where $S = \bar{Q} - E$ and $\bar{Q}$ is the total forced delivery and (2) on the elasticities of demand for rice on the residual free market (E_1) and on the subsidized market (E_2). We can then obtain P_0/P_S as a function of P_F/P_S.

We give in table 1 time series data for r between 1970-71 and 1979-80. This is based on an estimation of home consumption by rice producers equal to 26 percent of output. In 1976-77, the year for which the farm management survey information is available, r is equal to .47.

The elasticities of demand are first taken to be equal on both markets. This is because of two reasons. The first is that access to the subsidized market is not determined on a means test basis but available to all consumers where outlets exist. As a result, both rich and poor concur to both markets. Second, there are, as of yet, no available empirical data on price elasticities by income class. We, consequently, use the results of El Gendy who estimated a demand elasticity for rice of -.5.

Since it is known, however, that subsidized outlets are available in the cities, but more rarely so in the countryside, and that urban dwellers have a

TABLE 1

Rice Output and Final Uses

Year	Rice output, Q	Quota and overquota sales to cooperatives, $\bar{Q}$	Rice exports, E	Home consumption, H = .26Q, H	Domestic supply $Q_0 = Q - E$	Subsidized consumption $S = \bar{Q} - E$	$S/Q_0 = r$
	10^3 tons						
1970-71	1,563	750	654	406	909	96	.11
1971-72	1,520	764	515	395	1,005	249	.25
1972-73	1,504	755	456	391	1,048	299	.29
1973-74	1,364	763	298	355	1,066	465	.44
1974-75	1,348	741	136	351	1,212	605	.50
1975-76	1,454	731	104	378	1,350	627	.47
1976-77	1,380	676	211	359	1,169	465	.40
1977-78	1,364	653	200	355	1,164	453	.39
1978-79	1,409	683	154	366	1,255	529	.42
1979-80	1,504	716	175	391	1,329	541	.41

Source: Egypt, Ministry of Agriculture (Cairo, 1981).

per capita income higher than rural inhabitants, we also simulate the case where $E_1 = -.6$ and $E_2 = -.3$. These elasticities reflect the fact that the demand for rice, an essential staple food in Egypt, is more inelastic in the rural than the urban sector.

Once P_0/P_S has been obtained, we can estimate the critical level of free sales as a share of the marketed surplus that insures a net positive gain from the scheme of forced deliveries. In tables 3 and 4, we give estimates of P_0/P_S for alternative values of the price gap, P_F/P_S. In table 3, $r = .47$ and $E_1 = E_2 = -.5$. In table 4, $r = .47$ with $E_1 = -.6$ and $E_2 = -.3$.

The values of M/Q_0 have been calculated for different values of the ratio $\epsilon = P_D/P_S$. To give an idea of the value of prevailing price ratios, α and ϵ, we present available time series evidence in table 2. As it can be seen, ϵ was equal to 1.67 in 1976-77. There are few observations on the gap, α, between free-market and subsidized consumer price. However, this ratio was equal to 1.20 in 1967-68, 2.00 in 1975-76, and was as high as 3.90 in 1980-81.

We see from table 3 that, with $\epsilon = 1.67$, the minimum M/Q_0 for positive gains is .06 with $\alpha = 2$, .28 with $\alpha = 2.1$, etc. In table 4, with $\epsilon = 1.67$, the minimum share of free sales is .35 with $\alpha = 1.9$, .55 with $\alpha = 2.0$, etc. It is interesting to note that the minimum share of free sales increases with P_0/P_S, a relation which is at first sight counter to intuition. Indeed, intuition dictates that the minimum share of free sales for positive gains should decline when the residual free-market price, P_F/P_S, increases. What happens, however, is that P_0 also increases when P_F increases. As a result, a higher P_0 implies that farmers would gain more from elimination of

TABLE 2

Paddy and Rice Prices, 1967–68 to 1978–79

Year	Delivery quota price, P_D	Subsidized consumer price, P_S	Free-market price, P_F	$\varepsilon = P_D/P_S$ [a/]	$\alpha = P_F/P_S$
	L.E. per ton rice				
1967–68	45	50	60	.90	1.20
1968–69	45	50	[b/]	.90	
1969–70	41	50		.82	
1970–71	41	50		.82	
1971–72	41	50		.82	
1972–73	41	50		.82	
1973–74	48	50		.96	
1974–75	60	50		1.20	
1975–76	75	50		1.50	
1976–77	84	50	100	1.67	2.00
1977–78	98	50	105	1.96	2.10
1978–79	98	50	128	1.96	2.56
1979–80	113	50	147	2.26	2.94
1980–81	128	50	195	2.56	3.90

a/ The conversion rate between paddy and rice: 1.50 kg. of paddy = 1 kg. of rice.

b/ Blanks indicate no data available.

