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Chapter 7

The Impact of Protection and Controls on Agriculture

The effect on Egyptian agriculture of the trade, price, and production restrictions reviewed in the preceding chapter must be assessed. In gauging the impact, positive and negative, of protection and controls we have adopted the conventional approach of estimating effective rates of protection (ERPs) and domestic resource costs (DRCs). (The results are reported on pp. 160 ff. below.) This approach, however, does not yield the information about effects on production and resource allocation needed in this context. Therefore, we have worked out a methodology for direct measurement of the effects on land use of all government intervention in agriculture and applied it to the major crops. (See pp. 168 ff. below.) The details of the methodology and statistical estimates are given in Appendix A. On this basis, conclusions are drawn in regard to the economic effects of price distortions and quantitative regulations. Since income-distributional aspects have played a major role in government policies vis-à-vis agriculture, the final section of the chapter discusses the implications of agricultural price policies for income distribution within that sector.

THE PROTECTIVE POSITION, 1961–1968

For fourteen major crops we have calculated both effective rates of protection (ERP) and domestic resource costs per U.S. dollar (DRC) to show the degree of protection, positive or negative (see Table 7–1). The years 1961, 1963, and 1964 were selected partly because these were the only years for which adequate data on both outputs and inputs by crops were available.[1] Moreover, these are the years straddling the devaluation of 1962: we thus obtain a clear picture of what happened to the competitive position of Egyptian agriculture in connection with the devaluation. The year 1962 was excluded although data were available, since for several crops it cannot be determined to what extent they were sold before or after the devaluation.

ERPs and DRCs were estimated on the basis of standard definitions, but a number of problems in regard to data and concepts were encountered.[2] Here we shall only point out that both ERPs and DRCs are calculated for refined sugar instead of cane, which has no applicable international price.[3] Note, also, that DRCs are based on imputed market prices for land and capital.

Looking first at 1961 in Table 7–1, we find wide differences in the ERPs enjoyed by various crops. Some crops—corn, millet, sesame, wheat, beans, chick-peas, and sugar—enjoyed positive protection, while others—cotton, rice, peanuts, barley, lentils, and onions—suffered negative "protection."[4] Typically, it is the export crops that were negatively "protected." The degree of protection is generally exaggerated and the degree of negative protection overstated for 1961, because value added at international prices was calculated at official exchange rates whereas in fact, at various times during the year, exchange premiums applied. In the autumn of 1961, however, there was a period without premiums and our calculations are relevant for that time. For cotton (including cottonseeds) we should add, as appears in Table 7–3, that the negative protection in 1961 was the result of excessive negative protection for cottonseed; lint was actually positively protected in 1961. Since different cotton varieties have different proportions between lint and seed output, the system obviously discriminated in favor of the varieties with relatively high output of lint. After 1962 both lint and seeds were negatively protected, but seeds much more so than lint.

Domestic resource costs, DRCs, show a fairly similar picture for 1961. Cotton, rice, peanuts, lentils, onions, and chick-peas had DRCs below the official exchange rate; the rest had DRCs higher than the official rate. For barley and chick-peas, the positions are reversed; barley appears as negatively protected but has a DRC below the official rate, while chick-peas, with a high positive ERP, nevertheless show a DRC lower than the official rate. But for the other crops there is a clear correspondence between ERP and DRC (see pp. 188 ff. below).

On the average there was a slight negative protection in 1961 (−0.4 percent), and domestic resource costs were at the level of the official exchange rate. We thus reach the interesting conclusion, already mentioned, that there seems to have been no need in agriculture for protection or devaluation in 1961. From the point of view of resource allocation, the average ERP (close to zero) is, of course, deceptive. Behind the innocent-looking average there is

TABLE 7–1

Effective Rates of Protection (ERPs) and Domestic Resource Costs (DRCs) for Major Field Crops, 1961, 1963, and 1964

	ERP (percent)			DRC (piasters per U.S.$)					
				1961		1963		1964	
	1961	1963	1964	Excl. Trade and Transport Margins	Incl. Trade and Transport Margins	Excl. Trade and Transport Margins	Incl. Trade and Transport Margins	Excl. Trade and Transport Margins	Incl. Trade and Transport Margins
Summer crops									
Cotton (lint and seeds)	−7	−21	−22	29	32	32	36	27	32
Rice	−26	−48	−54	24	29	21	26	24	29
Corn	18	1	−14[a]	35	39	40	45	48[a]	53[a]
Millet	0	−2	16	36	40	49	55	68	75
Peanuts	−50	−52	n.a.	18	22	17	21	n.a.	n.a.
Sesame	35	10	n.a.	35	39	39	44	n.a.	n.a.
Autumn crops									
Corn	16	0	−14	48	52	56	62	48	53
Winter crops									
Wheat	16	−13	−10	45	50	44	49	46	51
Barley	−6	−2	−3	34	38	41	46	43	47
Beans	62	51	51	64	69	60	65	54	59
Lentils	−5	4	n.a.	29	33	38	43	n.a.	n.a.
Onions	−31	−47	−56	14	18	11	16	11	16
Chick-peas	45	56	n.a.	27	31	50	55	n.a.	n.a.

Perennial crops									
Sugar, incl. refined	46	−69	−47	53	53	22	22	30	30
Weighted average									
All 14 crops	−0.4	−25.1	n.a.	32.9	36.4	32.3	36.6	n.a.	n.a.
10 crops	—	−25.2	−24.4	—	—	32.5	36.7	32.7	36.9
Official exchange rate (piasters per U.S.$)				35.2		43.5		43.5	

NOTE: ERP is calculated as domestic value added at domestic prices *minus* domestic value added at international prices (in domestic currency) divided by the latter. DRC is calculated as current market wages *plus* imputed current market rental of land *plus* "normal" market return to capital and management per U.S. dollar of net foreign currency earnings.

SOURCE: B. Hansen and K. Nashashibi, "Protection and Competitiveness in Egyptian Agriculture and Industry," NBER Working Paper 48, New York, 1975, Tables 2 to 10.

a. Average of autumn and summer corn, the latter of rapidly increasing importance.

a wide dispersion of effective rates of protection, presumably with an impact on allocation.

From 1961 to 1963 there was a sharp drop in the effective rate of protection at largely unchanged domestic resource costs, and after the devaluation of 1962, agriculture continued to remain competitive at the old official exchange rate. The fall in the effective rate of protection is mainly the result of the fact that devaluation was not reflected in domestic agricultural prices. Its magnitude is exaggerated for the reason mentioned before—the ERPs of 1961 are at the official exchange rate and disregard the foreign exchange premiums occasionally applied during that year. Partly, however, the decline in the ERPs is due to improved terms of trade; prices for cotton, rice, and sugar improved substantially on international markets. Thus, the strong shift in the ERP position of sugar from 46 percent to −69 percent was largely due to the very high international sugar price in 1963, which was not reflected in domestic sugar prices.

Despite the devaluation and some domestic inflation of factor prices, there was on average little change in the DRCs. This was possible because yields increased substantially from 1961 to 1963 (and 1964),[5] while foreign prices for some outputs increased. In 1964, average DRCs were almost the same as in 1961. We note the very strong decline in the DRC for sugar: with a DRC well above the official exchange rate in 1961, sugar became highly competitive in 1963 due to the international price increase, even at the old exchange rate. The case is interesting because it shows how difficult it can be—on the basis of information for a single year—to judge which commodities should be produced in the longer run. We shall return to the problem in Chapter 8.

In addition to the weighted averages of DRC calculated in Table 7–1 for all crops (fourteen in 1961 and 1963, ten in 1963 and 1964), Table 7–2 shows DRC calculated for a full three-year rotation, including all the big crops, cotton, rice, corn, wheat, and beans, as well as clover. It was not possible, however, to calculate either international value added or domestic resource costs for clover, which is a nontraded commodity (even within the country trade with clover is limited, and an imputed price, based on the value of animal output, would have to be applied). Since, moreover, it is complementary with cotton, it presents great difficulties in estimating "value added." Thus, clover is not really included in the estimate. The DRCs obtained for the rotation as a whole for 1961 and 1963 were slightly above the weighted average calculated for all crops in Table 7–1.

To get an impression of the changes in the protective position of agriculture from 1964 onwards, we calculated a proxy for the ERPs from 1961 to 1968, shown in Table 7–3. On the basis of domestic ex farm prices and international prices converted at the official exchange rate, we have calculated the nominal, de facto rate of protection, that is, the implicit rate of tariff defined

TABLE 7–2

Example of Domestic Resource Costs for Full Three-Year Rotation

(£E per feddan)

	1961		1963	
	Net Foreign Exchange Earnings[a]	DRCs[b]	Net Foreign Exchange Earnings[a]	DRCs[b]
First year				
Clover (1 cut)	—	—	—	—
Cotton	71	64	90	74
Second year				
Wheat	18	26	30	34
Corn (autumn)	19	28	20	29
Third year				
Beans	13	25	20	29
Rice	14	36	70	41
All years	165	179	230	207
DRC, full rotation[c,d]	38		39	
Official exchange rate[d]	35.2		43.5	

SOURCE: B. Hansen and K. Nashashibi, NBER Working Paper 48, New York, 1975, Tables 2, 3, 5, 6, 8, and 9.

a. Converted to £E at official exchange rate.

b. Including domestic trade and transport margins.

c. Obtained by dividing net foreign exchange earnings expressed in U.S. dollars into DRCs expressed in Egyptian pounds.

d. In piasters per U.S. dollar.

as the difference between domestic and international prices divided by the international price. A weighted average was calculated as the difference between the total value of all crops at domestic and at international prices divided by the total value at international prices. The nominal rate of protection, thus defined, differs from the ERP in two regards: there is no deduction for traded and nontraded produced inputs; and nontraded outputs (straw and stalks) are not considered. Moreover, the calculation does not include some small crops.