TABLE 3

Minimum M/Q_0 for Positive Gains from Forced Deliveries cum Free Sales
for $r = .47$, $E_1 = -.5$, $E_2 = -.5$

$\alpha = \frac{P_F}{P_S}$	$\beta = \frac{P_0}{P_S}$	$\varepsilon = \frac{P_D}{P_S}$ .9	1	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33
1	1.00	1.00	∞	1.00							1.00
1.1	1.05	.75	.50	1.7							
1.2	1.11	.70	.55	-2.0							
1.3	1.17	.68	.57	0							
1.4	1.23	.66	.58	.26	-1.4						
1.5	1.30	.67	.60	.39	- .17	∞	2.18				1.24
1.6	1.37	.67	.62	.47	.15	-1.3					
1.7	1.44	.68	.63	.51	.30	- .30					
1.8	1.52	.69	.65	.56	.40	.07	-1.15				
1.9	1.60	.70	.67	.59	.47	.25	- .30				
2	1.69	.72	.69	.63	.54	.38	.06	-.82	∞	2.82	1.94
2.1	1.79		.72	.67	.60	.48	.28	-.15			
2.2	1.89		.74	.70	.64	.60	.42	.16	-.55		
2.3	1.99			.73	.68	.49	.51	.34	-.03		
2.4	2.11			.76	.73	.68	.60	.49	.27	-3.14	
							large	medium large	small medium large		

TABLE 4

Minimum Share of Free Market Sale (M/Q_0) for Positive Gains from Forced Deliveries cum Free Sales for $r = .47$, $E_1 = -.6$, $E_2 = -.3$

$\alpha = \frac{P_F}{P_S}$	$\beta = \frac{P_0}{P_S}$	$\epsilon = \frac{P_D}{P_S}$ .9	1	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33
1	1.00	1.00	∞								
1.1	1.07	.85	.70	1.43							
1.2	1.14	.80	.70	-1							
1.3	1.22		.73	.38	3.67						
1.4	1.30		.75	.57	- .43						
1.5	1.38		.76	.64	.29	∞					
1.6	1.47		.78	.70	.52	-.30					
1.7	1.56		.80	.74	.62	.30	-3.67				
1.8	1.65			.76	.68	.50	- .15				
1.9	1.75				.74	.63	.35	-1.14			
2	1.85				.78	.70	.55	.12	∞		
2.1	1.96					.77	.67	.48	-.4		
2.2	2.07						.75	.65	.35	2	
2.3	2.18							.74	.60	5	
2.4	2.31								.78	.61	-.29

forced deliveries unless they are able to sell higher shares of their marketed surplus on the residual free market.

In table 5, we present data for the eastern Delta region, the main rice-growing area of Egypt, for three farm classes. We continue to assume that Egypt would have exported the observed 15 percent of output levied on farmers as a tax. We derive the free-market sales as a share of output for domestic use under three conditions. The first is when the quota of forced deliveries is as observed in 1976-77 with both evasions and measurement errors; the second is when it is defined as 50 percent of output; and the third is when it is defined as 1,200 kilograms of paddy per feddan. As can be seen, M/Q_0 increases with farm size indicating that the current system of forced deliveries cum free-market sales favors the larger farms. The range of variation of the share of free-market sales is between 38 percent for the small farms and 69 percent for the larger ones.