A comparison between the ERPs in Table 7–1 and the nominal rates in Table 7–3 for the years 1961, 1963, and 1964 shows that the difference be-

TABLE 7–3

Nominal de facto Protection (+) or Taxation (−), Nine Major Field Crops, 1961–1969

(percent)

Crop	1961	1962[a]	1963	1964	1965	1966	1967	1968	1969
Cotton									
Lint	6.0*	—	−10.6	−12.7	−1.4	−17.0	−23.6	−28.8	35.2
Seed	−81.5*	—	−83.7	−85.0	−85.7	−85.6	−84.6	−84.1	−83.5
Total	−12.8	—	−23.1	−27.0	−20.5	−30.5	−33.7	−37.2	41.2
Rice	−22.9	—	−46.3	−52.2	−48.4	−36.4	−36.3	−41.9	−37.5
Corn	20.0	—	4.1	−7.0	−8.6	20.0	34.4	13.5	23.3
Millet	9.2	—	3.0	16.0	18.1	30.1	37.7	11.1	8.7
Wheat	39.7	—	−1.8	−12.5	7.7	20.1	35.2	30.7	35.8
Barley	−3.3	—	−0.6	0.0	−18.3	−12.4	4.2	−10.4	−9.2
Beans	78.3	—	45.2	56.5	38.1	28.3	66.0	4.0	−16.4
Onions	−22.0	—	−45.8	−52.3	−41.1	−49.2	−69.9	−65.2	−69.2
Cane	41.0	—	−50.9	−28.7	130.3	162.6	157.0	158.8	50.5
All crops, weighted average	−0.5	—	−22.6	−24.5	−16.6	−12.4	−15.2	−22.5	−25.3
All crops, weighted index of distortion	17.6	—	28.9	28.7	25.2	31.1	38.4	35.3	36.8

SOURCES: Our calculations; see B. Hansen and K. Nashashibi, NBER Working Paper 48, New York, 1975, Tables 2 to 10, 16, and 18.

a. Exchange rate was changed in May 1962.

tween these two measures is small in most cases, wheat (with a high value for straw) being the major exception. The weighted averages are also quite similar. These findings should cause no surprise; after all, in Egyptian agriculture traded produced inputs are small compared with outputs, and rates of protection for such inputs are small, too. It appears that we can use the nominal rates as a reasonably good proxy for ERPs, at least as far as the weighted averages are concerned.

Four facts then stand out as characteristic of agricultural price policies during the 1960s:

1. The increase in the average negative rate of protection—that is, the rate of "taxation" of agricultural production—that took place from 1961 to 1963 in conjunction with the devaluation of 1962 turns out to have been a permanent increase of "taxation."[6] After a certain decline in 1965 and 1966, the weighted average rate of "taxation" increased to 22 percent in 1968, and to one quarter in 1969. Since 1963, agricultural production has thus been heavily taxed as compared with a state of free trade.

2. This rise in taxation was mainly the result of a widening difference between international prices and domestic ex-farm prices for cotton, rice, and onions, in other words, for the export crops. The taxation of cotton increased steadily from 1963 to 1969, when it reached a peak of 41 percent, with cotton valued at international prices; with cotton valued at domestic prices, the tax rate was more than 50 percent. Rice was taxed at about 43 percent during the years 1963 to 1969. Thus, the policy of the fifties to lower and abolish export taxes was reversed, not through formal export taxes but through the government agencies' buying and selling prices. In itself, this price policy must have been detrimental to exports and generally must have affected allocation in agriculture. Increased land taxes would have been a feasible alternative insofar as government revenues are concerned, but the wider distributional problem of keeping the cost of living low and distribution within agriculture equitable would then have remained to be solved (see below). As we shall try to show in the following section, the price policy is not the whole story, however, because direct intervention in production overlaps with the allocative effects of pricing between crops. But the overall effect of discrimination against agriculture remains. Also, there must have been effects on allocation *within* agriculture.

3. The two big domestic food crops, wheat and corn, show a development entirely different from that of the export crops. Wheat and corn are important import substitutes. From a high level in 1961, 39.7 and 20.0 percent, respectively, protection gradually fell until 1964, when it was negative for both wheat and corn. In 1965 it fell further for corn but increased somewhat for wheat. After 1965 the rate of protection rose again, and levels of about one-third were reached in 1967. This development is closely geared to

the rise and fall of PL480 deliveries of grain. We recall that PL480 deliveries, beginning at the end of the 1950s, increased rapidly during the first half of the 1960s and were abrogated in 1965. The development of domestic producer prices was not the outcome of deliberate government pricing. For wheat the government's official purchasing price remained constant during the 1960s; for corn it remained constant until 1965, when it was increased slightly. What probably happened was a drop in the free market prices (the farmers had the right to sell surplus production in the free market) during the PL480 years of abundant supplies, followed by a rise when supplies became scarcer. (For wheat, however, see below, pp. 179 ff.)

PL480 deliveries thus had an impact upon the domestic prices of wheat and corn. For both crops the acreage fell substantially until 1965. While PL480 aid has often been accused of "distorting" agricultural production in the receiving countries in this fashion therefore harming the development of agriculture, this is just not the case for Egypt. Aside from the fact that acreage restrictions, indirectly, appear to have been more dominant in affecting corn production, the fact is that these crops had been highly protected before PL480 deliveries began pouring in. Protection then disappeared with the inflow of PL480 deliveries, and reappeared when PL480 was abrogated. Thus PL480 actually tended to remove (if only temporarily), rather than cause, distortion in agricultural production.[7]

Cane shows a development in the rate of protection similar to that for wheat and corn, albeit for quite different reasons. After the strong international price increase for sugar in 1963, the rate of protection became negative in 1963 and 1964 because domestic producer prices were kept unchanged by the government. When international prices fell to a low level in 1965, it became positive once more and very high. However, toward the end of the 1960s, cane once again moved toward a competitive position.

For the small crops, finally, development has depended on domestic demand and supply conditions, with relatively little domestic government intervention.

4. The degree of *output* price distortion *within* agriculture—as compared with conditions of free trade—increased substantially from 1961 to 1963, with a further substantial rise in 1967. In Table 7–3 (bottom row) we show a dispersion measure of price distortion. It is defined as the sum of all absolute differences (without regard to sign) between crop values at domestic prices and at international prices, expressed as a percentage of the total crop value at international prices. This measure of price distortion has, of course, a close affinity to the primitive aggregate distortion measure we suggested in Chapter 3 (p. 54).

Our price distortion measure rose from 18 percent in 1961 to 29 percent in 1963, and remained at this level until 1966. In 1967 it jumped further to

38 percent. The growth of price distortion within agriculture was mainly the consequence of the government's failure to pass on to the farmers the full increase in the international prices of cotton and rice that took place during the sixties.

We conclude that it was not only general price discrimination *against* agriculture as a sector that increased sharply from 1961 to 1969 (with a temporary reversal in 1964 and 1965)—price distortion *within* agriculture did, too. In both regards, price distortion probably diminished somewhat again in 1970 when the international prices of cotton and rice declined.

It is one thing, however, to calculate ERPs and DRCs on the standard definitions, as well as indices of price distortion; it is quite another to interpret the numbers that emerge from such calculations. On the assumption of increasing costs (realistic in agriculture), it is usually held that (a) the ERP tells us whether at existing prices an industry (commodity) should expand or contract if protection were removed and general equilibrium prevailed, and (b), ceteris paribus, the larger the ERP (numerically), the larger the expansion (contraction) to be expected. But that does not follow.[8]

The DRCs do inform us in principle whether production in particular industries should be expanded or contracted in general equilibrium without protection, because DRCs are supposed to be measured at shadow prices for domestic resources under conditions of nonprotected general equilibrium, and should be compared with the equilibrium shadow exchange rate. Note, however, that even if we limit ourselves to ranking industries, we now have to know the shadow factor prices. The crux of the matter is, of course, that we do not really know these shadow prices. As a matter of fact, what we have used in the calculations leading to the DRCs in Table 7–1 are the (actual or imputed) market prices of labor, land, and capital (and nontradables) in Egypt for 1961, 1963, and 1964, respectively.

Since the questions that the ERPs and DRCs attempt to answer are important, indeed, for appraising current economic policies and production and development potentialities, and since neither measure is satisfactory as to either theoretical soundness or computational accuracy, we try a different approach to these questions in the following section. Finally, the results of these three approaches to an evaluation of Egypt's agricultural policies will be compared.

AN ATTEMPT TO QUANTIFY THE SUBOPTIMALITY OF CROP POLICIES, 1962–1968

During the last decade, the Egyptian government has had, as we know, the power and machinery to interfere systematically with both agricultural prices and cropping patterns. Certainly, domestic prices differed from international prices, and acreages could differ from what cultivators would have chosen them to be at the given domestic prices.

From an efficiency point of view, the basic question is whether actual crop areas differed from the optimal level at the given international prices. After all, the government might just conceivably have interfered with crop areas to obtain an optimal pattern, even though domestic prices were not aligned with international prices. And it might be perfectly rational to allocate resources via direct command and to use prices exclusively for solving targets of income distribution. The problem is only to do it well! Since the Egyptian government has to some extent favored this kind of policy, it should not be assumed a priori that allocations of land by crop must have been suboptimal just because ERPs and DRCs point in that direction at actual government-determined ex-farm prices. Even less can we infer, under these circumstances, the degree of misallocation of resources, the losses from inefficiency, and so forth from the size of ERPs and DRCs. In addition we have the general problem that even at market-clearing prices, the ERPs and DRCs do not accurately indicate the allocational effects of intervention with inputs. The actual outcome of price distortions must be studied together with direct interference as compared with an optimal allocation before concluding whether government direct intervention has led toward or away from the optimum.

To calculate an optimal cropping pattern at given international prices would be a formidable exercise in operations analysis, and the information needed would probably not be available.[9] Hence, we have chosen a simpler, indirect method which, if the underlying assumptions are correct, may permit us to quantify the degree of suboptimality of the actual cropping pattern and calculate the loss from such suboptimality. (For a detailed discussion of methodology and estimates, see Appendix A.)

Methodology.

Assume that we know what the area response functions are for individual crops in the complete absence of direct government intervention with areas. Such response functions would tell us how cultivators actually reacted in the past to changes in prices and other relevant circumstances, such as yields, available area, labor, water supply, and so forth. Let the response functions be of the Nerlove type. We can then predict crop areas for a period with government controls on the assumption of (1) actual domestic prices and actual (short-term) response functions; (2) actual international prices and actual (short-term) response functions; and (3) actual international prices and hypothetical instantaneous long-term adjustment.

A comparison between prediction 1 and actual crop areas will yield an estimate of the extent to which the government's interference has forced cultivators to deviate from the cropping pattern they would have chosen at the given domestic prices without government area interference.

A comparison between prediction 2 and actual crop areas will tell us whether or not government area interference has forced cultivators to adopt a crop pattern similar to what they would have chosen themselves had the domestic prices been equal to international prices. Should this happen to be the case, the government has performed as well as the market forces would have done at the given international prices without area controls.

A comparison between predictions 2 and 1 will show the difference between the result of private market forces at actual domestic prices and at perfectly free trade and thus illustrate the effects of price distortion.

A comparison between prediction 3 and actual crop area will indicate the distance of the actual pattern from the optimal crop pattern—assuming that the cultivators' long-term response is optimal. If the government could instantly accomplish a cropping pattern according to this prediction, area allocation would be optimal and perhaps better than what the cultivators could accomplish under free trade. It should be understood that such perfect planning would require that there be no extra (social) costs involved in instantaneous adjustment, and that the government be capable of making perfect forecasts of both prices and yields for the crops to be sown. We assume that these conditions are fulfilled.