Compared to the minimum M/Q_0 for farms to derive positive gains from the system of forced deliveries cum residual free-market sales versus a fully free domestic market alternative given in tables 3 and 4, the observed levels in table 5 show that many farms have indeed benefited from the present system. At the observed price conditions of 1975-76, for instance, with $\alpha = P_F/P_S = 2$ and $\epsilon = P_D/P_S = 1.67$, the threshold of free sales in domestic supply in table 3 is 6 percent, a level that was exceeded in all three farm types. In table 4, the threshold is 55 percent. Forced deliveries consequently only allowed positive gains for the medium and large farms, a total of 16 percent of the farms in the area, while small farms, with insufficient residual free-market sales, are hurt relative to a free domestic market alternative. In general, we see from table 3 that there is a wider range of price combinations

TABLE 5

Data on Paddy Production and Disposition in 11 Villages of the Eastern Delta Region, Egypt, 1975-76

	Unit	Farm class I	Farm class II	Farm class III	Total or average
Farm sizes	feddan	0-3	3-10	10+	
Observations	number	83	44	26	153
Average farm size, A	feddan	1.87	5.23	23.10	6.45
Paddy area per farm, A_r	feddan	.94	2.23	11.60	3.12
Output per farm, Q	kg/paddy	2,356	5,188	21,296	6,388
Home consumption, H	kg/paddy	775	873	1,278	891
Export "tax," E (.15Q)	kg/paddy	353	778	3,194	958
Output for domestic use, $Q_0 = Q - E$	kg/paddy	2,003	4,410	18,102	5,430
Observed quota sales, $\overline{Q}$	kg/paddy	1,173	2,900	12,580	3,608
Quota for domestic use, $S = \overline{Q} - E$	kg/paddy	820	2,122	9,386	2,650
Free-market sales, $M = Q - H - S$	kg/paddy	761	2,193	10,632	2,847
M/Q_0		.38	.50	.59	.52
Estimated quota sales, $\overline{Q} = .5Q$	kg/paddy	1,178	2,594	10,648	3,194
Quota for domestic use, $S = \overline{Q} - E$	kg/paddy	825	1,816	7,454	2,236
Free-market sales, $M = Q - H - S$	kg/paddy	756	2,499	12,564	3,261
M/Q_0		.38	.57	.69	.60
Estimated quota sales, $\overline{Q} = 1{,}200\ A_r$	kg/paddy	1,125	2,680	13,924	3,744
Quota for domestic use, $S = \overline{Q} - E$	kg/paddy	772	1,902	10,730	2,786
Free-market sales, $M = Q - H - S$	kg/paddy	809	2,413	9,288	2,711
M/Q_0		.40	.55	.51	.50
Distribution of farms	percent	83.6	14	2.4	100

Sources:

that results in gains for the large rather than the medium and for the medium rather than the small farms. There are also price conditions where all farms lose, in particular, when residual free-market prices are low. Alternatively, if the residual free-market price is very high, all farms lose since it indicates that the fully free domestic market alternative would have also yielded a high price, this time applicable to the full domestic supply. This is, for example, the case with the price conditions observed in 1980-81 when the residual free-market price was nearly four times higher than the subsidized price.

The conclusion is that the system of forced deliveries cum residual free-market sales can indeed benefit farmers under some price combinations, for example, those observed in 1975-76. In this case, however, the scheme is regressive as larger farms, with a larger share of output sold on the residual free market, derive greater benefits from the system than smaller farms. Under many price conditions, however, and particularly when the residual free-market price is either too high (e.g., $P_F/P_S > 3$ for $P_D/P_S = 1.67$) or too low (e.g., $P_F/P_S < 2$ for $P_D/P_S = 1.67$), all farmers are hurt and would fare better under a fully free domestic price alternative.

V. Area Requirements, Cropping Patterns, and Income Per Feddan

From time to time, the Egyptian government sought to control cropping patterns through statutory requirements on the proportion of area to be allocated to various crops by farmers in different regions. The area under cotton is first determined on the basis of national requirements and, of the balance, area is allocated for wheat and rice, the proportions varying in different regions. Cotton, rice, and wheat have been subjected to direct or indirect price controls whereas direct area controls now exist only for cotton and rice.

An examination of the cropping pattern in different governorates reveals that, while crops such as wheat are grown throughout the country, sorghum, rice, and to a lesser extent cotton are grown in fairly specific zones while sugarcane and maize are concentrated in a few governorates (Ministry of Agriculture, Research Report No. 4). In view of this regional specialization of crops, it is reasonable to expect the area requirements to bear unequally across regions and, thus, to accentuate the interregional differences in income per feddan.

However, even within a region, farmers may divert their cropping pattern away from the government-imposed cropping pattern because of the high profitability of alternative crops such as vegetables and fruits. As already noted earlier, the noncompliance of the area requirements would invite fines. If the marginal return from diversion of area from a controlled crop to a nonquota crop is more remunerative than the fine imposed, farmers may disregard the fine and switch to the nonquota crops at the margin. In addition, the enforcement of payments of fines has been somewhat relaxed in recent years.

Several studies have shown that the net revenues per feddan are higher on summer vegetables (potatoes in particular), fruits (watermelon), and sugarcane which are crops competing for area with cotton and rice (Cuddihy; Ministry of Agriculture, Research Report No. 4). In comparison with rice and cotton, the additional net return (net of cash costs) for the above-mentioned alternative crops is in the range of L.E. 200 to L.E. 250 per feddan which is substantially higher than the fine imposed for noncompliance of rice quota amounting to L.E. 51 per ton of rice not delivered (or L.E. 75 per feddan of rice area diverted, assuming the yield to be 2.5 tons per feddan, and a quota rate of

60 percent of output). It is, therefore, not surprising that there has been a significant shift in the overall cropping pattern for Egypt in favor of sugar-cane, orchards, and summer vegetables (see table 6). It would be interesting to explore the direction of interregional and intersize class distribution of benefits from such a switch to more remunerative crops in terms of gross and net income per feddan.

While a switch to crops such as summer vegetables is thus undoubtedly profitable, whether or not it is feasible in all regions and for all farmers depends on a number of considerations. First, an important constraint is the additional financial (cash) costs involved in such a switch. This itself may vary across different size class farms depending on the extent of hired labor costs.

Table 7 gives the total costs per feddan (including the cash costs on labor and the opportunity cost of land) for raising crops alternative to rice and cotton along with the cash costs as a proportion of total costs. Cash costs, as a proportion of total costs are substantially higher for fruits and vegetables than for rice.[11] Furthermore, labor costs constitute a major item of total costs for the cultivation of vegetables owing to their higher labor intensity (Ministry of Agriculture, Research Report No. 4). As such, financial constraints may be less serious for small farms endowed with a higher ratio of family labor per feddan. However, in regions such as the Delta where cultivation of cotton and rice (which are also labor intensive) is mandatory, financial constraints for the growth of summer vegetables may be serious for small farms because they have to incur costs on hired labor. By contrast, in regions and for farmers not growing rice and cotton, availability

TABLE 6

Crop Areas: Changes in Cropping Patterns, 1950-1954 and 1975-1978

	1950-1954	1975-1978	Change
	1,000 feddans		percent
Sugarcane	96	239	+149.0
Fruits	94	313	+233.0
Summer vegetables and miscellaneous crops	290	930	+221.0
Cereals	2,688	3,348	+ 24.6
Cotton	1,765	1,302	- 26.2
Total cropped area	4,933	6,162	+ 24.4

Source:

TABLE 7

Cash Costs as a Proportion of Total Costs of Production of Rice and Other Summer Crops, 1973-1978

Year	Cost of production											
	Rice			Sugarcane			Vegetables			Fruits		
	Total	Cash	Proportion of total	Total	Cash	Proportion of total	Total	Cash	Proportion of total	Total	Cash	Proportion of total
	L.E. per feddan		percent	L.E. per feddan		percent	L.E. per feddan		percent	L.E. per feddan		percent
1973	50.77	25.55	50.3	81.9	36.6	44.6	123.6	106.8	86.4	97.3	58.0	59.6
1974	58.5	28.7	49.1	99.1	43.1	43.5	129.5	111.6	86.2	101.6	62.6	61.5
1975	70.1	33.4	47.6	127.2	57.2	40.3	155.6	137.1	88.1	114.7	71.1	61.9
1976	86.2	39.4	45.7	166.6	66.3	39.8	197.6	175.1	88.6	145.0	84.3	58.1
1977	91.4	39.6	43.4	186.9	75.8	40.5	224.7	201.5	89.7	172.1	89.2	52.0
1978	101.8	47.0	46.2	199.4	74.9	37.6	251.3	225.9	89.9	292.9	160.4	55.0

Source:

of family labor lowers total cash costs thus rendering growth of vegetables an eventually feasible proposition.