As Appendix A shows in detail, straightforward application of the conventional neoclassical trade model at given resources and Hicks-neutral technical progress, linearization, and the introduction of a special variable, K (to account for past government restrictions on cotton acreage) lead directly to the following (reduced form) area response function of the Nerlove type:

$$A_i = \alpha_{1i} + \alpha_{2i}(F_i)_{-1} + \alpha_{3i}A_{-1} + \alpha_{4i}A_{-2} + \alpha_{5i}L + \alpha_{6i}L_{-1} \qquad (1)$$
$$+ \alpha_{7i}W_T + \alpha_{8i}W_{T-1} + \alpha_{9i}K + \alpha_{10i}(A_i)_{-1},$$

where the α's are coefficients, A_i denotes area of crop i, A, total crop area, L, total labor input in agriculture, W, total water supply (discharge of Nile at Aswan), and K expresses government restrictions on the cotton acreage. The variable F_i expresses relative profitability of crop i and is defined as the ratio of output value per feddan of crop i to a weighted average of output values per feddan for all crops. F_i is influenced by both relative prices and relative yields.

These response functions were estimated on the basis of data for the years 1913 to 1961. The estimates—with $K = 0$—were then used for predictions 1 and 2 for the years 1962 to 1968. For prediction 3, the "optimal area," we used the stationary form, deleting K,

$$A_i = \frac{\alpha_{1i}}{1 - \alpha_{10i}} + \frac{\alpha_{2i}}{1 - \alpha_{10i}} F_i + \frac{\alpha_{3i} + \alpha_{4i}}{1 - \alpha_{10i}} A \qquad (2)$$

$$+ \frac{\alpha_{5i} + \alpha_{6i}}{1 - \alpha_{10i}} L + \frac{\alpha_{7i} + \alpha_{8i}}{1 - \alpha_{10i}} W_\tau .$$

In both equations (1) and (2), the index τ, attached to water, refers to the months May–June for summer and autumn crops and to September of the preceding year for winter and perennial crops.

The results of the predictions are given in Appendix A, Table A–3, and depicted in Charts 7–1 to 7–11. Three estimates were made of all response functions, a least squares estimate (denoted L.S.), and instrumental variables estimates, Step 1 (I.V.1) and Step 2 (I.V.2). Since the L.S. is biased and I.V.2 has theoretical advantages over I.V.1, we have used the I.V.2 estimate wherever possible. However, in some cases this estimate had to be given up for computational reasons, or it led to unstable response functions. In such cases I.V.1 was chosen. In one case I.V.1 led to an unstable response function and the L.S. had to be used. The charts indicate which estimate is used.

The Predictions for 1962–1968.

Our area response functions are estimated on the basis of data for the period 1913–1961. In applying the response functions to the years 1962 to 1968, the conventional procedure would be to compare predictions with actual developments during these years to test the predictive power of our estimated functions. We are prevented from proceeding like this because we know that our functions are not well-specified for these years: government intervention was much more extensive and took on other forms than during the estimation period. Indeed, we want to use the deviation of actual from predicted acreage as a measure of the impact of government intervention. This leaves us in the awkward position of having to accept our estimated response functions as articles of faith for the period 1962–1968, although it is clear that, even if the functions should happen to be correctly specified for 1913–1961, that may not be the case for 1962–1968—quite apart from the problem of the nature and extension of controls (for example, the effects of the radical change in the water supply after 1964 may not be correctly described by the water variable in the response functions).

A simple test of the predictive power of our model could, nonetheless, be made for 1962 because that year was relatively free from direct intervention in acreages: a comparison was made between the errors of prediction 1 and the errors of two "primitive" predictions. Prediction 1 was clearly superior to both kinds of primitive prediction. This test offers us little comfort, however, because ours is the much more ambitious task of forecasting recursively all the years from 1962 to 1968.

Moreover, it is very disturbing for an analysis of the predictions that theoretical confidence limits for our kind of problem have not been established to the best of our knowledge. A related problem is that, while the coefficient of lagged relative output-value, F_i, in all cases (except corn, millet, and wheat, where the coefficient is very close to zero in any case) and the coefficient for the lagged acreage (in most cases) are significantly different from zero, the coefficients for the other determinants—total acreage, labor, and water—more often than not are insignificant in regard to sign. This latter circumstance is not without importance for total acreage and labor, although these did not change much from 1962 to 1968; in relation to water it takes on primary importance because water supply changed so much beginning with 1965, far beyond anything experienced during the period of estimation. All we can do about this problem is to throw in whatever à priori knowledge we have about the influence of water on the individual crops.

We shall keep these problems in mind in interpreting the predictions, and consider for each particular crop whether other systematic factors beside controls may have caused actual developments to deviate from predictions or whether some coefficients determined with great uncertainty are leading us astray. But generally we are disregarding stochastic disturbances and treat our estimated response functions as if they exactly and correctly explained the development of crop acreages in the absence of controls—unless we have positive reasons for not doing so.

Cotton

We know that cotton acreage has been subject to government interference and that 1965 was the year when the government's administrative capability for controlling the cotton acreage was greatly enhanced through the cooperative system.

A glance at Chart 7–1 immediately reveals that something dramatic happened between 1964 and 1965. From 1962 through 1964, actual cotton acreages had been very close to the acreages predicted on the basis of actual ex-farm prices, assuming no controls (prediction 1). In 1965, the actual acreage jumped up by about 20 percent, while prediction 1 shows almost no change for acreage. From 1965 onwards there are declines in both actual and predicted area, with actual area running 200,000 to 300,000 feddan above the forecast until 1968, when the gap shrinks to about 75,000 feddan.

There is little doubt that the upward shift in actual acreage in 1965 can be ascribed to government intervention. The acreage allotments to cotton were 1.8 million feddan for 1961 and 1962, but were lowered to 1.6 million feddan for 1963 and 1964. In 1964, the allotment was only slightly larger than actual

Legend to Charts 7–1 to 7–11

Line 1 represents area prediction 1: farmers' response to actual domestic prices

Line 2 represents area prediction 2: farmers' response to hypothetical domestic prices = current international prices

Line 3 represents area prediction 3: "optimal area," i.e., instantaneous long-term adjustment to current international prices

Vertical line represents standard error of regression (SER)

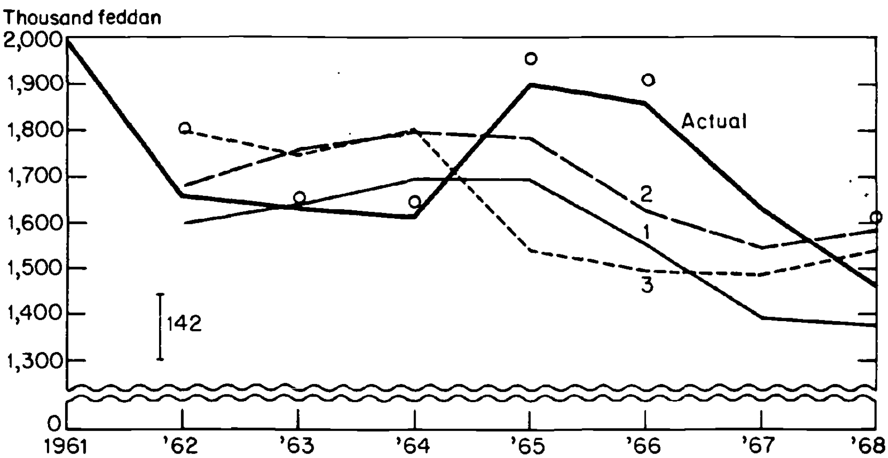
Circles represent official acreage allotments (plans)

Individual years are agricultural years: previous November 1 to current October 31

Sources: Actual area: NBER Working Paper 48, New York, 1975; predictions 1, 2, and 3: Table A–3; SER: Table A–2; official acreage allotments: Ministry of Planning, Cairo. We have assumed that the Ministry's "year" is the budget year and that the crops are included in the budget year in which they are harvested—the only solution for making the Ministry of Planning data consistent with those of the Ministry of Agriculture.

CHART 7–1

Cotton: Actual versus Predicted Crop Areas



acreage.[10] With little administrative power behind them, the allotments for those years were probably little more than passive predictions. For 1965, however, the allotment was increased to 1.95 million feddan.[11] The upward shift in actual acreage by 0.3 million feddan in 1965 reflects both the increased allotment and the strengthened arm of the government.

The change in water supply in 1965 stemming from the High Dam at Aswan can easily be dismissed as a possible explanation of the upward shift in actual acreage. Taking our response function at face value, the increased water supply that year should have led to a fall in the cotton acreage; both in the short and the long run, water is estimated to have a negative (albeit insignificant at the 5 percent level) impact on cotton acreage (see Appendix A, Table A–2). It might be argued, however, that the response function does not correctively identify the impact of water supply on cotton acreage. While undoubtedly in the short term greater water supply leads to more rice cultivation at the expense of other summer crops, including cotton, in the long term increased summer water supply has historically gone together with an increase in perennial irrigation and in total summer crop acreage—and therefore in cotton cultivation. Our response function includes both total crop acreage and water supply as explanatory variables, and due to the long-term correlation between these two, our estimates may not correctly distribute their roles.[12] At any rate, the positive long-term effect of water supply on the cotton acreage should work through an expansion of perennial irrigation, and we know that conversion in Upper Egypt from basin to perennial irrigation, which should be one of the major benefits of the High Dam, did not take place immediately after the closure of the Dam and had made only partial progress by the end of the sixties.

But the possibility should not be excluded that part of the downward trend in all three predictions from 1965 on is due to mis-specification in this regard. Also, note the low significance of the negative sign of the coefficients for water. Disregarding the change in water supply as of 1964, prediction 3 ("optimal acreage") would show only a slight decline in 1965 and 1964; and 1968 would again be about the same as in 1964. Since relative output value at domestic prices, F_{cotton}, fell sharply in 1965 and 1966, predictions 1 and 2 would show a decline in 1966 and 1967, even apart from water.