The data obtained by the farm management survey conducted by ERA 2000 in three different regions in Egypt for the year 1978 allow us to test the above hypotheses, especially because these data are reported regionwise and size classwise, separately for the rice-growing Delta region, and the nonrice-growing areas of lower and upper Egypt, along with details of their livestock economy. Since water allocations, area requirements, and price controls are pervasive and still exist for rice, a comparison of rice-growing Delta farms with farms in other regions allows us to trace out the regional impact of government policy in addition to observe the intersize class differences.

The data are summarized in table 8. The Delta region, the most productive zone in Egypt, ironically is also the zone most severely affected by the impact of price and area controls on rice and cotton. This zone produces 96 percent of total rice in Egypt. We computed the (weighted) gross income per feddan at farm gate prices prevailing in 1978 and at the national average yields for 1976-1978. We also computed the net income per feddan (net of all cash costs). The cropping patterns of small and large farms in the three regions are contrasted in juxtaposition with their livestock assets.

In the Delta region, large farms realized gross incomes per feddan substantially higher (16 percent) than small farms essentially by switching cropping patterns in favor of miscellaneous crops such as fruits and vegetables. Small farms were unable to effect similar shifts in cropping pattern owing essentially to the mandatory requirements for the cultivation of rice and cotton and the necessity to grow berseem for animal feed. Such a switch to

TABLE 8

Cropping Patterns and Income Per Feddan by Region and Farm Size, 1978

Crops	Delta region				Lower Egypt				Upper Egypt			
	Small		Large		Small		Large		Small		Large	
	Total area	Proportion of total	Total area	Proportion of total	Total area	Proportion of total	Total area	Proportion of total	Total area	Proportion of total	Total area	Proportion of total
	feddans	percent	feddans	percent	feddans	percent	feddans	percent	feddans	percent	feddans	percent
Rice	.77	26.9	5.00	23.97	0	0	0	0	0	0	0	0
Cotton	.47	16.4	4.04	19.4	0	0	1.30	10.9	.19	7.5	1.41	11.7
Wheat	.54	18.9	3.66	17.5	.17	6.3	1.25	10.4	.42	16.6	2.23	18.6
Maize	.26	9.1	2.52	12.1	.71	26.4	2.33	19.5	.30	11.9	1.73	14.4
Berseem	.82	28.7	4.17	19.9	.56	20.8	2.17	18.1	.42	16.6	1.23	10.2
Miscellaneous (fruits and vegetables)	0	0	1.49	7.1	1.25	46.5	4.92	41.1	1.20	47.4	5.42	45.1
Cultivated area	1.64		12.13		1.18		7.71		1.21		8.36	
Cropped area	2.86	100	20.86	100	2.69	100	11.97	100	2.53	100	12.02	100
Cropping intensity	174		172		228		155		209		144	
Livestock/ cropland	1.60		.30		1.45		.39		1.08		.25	
	L.E.		L.E.		L.E.		L.E.		L.E.		L.E.	
Gross income per feddan	154		179		232		206		190		180	
Net income per feddan	81		85		116		103		95		90	

Source: ERA 2000.

vegetable cultivation would have required heavy financial outlays because family labor of small farms would have been more than fully utilized in the cultivation of rice, cotton, and berseem--the three labor-intensive crops. As it is well known, wage rates are substantially higher in the governorates comprising the Delta region so that vegetable cultivation with hired labor is an infeasible proposition for small farms in the Delta region.[12]

Interestingly, the differences in net income per feddan are much less pronounced than that in gross income as between small and large farms in the Delta region. This is understandable in view of the higher proportion of hired labor to total labor among large farms and of the prevailing high wage rates in the Delta region.

It is significant that, in the nonrice-growing regions of lower and upper Egypt, small farms realized gross income per feddan substantially higher than their counterparts in the Delta region as well as than large farms within the regions. Non-Delta farms devoted a substantial proportion of area to miscellaneous crops such as fruits and vegetables apart from making more intensive use of their land. Apparently, where area requirements are inoperative owing to agroclimatic reasons, small farms grew vegetables overcoming the financial constraints by making more intensive use of family labor for these crops subject, of course, to the constraints imposed by their livestock economy. Thus, the non-Delta small farms made use of both options--a more remunerative cropping pattern and higher cropping intensity--and realized gross incomes higher than large farms.