Why, then, did the authorities push cotton acreage so strongly in 1965? It is clear that export considerations were responsible, but not nearly as clear how the authorities reached their decision. Having no information about the government's internal deliberations, we have to infer our answers from circumstantial evidence. The strong fall in "optimal acreage," as just pointed out, may not be significant, but there is nothing to indicate that the true optimum should be larger than for 1964; on the contrary, the relative output-value of cotton was lower in 1965 than in 1964. It is true that prediction 2, showing farmers' hypothetical short-term response to international prices did point to a substantially larger acreage in 1964 than the actual one (almost 0.2 million feddan), and to a continued high level for 1965. The acreage increase in 1965 could thus be interpreted as a delayed government overreaction to international prices, as if the authorities had reacted to international prices in much the same way as the farmers had done in the past. It appears, however, that the reactions of the authorities were based, rather, on some kind of "commodity balance" thinking. When export sales were brisk and stocks depleted

TABLE 7–4

Cotton Acreage, Export Volume, and International Prices, 1962–63 to 1968–69

	Acreage (000 feddan)			Relative Output Value at International Prices (F_{cotton})[b]	
	Actual	Allotted	Export Volume (000 MK)[a]	(Index)	International Cotton Price (£E per MT)
1962–63	1,627	—	6,061	2.06	303
1963–64	1,627	1,850	5,835	1.97	311
1964–65	1,611	1,630	6,843	2.11	353
1965–66	1,900	1,950	6,848	1.84	345
1966–67	1,859	1,900	6,043	1.86	365
1967–68	1,626	n.a.	5,194	2.04	416
1968–69	1,464	1,600	4,783	2.20	457

NOTE: The year is the cotton year September 1–August 31. The acreage is for the crop harvested at the beginning of the cotton year and sown at the middle of the preceding cotton year; the figures are for acreage sown.

SOURCES: Acreage: B. Hansen and K. Nashashibi, NBER Working Paper No. 48, New York, 1975; F_{cotton}: Table A–4; international cotton price: B. Hansen and K. Nashashibi, ibid., Table 17; export volume: *Economic Bulletin*, N.B.E., 1969.

a. MK = metric kantars (= 50 kg).

b. See Table A–4.

in 1964, the government reacted by expanding the cotton acreage, and a sort of "cobweb cycle" was generated during these years, with acreage lagging one year behind the export volume. Table 7–4 gives figures for acreage, export volume, relative output-value of cotton in terms of international prices (F_{cotton}), and the international cotton price itself.

While export volume, relative output value in terms of international prices, as well as the international cotton price, all could explain the acreage expansion from 1964 to 1965, only the (lagged) export volume can explain the subsequent development: a continued large allotment and cotton acreage in 1966, followed by a fall in acreage in 1967 and 1968. (We are assuming that the actual acreage in 1967–68 roughly reflect the allotments.) The allotment for cotton was cut down from the 1967 level to about 1.6 million feddan in 1968.[13] The export volume in a particular year is, in turn, determined by foreign demand, Egyptian acreage, yield, and surplus stocks. Since the Egyptian authorities are known to think in terms of commodity balances, it seems clear that we have here the basic explanation of the cotton acreage policy. More appropriate forecasting methods would clearly have led to a different acreage policy.

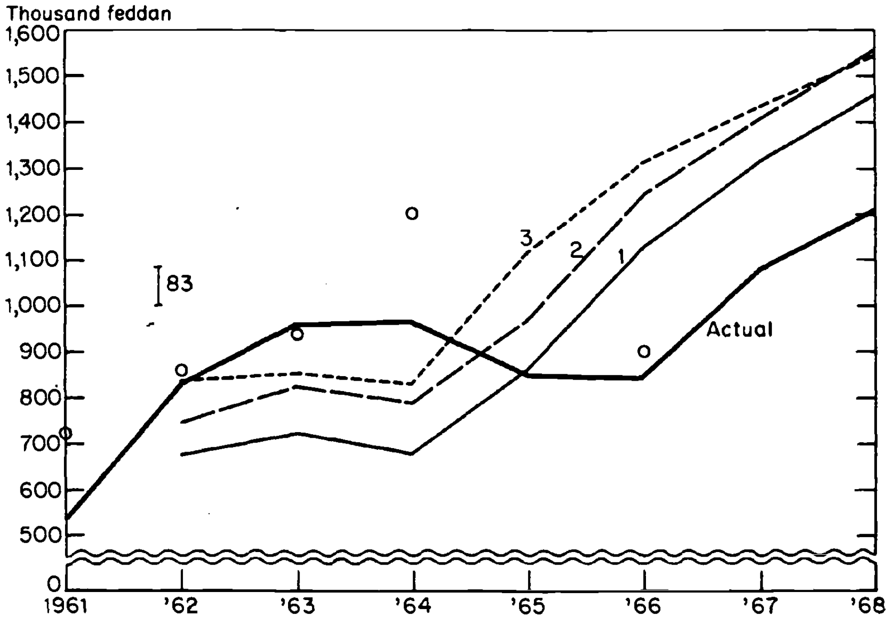
How suboptimal was the cotton acreage policy? Taking our prediction of the optimal area (prediction 3) at face value, it would seem that, after having been somewhat below optimal from 1962 through 1964, the actual area was about 0.4 million feddan too large in 1965 and 1966. This amounts to a misallocation of about 4 percent of the total crop area in the country. The downtrend in the predicted optimal area from 1965 on is due exclusively to the enlarged water supply. As already pointed out, our estimated response function may exaggerate the negative effects of water on the cotton acreage. The relative output-value of cotton—F_{cotton}—was about the same in 1967 as in 1962, and the same in 1968 as in 1964. We cannot exclude the possibility that the cotton acreage was again about optimal already in 1967 and that it even may have been suboptimal in 1968. All we can say with some confidence, therefore, is that the cotton acreage in 1965 and 1966 was significantly higher—perhaps more than 25 percent—than the true optimum, whereas for the other years it may not have been very different from the optimum.

RICE

Rice is the second big export crop the government was much concerned about during the sixties. Here, too, it is immediately clear from Chart 7–2

CHART 7–2

Rice: Actual versus Predicted Crop Areas



that something dramatic happened around 1965; while prediction 1 (farmers' response at actual ex-farm prices without controls) points to a strong increase that year, actual acreage fell substantially. Clearly this was an inevitable result of the increase in cotton acreage. The government could not push up the cotton acreage by 300,000 feddan without causing the acreage for other summer crops (rice and maize) to fall.

The picture is complicated by the fact that prediction 1, based on actual ex-farm prices, indicates a much lower rice acreage than the actual one from 1962 through 1964. Most probably it is again the water supply variable that causes problems. We note first (Appendix A, Table A–2) that the unlagged water coefficient in the estimated response function for rice is large, highly significant, and positive, as should be expected, while the lagged coefficient is small and insignificant. It should also be recalled that, as an indicator of water supply, we have used the monthly discharge of the Nile at Aswan in May–June. The discharge at Aswan at a given point of time may be a relatively poor indicator for the simultaneous water supply to the fields in the Delta, where most of the rice is grown (see Chapter 6, p. 146). Since the need for boosting exports began to be felt strongly already in 1961, when both the cotton and rice crops failed and exchange reserves were exhausted, the authorities were apparently able to shift the irrigation patterns to the advantage of rice cultivation—hence the high level of actual rice acreage from 1962 to 1964.[14] Note that the actual acreages in 1962 and 1963 correspond to the plans. For 1964 the plan was unrealistically high, but acreage continued to increase.[15]

All this, however, does not imply that rice cultivation should have diminished when summer water supply increased in 1965. Plan figures for 1965 are not available, but in this year the authorities must have deliberately sacrificed rice acreage to expand cotton acreage. They may have been influenced by the fact that the relative output-value of rice—F_{rice}—in terms of international prices fell by about 8 percent from 1963 to 1964. Also, in 1966, for which the plan is again available, rice acreage was kept down despite a strong fall in the relative international output-value of cotton and an almost equally sharp rise in that of rice. Only when the cotton acreage was allowed to decline in 1967 and 1968 did the rice acreage increase. Thus, both cotton and rice (as well as corn, see below) acreages seem to have been controlled largely in response to the exports of cotton, with a one year lag. This is not an optimal system of control—unless, of course, the Egyptian acreage policies were linked to the bilateral trade agreements with and the demands from the Soviet Union. In fact, the fluctuations in cotton exports seem to have been geared to the yield of long staple cotton in the Soviet Union, and to some extent Egyptian agriculture thus may have served as a buffer for unexpected cotton crop fluctuations in the Soviet Union.

How far, then, was the actual rice acreage off the optimum? If we admit that our water specification may be deficient by ignoring the storage possibilities in the Delta[16] and by exaggerating the impact of water from 1965 on,[17] there is little we can say except that the rice acreage must have been substantially below the optimum level in 1965 and 1966, and perhaps also in 1967 and 1968.

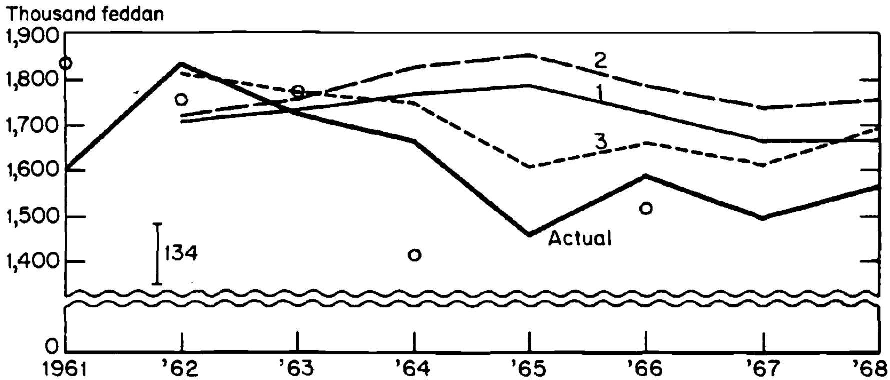
CORN

Corn is the third big summer–autumn crop to be influenced by the policy changes in 1965. We find that prediction 1, based on actual ex-farm prices, explains the actual acreage fairly well until 1964, although the direction of change is wrong. In 1965, contrary to the forecast of a continued increase, there is a substantial drop in the corn acreage, as should be expected considering the expansion in cotton acreage. It should be recalled that the authorities had good reasons for planning a decline in the production of cereals for domestic consumption from 1962 to 1965 (and perhaps even 1966). The inflow of PL480 aid reached a high level during this period, and, although American corn is not a good substitute for Egyptian "durra" as a food grain, one should certainly expect some impact on domestic production. In fact, the government planned for a sharp contraction in corn acreage already in 1964, probably related to the excessive expansion planned for rice.

The forecasts for the (total) corn acreage hide the strong shift from autumn (short season) to summer (full season) corn that took place mainly after 1964, partly made possible by the increase in water supply during the spring. The yield of summer corn is about 50 percent higher than that of

CHART 7–3

Corn: Actual versus Predicted Crop Areas



autumn corn. Our estimates for the period 1913–1961 show a negative, albeit small, impact of the greater water supply on total corn acreage, but our model does not distinguish between summer and autumn corn. Since an increase in water supply, however, raises average yield through the relative increase of summer corn, it also raises output value per feddan and thereby the *F*-variable. For corn, the water and the *F*-variable tend to be correlated, and possibly our estimate may not distribute the roles played by water supply and relative profitability correctly.

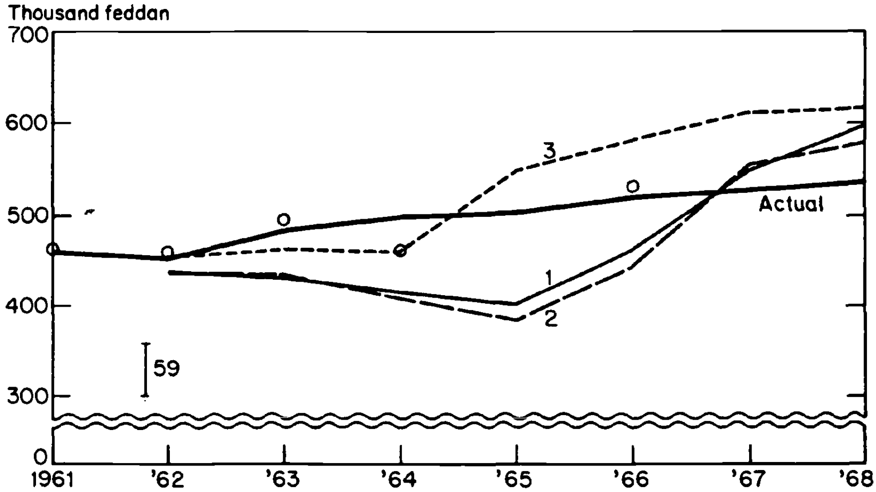
We note, nonetheless, that prediction 3 (the optimal acreage) predicts the movements of the actual acreage during the whole period fairly well, though with a slight upward drift, suggesting that government interference may have brought the acreage closer to optimum than the price mechanisms under free trade might have done.

MILLET

This subsistence food grain is mainly grown in Upper Egypt, and we should not expect cotton controls to have significant repercussions on its acreage. Actual acreage has been expanding slowly (together with labor), whereas the forecast at actual ex-farm prices first shows a slow decrease until 1965 and then a rapid increase. The actual development follows planned acreage fairly accurately and it would seem that here government interference could be the proper explanation for the increase in acreage.

CHART 7–4

Millet: Actual versus Predicted Crop Areas

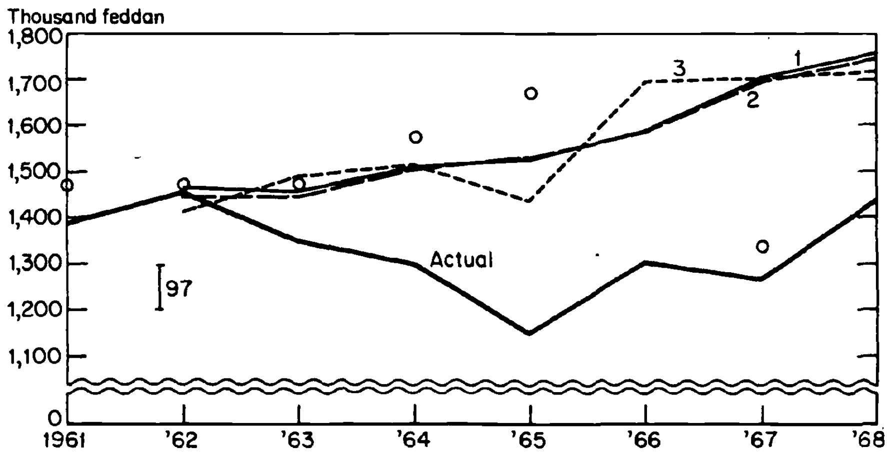


WHEAT

One would be inclined to expect that during the years of the PL480 wheat inflow government efforts were directed at limiting the wheat area and that, once PL480 aid was cut off and wheat supply suddenly became a serious problem, planning aimed at increasing the wheat area. Actually, available acreage plan figures show almost the opposite development (see Chart 7–5). Through 1963 the planned area was kept constant at 1.475 million feddan. It was increased to 1.575 million feddan for 1964—before there was any doubt about the continuation of PL480 aid. The uptrend continued to 1.672 million feddan for 1965, but here we might see the influence of deteriorating relations with the United States, although the wheat shipment agreement did not lapse until July 1965 and a six-month extension was then obtained. The plan figure for 1966 is, unfortunately, not available, but for 1967 (that is, for the wheat crop sown in November–December 1966) the planned area was cut down to 1.338 million feddan.

These developments in the planned wheat area are hard to understand, unless the Egyptian requests for PL480 shipments are seen as stemming from the shortfalls of the actual areas as compared with the planned ones and, hence, of actual as compared with planned production. But then we have to explain why the actual wheat acreage fell so sharply until 1965 and then started increasing again, thus moving opposite to the plan figures. Our model does not help us to understand this discrepancy; prediction 1 (at actual ex-

CHART 7–5
Wheat: Actual versus Predicted Crop Areas



farm prices) points to a steady increase in the wheat area over the whole period from 1962 to 1968.

This is a situation where a general economist would see no problems. A glance at the relative wheat price, or, better still, the relative profitability indicator, *F*, in Appendix A (Table A–4) seems to explain everything fairly well. For wheat, *F*, calculated at ex-farm prices, fell by 25 percent from 1961 to 1964 and rose by 8 percent from 1964 to 1967. From 1962 to 1965 the acreage fell by 20 percent, and, at a short-term price elasticity of 0.8, the drop would be explained (assuming a one-year lag) by relative profitability. Profitability explains less of the increase from 1964 to 1967, unless we assume a somewhat higher short-term elasticity. A priori, such elasticities would look a bit high, but not impossible. The problem is that our econometric estimates for 1913–1961 yield a very low short-term *F* elasticity for wheat—0.03. It is true that the estimate for the coefficient of *F* is very imprecise, but even if we assume the coefficient's value to be equal to the estimate *plus* three standard deviations, the elasticity would still reach only 0.15.

This raises the question whether the elasticity of the wheat acreage with respect to *F* may have increased drastically from the 1913–1961 period to the prediction period. It stands to reason that over time wheat has become less and less of a subsistence crop; this in itself tends to increase elasticity. An important contributing factor might also be the compulsory delivery of wheat. During the period of prediction, farmers were obligated to deliver a certain proportion of their wheat crop to the government at relatively low fixed producer's prices. The average ex-farm price actually obtained by the farmers should reflect this arrangement for farmers who normally sold the wheat crop. But for subsistence croppers it may have also meant forced sales beyond what they would normally have contemplated. If wheat was suddenly forcibly transformed this way into a (low-priced) cash crop, it made sense for farmers to shift to a more profitable cash crop or to a subsistence crop without compulsory deliveries—hence the higher response elasticity during the period of prediction.

We note that from 1963 onward actual acreage was below the optimal level. The sudden growth in optimal acreage from 1965 to 1966 is related to the diminution in the September flow of water at Aswan. Our response functions show wheat as negatively dependent upon water supply, but the relatively large coefficients are not significantly different from zero even at the 5 percent level, and a priori there seems to be no reason for such a strong negative relationship. With a price elasticity close to zero, the true optimal area may therefore have been of the same order of magnitude in 1968 as in 1962, and by 1968 the actual area could have become approximately optimal again. Thus, it would seem that the actual wheat area was substantially below the true optimum from 1963 to 1967. This result is of some interest because it is frequently contended by specialists that wheat is an inferior crop that should not be grown in Egypt to any significant extent.[18]

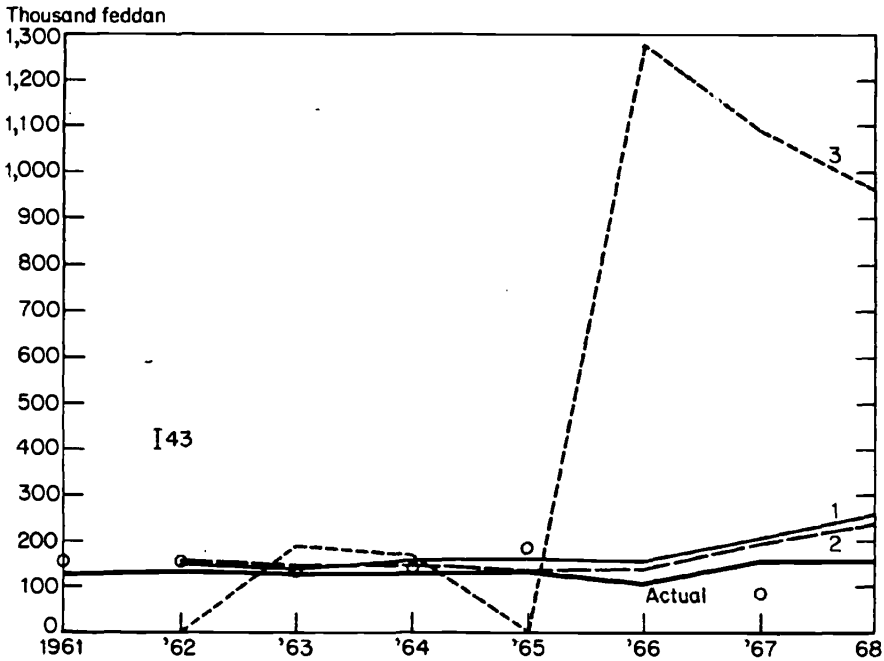
The conclusion would thus appear to be that the reduction in the actual wheat acreage and its suboptimality were, indeed, a consequence of government intervention, albeit not via acreage but via compulsory deliveries at low prices. The latter, obviously intended to increase urban supply, was thus counterproductive in regard to area cultivated. The efforts to bolster wheat acreage and, at the same time, enforce deliveries at low prices were inconsistent measures, with the latter taking the upper hand in affecting actual acreage.