An interesting aspect of the small farm economy common to all regions of Egypt is the high ratio of livestock to cropland. A complete analysis of all

the factors underlying this phenomenon is beyond the scope of this paper. However, three factors can readily be noted. First, indivisibility (at least one animal is needed for plowing) is an important factor. Second, livestock performs the dual role of an income-generating asset (milk and meat, whose prices have tripled during the 1970s), and a factor of production (draft power) and, at the same time, requires human labor for maintenance. Small farms with abundance of family labor, and with little access to other financial resources (to grow more remunerative crops), find the maintenance of a high ratio of livestock to cropland a worthwhile proposition. Third, livestock is also an easily disposable (marketable) liquid asset enabling small farms to sell in hard times and repurchase in good years (Jodha; Subbarao, 1980): a function extremely important in countries where the institutional financial (credit) market is severely biased against small farms. It is, therefore, not surprising that berseem, with its free-market price rising threefold in the 1970s, occupies an important place in the cropping pattern of small farms in all regions.

To summarize, the adverse regional effects of area controls appear to be far more serious (in terms of income per feddan) than the adverse effects at the intersize class level within a region. The rice Delta region suffered most as a result of price and area control policies. In other regions, small farmers minimized losses by both switching to more remunerative crops and by cultivating their tiny bits of land more intensively. Historically, the experience of many developed countries, as well as other developing countries such as India, suggests that improvements in agricultural productivity occurred via regional specialization of crops. There is no reason why Egypt cannot follow a similar policy of regional specialization. But this can occur only if

the regime of price and area controls supports (rather than hinders) the emergence of profitable monoculture zones. At present, the cumulative effect of price and area controls appears to seriously undermine Egypt's great potential for regional specialization.

Appendix 1

Notations Used

Q = Total output

E = Exports

$Q_0 = Q - E$ = Output for domestic use

S = Subsidized consumption

H = Home consumption by farmers

M = Residual free-market sales

$F = H + M$

$r = S/Q_0$ = Share of domestic supply procured under forced delivery

$\overline{Q} = E + S$ = Total forced delivery

P_0 = Equilibrium domestic price

P_F = Price of residual free-market sales

P_S = Price of subsidized consumption

P_D = Forced delivery quota price

$\varepsilon = P_D/P_S$

$\alpha = P_F/P_S$

$\beta = P_0/P_S$

E_1 = Demand elasticity on the residual free market

E_2 = Demand elasticity on the subsidized market.

Footnotes

[1]The Indian situation was analyzed in Subbarao (1979).

[2]Three earlier studies that dealt specifically with the implications of compulsory deliveries on income distribution are: Abdel Fadil; Radwan and Lee; and de Janvry, Siam, and Gad.

[3]Since 1976, quotas on wheat were dropped. Quotas with fixed prices and area allotments still exist for cotton, beans, lentils, and sugar.

[4]Hayami, Subbarao, and Otsuka argued that, if the producer quota scheme is effectively implemented, it is possible to obtain significant improvements in income distribution with little loss of economic efficiency. However, the scheme is likely to have adverse effects on income distribution in the absence of effective implementation.

[5]For a brief yet insightful analysis of the evolution of cooperatives as instruments of state control over the agricultural economy, see Radwan and Lee, op. cit.

[6]For a detailed description of the modus operandi of the area requirements, see Ministry of Agriculture, Research Report No. 4.

[7]Officially, a "free market" does not exist in Egypt because it is not legally recognized. It is, however, well documented that a free market does exist. The "black market" nature of this free market explains why official price statistics for the transactions it harbors are not available.

[8]Korayem distinguished four delivery mechanisms for public distribution of essential commodities: (1) at fixed (subsidized) prices without any

quantity limitation (bread); (2) use of ration cards (oil, sugar, and tea); (3) use of ration cards whenever the commodity is available (rice); and (4) first-come-first-served (frozen meat and fish).

[9]This is in sharp contrast to the Indian case modeled in Hayami and Subbarao, where there are no area/water requirements and compulsory quotas have (at least theoretically) a built-in progressiveness, with complete exemption for small farms.

[10]See list of notations used in appendix 1.

[11]For sugarcane, the proportion of cash costs to total costs is comparable to rice. However, sugarcane is a long-duration (perennial) industrial crop harvested once in 10 months. As such, farmers' investment is virtually locked in for almost a year--a factor which severely restricts the ability of small farms to grow this crop. Also, sugarcane is concentrated in two governorates.

[12]Time series and cross-section data on wage rates for men and women compiled and circulated by Alan Richards.

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