BARLEY

Barley is the crop for which the deficiencies of specification in the acreage response function may be most serious. To the extent that it grows on the coastal strip, it depends on rainfall rather than on Nile water. It is not generally part of the standard rotations and does not compete with other crops. Nonetheless, there is a partly significant, strongly negative influence from the

CHART 7–6

Barley: Actual versus Predicted Crop Areas



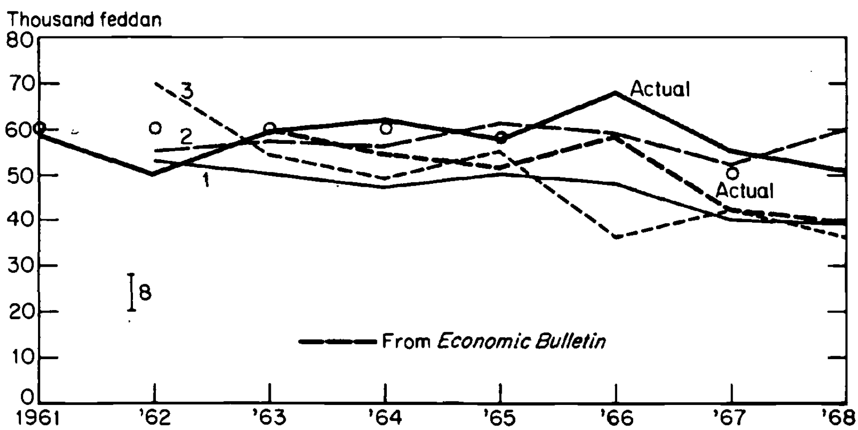
water variable. The barley acreage diminished strongly from 1913 to 1961, together with the expansion of cotton in the northern part of the Delta alongside the increase in water supply; but this historical relation does not exist any longer. Prediction 1 explains the actual acreage fairly well, although it is persistently running at a slightly higher level. This may be due to government interference—beginning with 1963, barley was banned in certain regions in the northern part of the Delta. According to prediction 3, barley should not have been grown at all in 1962 and 1965, the optimal acreage being negative for these years. From 1965 to 1966, the optimal acreage shoots up to 10 times the actual acreage. This enormous increase is exclusively related to the fall in the September flood discharge at Aswan from 1965 on. It might have been better to forecast without using the water variable after that time, in which case the optimal acreage would have become negative for all three years from 1965 to 1968. This prediction for the optimum for 1962–1968 probably correctly reflects the fate of barley in the standard rotation but cannot be true for the coastal strip, where nothing else can be grown.

Winter Onions

Although onions are a secondary, albeit potentially important, export crop, the government has always been interested in promoting their cultivation. The actual acreage from 1963 to 1968 was somewhat larger than prediction 1, the difference probably indicating government interference. Plan figures are available but appear to be simple, passive forecasts. It is noteworthy that prediction 2 (farmers' hypothetical response at international prices) predicts the actual area with great precision. The optimal acreage,

CHART 7–7

Onions (Winter): Actual versus Predicted Crop Areas



according to prediction 3, in 1962 was somewhat higher than the actual area, but then runs somewhat below it until 1965, when it drops substantially. This drop is related to the change in water supply, and once more the possibility of mis-specification has to be considered.

The estimate of the response function shows positive but insignificant coefficients for the water variable. These may be expected to have positive signs, onions being highly dependent upon water supply. They are sensitive, however, to overwatering, so that a linear specification may be wrong, and the sharp reduction in the September 1965 discharge need not necessarily imply that winter onions on land with perennial irrigation got less water than before. The decisive factor after 1965 is, rather, that basin irrigation diminished and perennial irrigation expanded, and this should have a positive effect on the onion acreage. Prediction 3 should probably be disregarded altogether for the years 1966, 1967, and 1968, when the true optimal acreage may have been increasing.

Beans

Here is a crop with an almost perfect explanation by prediction 1 (farmers' response to actual ex-farm prices) of the actual area. This could be taken to mean that direct government intervention with the acreage has been negligible or totally unsuccessful.[19] Plan figures are available; they tend to be at the level of the actual figures, and are probably passive forecasts.

CHART 7–8

Beans: Actual versus Predicted Crop Areas

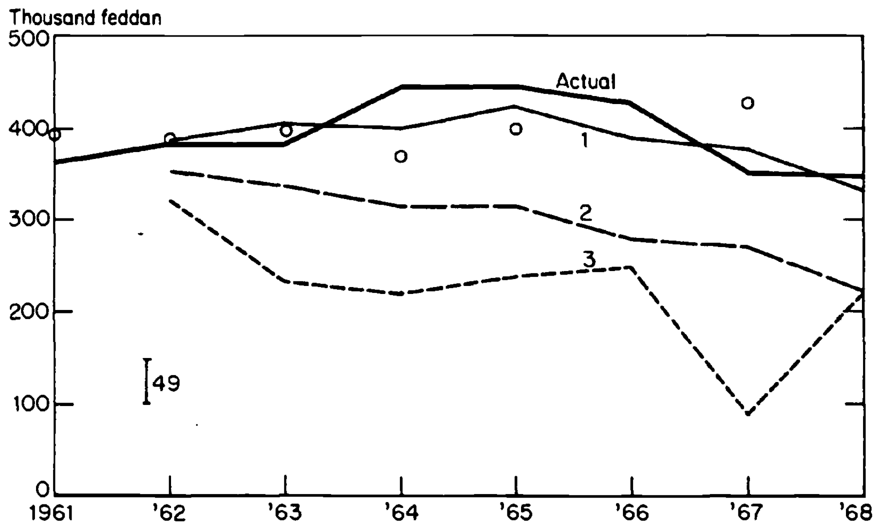
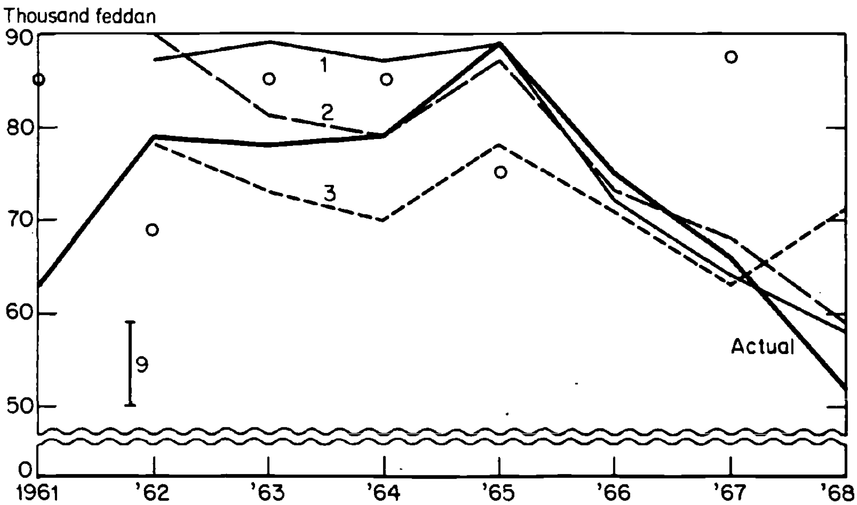


CHART 7–9
Lentils: Actual versus Predicted Crop Areas



The optimal acreage, according to prediction 3, is much lower than actual acreage. Note that the estimated coefficients for the influence of water supply are very small. Thus, the predictions are little influenced by the changes in water supply.

The picture corroborates our previous findings that beans are the most strongly protected crop in Egypt.

LENTILS

The situation is much the same here as with beans; actual ex-farm prices (prediction 1) explain the actual acreage very well from 1962 to 1968, particularly the steep decline from 1965 to 1968.

The optimal acreage of prediction 3 is running substantially below actual acreage through 1967. The influence of water is considerable, but it is not clear whether there is any mis-specification here. The negative lagged effect of water is highly significant.

HELBA (fenugreek)

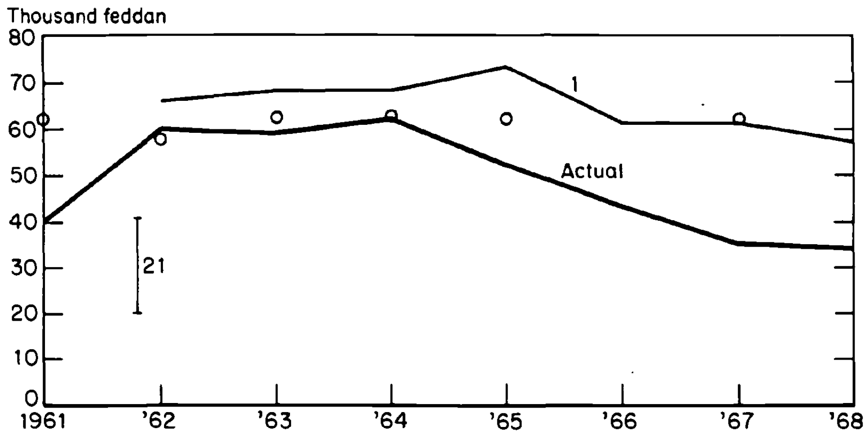
International prices were not available, and only prediction 1 could be used. Controls have probably been of little consequence for this small crop.

CANE

The major part of the acreage is grown under contract with the state-owned sugar factories, and the government is always able to fix upper limits

CHART 7–10

Helba: Actual versus Predicted Crop Areas



to the area cultivated. After the introduction of cooperatives, it has probably also been capable of exerting downward control over the contractual acreage, imposing upon the farmers the acreage allotted to cane in the annual plan.

Actual ex-farm prices (prediction 1) point to a declining acreage from 1962 to 1966 and to a slight rise thereafter, increasingly below the level of actual acreage. There is little doubt that the government exerts a decisive influence on acreage here.

The optimal acreage under prediction 3 reflects the violent fluctuations in the world price of sugar. At the peak of the world price in 1963, the actual area seems to have been about optimal. When world market prices, beginning in 1965, became more normal, the optimum seems to have been only some 30 to 40 thousand feddan, about one-quarter of the actual acreage. The coefficients of the water variable in the estimated response function are relatively small and there is nothing to indicate serious mis-specification for this crop.

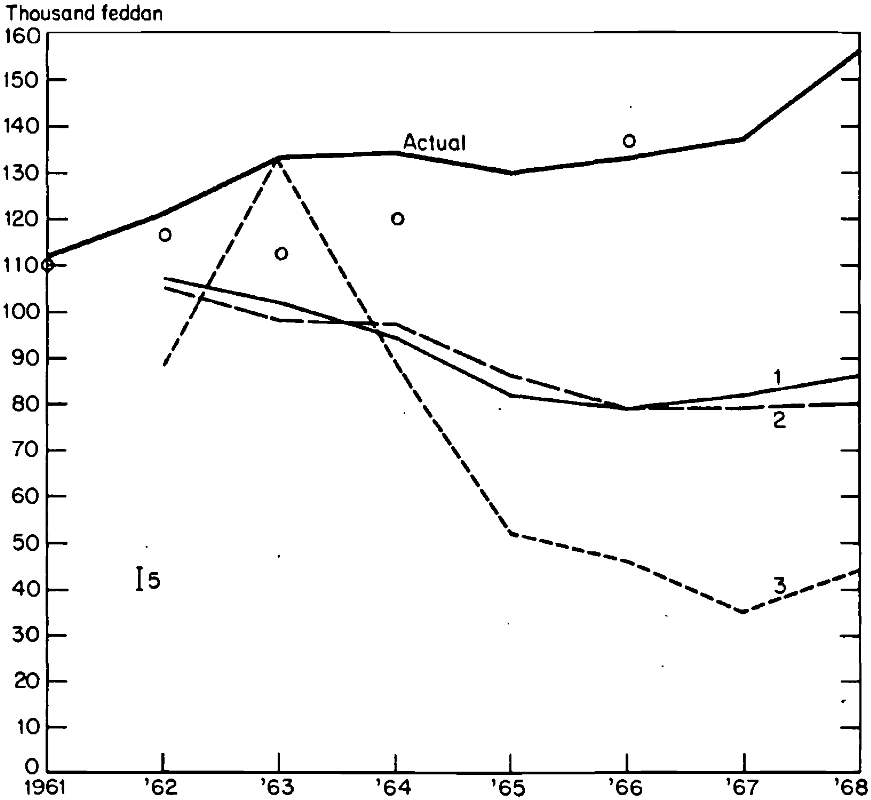
It should be emphasized that the international prices used for cane in predictions 2 and 3 are f.o.b.-based, imputed cane prices. Had c.i.f.-based prices been used (as in the case of the ERP and DRC estimates for sugar), the optimal cane acreage would have been 10–15 percent higher (see, further, Chapter 8, p. 239).

Problems of Measuring the Loss from Misallocation.

The concepts of ERP and DRC were originally established to indicate misallocation of resources via price distortions for commodities, or the loss from misallocation. It is easy to set up a formula for the total loss assuming

CHART 7–11

Sugar: Actual versus Predicted Crop Areas



our model to be a correct specification (excluding, among other things, produced inputs).

Let f as superscript denote foreign and d domestic. The loss is then measured by

$$\Sigma p_i^f q_i^f - \Sigma p_i^f q_i^d \qquad (3)$$

where q_i and q_i are the quantities produced when producer prices equal foreign and domestic prices, respectively, and producers in both cases are assumed to maximize the total crop value at actual producer prices. Note the difference between equation (3) and the ERP, which is based on the expression

$$\Sigma p_i^d q_i^d - \Sigma p_i^f q_i^d.$$

With a well-behaved community indifference map, expression (3) will measure (at least ordinally) the potential welfare loss from price distortion.[20] (We could normalize (3) through dividing by $\Sigma p_i^f q_i^f$ but it is immaterial for what follows.)

Considering the infinitesimal case where actual domestic prices deviate from international prices by dp_i, the loss is

$$\Sigma p_i^f dq_i \qquad (4)$$

which by assumption is nonpositive, and negative if any $dq_i \neq 0$.

In our model the production functions are (see Appendix A, equation 1):

$$q_i = y_i f_i(A_i, L_i, W_i) = q_i(y_i, A_i, L_i, W_i)$$

where in optimum $A_i = A_i(F_i, A, L, W)$, $L_i = L_i(F_i, A, L, W)$ and $W_i = W_i(F_i, A, L, W)$. We have thus

$$dq_i = [q'_{iA_i} A'_{iF_i} + q'_{iL_i} L'_{iF_i} + q'_{iW_i} W'_{iF_i}] \cdot dF_i, \qquad (5)$$

assuming y_i, A, L, and W to be constant. Recalling the definition of F_i (see Appendix A), insertion of (5) into (4) leads, after some rearrangement, to the following expression for the loss:

$$\Sigma[e^{q_i}_{A_i} e^{A_i}_{F_i} + e^{q_i}_{L_i} e^{L_i}_{F_i} + e^{q_i}_{W_i} e^{W_i}_{F_i}]\, p_i^f\, q_i^f \left[\frac{dp_i}{p_i} - \frac{\Sigma w_i y_i dp_i}{\Sigma w_i y_i p_i}\right] \qquad (6)$$

where the *e*s are partial (long-term) elasticities of the superscript with respect to the subscript. Replacing the first square bracket by $E^{q_i}_{F_i}$, the total elasticity of output with respect to relative output-value, (6) reduces to

$$\Sigma E^{q_i}_{F_i} \cdot p_i^f\, q_i^f \cdot \left[\frac{dp_i}{p_i} - \frac{\Sigma w_i y_i dp_i}{\Sigma w_i y_i p_i}\right]. \qquad (6')$$

We, thus, find the total loss by multiplying for each crop the total crop value, $p_i^f\, q_i^f$ (at optimum at international prices), by the (total long-term) supply elasticity, $E^{q_i}_{F_i}$, with respect to relative output-value, and by the difference between the nominal rate of protection for the crop itself and the (weighted) average nominal rate of protection for all crops. Note that the loss becomes zero when all crops enjoy the same rate of protection. An important implication is that if the only protection (negative or positive) is a general over- or undervaluation of the currency, there will be no loss from price distortion. This result is closely related to the fact that our model assumes completely flexible factor prices.

Equation (6′) lends itself to quantification, but requires estimation of all supply functions; we have made no attempt to estimate supply functions and would, in any case, miss one of the more important ones, that for clover. If supply functions are not available, we could work on the basis of equation (6). The latter, however, requires estimation of both production functions for all crops and response functions for all primary inputs—land, labor, and water—which is not feasible because information about inputs by crop is available only for land.

It might be thought that total loss from acreage misallocation could be obtained as the sum of the differences between optimal area (prediction 3) and actual area multiplied by domestic values added (DVA) per feddan at international prices, assuming that the difference between total actual and total optimal area would be cultivated by clover. A crude calculation for 1963 made on this basis shows a total loss of about £E9 million, or about 2 percent of total domestic value added at international prices for the crops covered. Such a calculation is, however, entirely unreliable since it is based on *average* DVA per feddan calculated at international prices, given the *actual* distortion. There were large differences between average DVA per feddan at international prices in 1963, and it is easy to visualize a deviation from the optimal crop pattern which, with this method of calculation, would even show a total gain. A correct method of calculation would be to take the difference between (a) the sum of optimal areas multiplied by DVA per feddan at international prices and at optimal cropping and (b) the sum of actual areas multiplied by actual DVA per feddan at international prices. We do not know, however, the DVA per feddan that would prevail at optimal cropping. Hence we have to abstain from quantifying the total loss.

Ranking According to ERP, DRC, and Optimal Acreage.

As a basis for ranking crops according to effect of protection on production we might use the quantity distortion

$$\frac{dq_i}{q_i} = E_{P_i}^{q_i}\left[\frac{dp_i}{p_i} - \frac{\Sigma w_i y_i dp_i}{\Sigma w_i y_i p_i}\right] \tag{7}$$

On our assumptions here (no imported inputs), the ERP for crop i is simply dp_i/p_i. Hence, ranking is bound to be different on the two criteria, unless the supply elasticities, $E_{P_i}^{q_i}$, are very similar for all crops.

Since we do not know the supply elasticities, we limit ourselves to studying the misallocation of land on the basis of our analysis of area responses. We can proceed in various ways. For example, we can compare the optimal acreage, prediction 3, with actual acreage and use the difference (divided by the optimal acreage) as a measure of misallocation. This would yield a measure of the combined effect of price distortion and direct government interference with acreage (disregarding random errors): A in Table 7–5.

We can also compare optimal acreage, prediction 3, with farmers' response to actual ex-farm prices, prediction 1, and use the difference (divided by optimal acreage) as a measure of the misallocation related to price distortions and market imperfections: *B* in Table 7–5.

Finally, we can compare farmers' response to actual ex farm prices, prediction 1, with farmers' response to international prices, prediction 2, and use the difference (divided by the latter acreage) as a measure of the short-term misallocation related to price distortions: *C* in Table 7–5.

The ranking of misallocation according to each one of these three measures will be compared with the ranking according to ERP and DRC.[21] This will throw light upon the latter two as measures of misallocation. The only year for which we can make this comparison is 1963, and it is possible only for the ten crops listed in Table 7–5.

We note first why there is no perfect rank correlation between ERP and DRC: nontraded outputs and inputs are included, and the DRCs are calculated

TABLE 7–5

Ranking of Crops in 1963 According to ERP, DRC, and Alternative Measures of Acreage Misallocation

			Rank in Decreasing Order		
Crop	ERP[a]	DRC[a,b]	*A* (Actual Area – Prediction 3)/ Prediction 3	*B* (Prediction 1 – Prediction 3)/ Prediction 3	*C* (Prediction 1 – Prediction 2)/ Prediction 2
Cotton	7	7	9	6	8
Rice	9	8	8	10	10
Corn	3	5	7	5	7
Millet	4–5	2	5	8	6
Wheat	6	3	10	4	5
Barley	4–5	4	4	3	4
Onions	8	10	2	7	9
Beans	1	1	1	1	1
Lentils	2	6	3	2	2
Cane	10	9	6	9	3

NOTE: Spearman's rank correlation coefficient works out as follows, with critical levels at 1 percent and 5 percent probability at 0.76 and 0.56, respectively:

ERP–DRC	0.75	ERP–*C*	0.57
ERP–*A*	0.45	DRC–*C*	0.50
DRC–*A*	0.10	*A*–*B*	0.41
ERP–*B*	0.84	*B*–*C*	0.67
DRC–*B*	0.59	*A*–*C*	0.45

a. According to Table 7–1.

b. DRC includes trade and transport margin.

on the basis of imputed factor prices to adjust for government controls over land rentals and to allow for normal profits on capital. It is also recalled that what disturbs the rank correlation between *A*, on the one hand, and *B* and *C*, on the other, is direct government interference with acreages, as well as random disturbances, while the lack of perfect correlation between *B* and *C* expresses differences between short- and long-term misallocation of land.

As is to be expected, neither ERP nor DRC can be used as an indicator of the long-term misallocations related to both price distortion and direct acreage interference (including random disturbances). The correlation coefficients ERP–*A* and DRC–*A* are insignificant and very low in the latter case.

The ERP could, however, be taken as a relatively reliable indicator of long-term and a weak indicator of short-term misallocation resulting from price distortions alone. The correlation coefficient ERP–*B* is significant at the 1 percent level, and that of ERP–*C*, at the 5 percent level.

The DRC, finally, can be used as a weak indicator of long-term misallocation stemming from price distortion, with the correlation coefficient DRC–*B* significant at the 5 percent level.

Needless to say, these results do not lend themselves to generalizations about the relative merits of different measures of distortion. As it happens, in this case the ERPs do, in fact, give a good indication of the relative extent to which acreages are off the optimum due to price distortion. This may be because the response elasticities with respect to price are quite similar here, but it may also be related to the fact that the share of purchased produced inputs in Egyptian agriculture is so low that substitution effects are negligible; in that case the ERPs should, indeed, be correct indicators.

Conclusions.

In the preceding discussions it may not have been easy to see the woods for all the trees: there are many crops and many years. We have, therefore, tried to summarize our findings in regard to misallocation of land in Table 7–6. The table works with averages of the 1962–1968 prediction period presenting, for each individual crop (except barley, for which there are serious specification problems, and helba, for which international prices are not available), as well as for all crops taken together, averages of the absolute deviations of actual from optimal crop areas measured as a percentage of the average optimal area ("optimal" as defined by our model and as measured by prediction 3). In proceeding like this, we have obviously assumed that upward and downward deviations are equally bad, and that a deviation of two acres is twice as bad as a deviation of one acre.[22] Our model contains three factors that contribute to making actual and optimal acreages deviate, and Table 7–6 shows a breakdown of the deviations on this basis.

TABLE 7–6

Misallocation of Land, Average 1962–1968

(percent of optimal acreage)

	Deviation from Optimal Acreage				
		Due to Imperfect Market Forces	Due to Government Interference		
	Total		Total	Price Distortion	Other Intervention
Cotton	12.1	5.4	6.7	2.3	4.4
Rice	21.8	4.7	17.1	8.6	8.5
Corn	5.3	6.1	−0.8	−2.1	1.3
Millet	8.9	14.0	−5.1	−2.2	−2.9
Wheat	16.4	2.1	14.3	0.9	13.4
Beans	78.3	37.4	40.9	36.3	4.6
Onions	29.5	25.7	3.8	−12.5	16.3
Lentils	10.3	11.3	−1.0	2.2	−3.2
Cane	93.8	42.5	51.3	0.0	51.3
Total	7.9	3.5	4.4	1.2	3.2

SOURCE: Our calculations.

1. The market forces are imperfect. Farmers' responses lead assymptotically at best to the optimum in the long run, and it may take considerable time for actual acreage to reach the vicinity of the optimum. If prices and other conditions change continuously—and they do—farmers will tend to be permanently off the optimum. We measure the impact due to this factor as the average of the absolute differences between predictions 2 and 3 (as percentages of the average optimal area). Note that we are here comparing the optimal pattern with another hypothetical situation: prediction 2 estimates what the areas would have been had international prices prevailed in Egypt.

2. Government intervention in prices, however, makes ex-farm prices differ from free trade prices. The difference is the price distortion, and we are particularly interested in its impact on land allocation.[23] We measure the impact of price distortion as the average of the absolute differences between predictions 1 and 2 (as a percentage of optimal acreage), prediction 2 being equal to prediction 3 *minus* the impact due to imperfection of market forces defined under 1. above.

3. After the impacts defined under 1. and 2. have been taken into account, a residual remains (the difference between prediction 1 and actual area) that we ascribe to other kinds of government intervention (like the

cooperatives and the irrigation system). This residual is presented as "other intervention" in Table 7–6. It should be recalled that it includes stochastic disturbances, for which we have no measure. We hope that these may tend to cancel each other out, but with averages based on only seven years we cannot be sure of that.

Finally, a few remarks are in order to explain the total figures in the last row. These were calculated by adding up the absolute average deviations for the individual crops and relating them to the sum of all optimal acreages. A positive deviation from the optimal acreage for one crop must, however, have a tendency to be balanced by negative deviations for other crops (given total acreage). Since this method of calculation accordingly involves double counting, the resulting percentages were divided by two to obtain the figures in the table.

Looking first at our estimates of the total deviation from optimal acreage (first column), we find that it varies between 5 and 94 percent for individual crops and approaches 8 percent for the total area. In other words, at least 8 percent of the total crop area was planted with the wrong crops.[24] Almost half of this (3.5 percent) can be ascribed to imperfections of the market forces; the rest is due to government interference. Thus, the imperfections of the farmer and the imperfections of government seem to have been on the same order of magnitude. The trouble is that they have, on balance, been cumulative. Far from improving upon the play of market forces, the government has just made things worse in regard to land allocation. The picture is not a uniform one, however. For three crops—corn, millet, and lentils—government interference appears to have improved land allocation. But this must be fortuitous; the government paid little attention to these crops in its allocation policies.

Price distortions account for a minor part of the misallocations ascribed to government interference, only 1.2 percent out of 4.4 percent for the total area. This result is not unexpected in view of the very low price elasticities found in this study. For the individual crops, the effects of price distortion are generally small (rice, beans, and onions being the exceptions). For three crops (corn, millet, and onions) the price distortions appear to have improved the alloeation of land, but, once again, this result was probably fortuitous.

The impact of "other (government) intervention," as measured here, varied much from crop to crop and appears to have improved land allocation for two crops, millet and lentils. In a previous section the question was raised whether direct acreage controls could have been used by the government for neutralizing allocational effects of price distortions made for income-distributional purposes. Effects of price distortions and other kinds of government intervention appear, indeed, to have tended to cancel each other out for three crops—corn, onions, and lentils. For two of these, however, the effects of price distortions were such as to improve land allocation, and we have no reason for supposing that the government reasoned that out in advance. Again, what happened was probably fortuitous. The important thing in this connection is, of course, that for the big export crops, together with wheat and corn, towards which the government's efforts were largely directed, "other intervention" served only to reinforce the misallocation due to price distortion.

Returning to the problem of the total loss incurred by misallocation of land (already discussed on pp. 185–188), the 8 percent misallocation of the total acreage might be taken as a starting point for conjectures about the total loss. If nothing of value had been grown on this 8 percent, the total loss would have been about 8 percent of total output (given certain assumptions of homogeneity of land), and this figure may serve as an upper limit to the possible loss. But something of value, even at international prices, was, of course, grown upon the misallocated land. Assuming, for example, that the value of what was actually grown was about half the value of what should optimally have been grown, the total loss would amount to about 4 percent of the total crop, and about half of this, 2 percent, would be due to government interference. These losses are big enough to cause serious concern for a poor country. On the national level, the equivalent of the loss, invested wisely, could have increased the growth rate of per capita income by 1 or 2 percent, or, at a given growth rate, could have served to make Egypt self-financing during the sixties—free from those foreign exchange and balance of payments problems that, to some extent, were the very excuse for introducing the controls.

A final caveat: the results obtained from this econometric exercise are, of course, no better than the model and the statistical estimates upon which it is based. In the light of all the objections we ourselves have raised against the model, the whole exercise should perhaps be viewed mainly as an illustration of a methodology for studying suboptimalities arising from price distortion and direct interference with agricultural production. Here we shall only repeat one crucial assumption, previously emphasized: that instantaneous adjustment to the long-term state at any moment would be cost-free. Hence, our identification of long-term response and optimum.

The delayed response of farmers is partly related to adjustments of price and yield expectations, partly to possible costs inherent in changing rotations suddenly. We have assumed that expectational adjustments are the dominant factor, and that ideally correct forecasts could be obtained at negligible costs. Of course, it could have been the costs of changing rotations that were the decisive factor, although we do not think so. In that case we could have, as another extreme assumption, identified the optimum with prediction 2, farmers' hypothetical short-term response at international prices. Then there would be no loss from the imperfection of market forces—indeed, the assumption would be that market forces are perfect—and there would be no room for improving land allocation through direct government intervention with acreage. It is clear that we would once again find price distortions to have been a minor factor in creating misallocation of land as compared with direct government intervention.

The truth probably lies, as usual, between the extremes—closer, in our view, to the first extreme than to the second. It would certainly be ridiculous to assume that peasants are perfect price forecasters; the costs involved in sudden changes of cropping patterns are more difficult to ascertain.

AGRICULTURAL PRICING AND INCOME DISTRIBUTION

Apart from the inevitable intervention through the management of the irrigation system, direct interference with crop rotations and acreages was largely absent in 1961, at least outside the land reform estates (about 10 percent of the cultivated area at that time). Since prices had been fairly stable for some years, it can probably be assumed that the composition of crops was roughly in equilibrium at the existing domestic prices. Thus, 1961 is a convenient year for examining the income-distributional effects of the government's agricultural pricing policies. Adjustment must be made, however, for the cotton crop failure that year.

We have already seen that, in applying an elaborate crop rotation system, most Egyptian farmers are multicroppers (cane and fruit growers being the major exceptions), but it is still possible to classify them by major crop. For example, farmers on a two-year rotation with cotton and no rice are particularly dependent upon cotton prices, while in the North farmers may grow rice every year with no cotton and are thus mainly dependent upon the rice price. To equalize agricultural income, therefore, it was a natural step for the government—on top of the land reforms—to attempt equalizing farmers' income from various crops.

The income position of the farmers, however, depends critically on whether they are owner-cultivators or tenants (sharecroppers), and on the extent to which they employ hired labor (small farmers hire less labor per feddan than big farmers). Table 7–7 shows income per feddan for owner-cultivators and tenants, with all or no labor hired, calculated on the basis of actual domestic and international prices, respectively. Income for an owner-cultivator who hires all labor is defined as the (maximum) land rental plus actual (residual) surplus to capital and management. For an owner-cultivator with no hired labor, income consists of land rental, imputed payment for the cultivator and his family's labor, *plus* actual (residual) surplus to capital and management. Income of a tenant is the same as that of an owner-cultivator

TABLE 7–7

Income in Agriculture, 1961

(£E per feddan)

	Income at Actual Prices				Income at International, Imputed Prices[a]			
	Owner-Cultivated		Tenant		Owner-Cultivated		Tenant	
Crop	All Labor Hired	No Labor Hired	All Labor Hired	No Labor Hired	All Labor Hired	No Labor Hired	All Labor Hired	No Labor Hired
Cotton[b]	45.580	56.660	24.230	35.310	44.258	55.338	15.435	26.515
Rice	18.554	26.504	6.660	14.610	25.021	32.971	13.127	21.077
Millet	21.163	27.283	13.023	19.143	14.317	20.437	3.328	9.448
Sesame	22.001	26.151	15.031	19.081	12.008	16.158	2.998	6.748
Peanuts	19.775	28.375	10.155	18.755	47.580	56.180	34.593	43.193
Corn (summer)	20.413	24.733	11.793	16.113	12.887	17.207	1.250	5.570
Corn (autumn)	11.859	16.178	3.239	7.559	6.558	10.874	−5.083	−0.763
Wheat	23.398	26.678	4.795	8.075	16.707	19.987	−1.896	1.384
Barley	18.168	20.768	5.262	7.862	17.306	19.906	4.400	7.000
Beans	21.657	24.317	9.827	12.487	9.647	12.407	−6.223	−3.563
Lentils	27.434	30.364	13.274	16.184	25.862	28.772	6.719	9.629
Onions (winter)	58.899	66.589	43.379	51.069	78.577	86.267	57.625	65.315
Chick-peas	54.274	57.394	40.134	43.254	31.333	34.453	12.244	15.364
Sugar cane	48.912	58.642	24.632	34.362	—	—	—	—

NOTE: It is difficult to give figures for income from sugar cane at international prices. Results depend upon the extent the loss or gain for the integrated industry is passed on to the sugar cane cultivators.

SOURCE: Hansen and Nashashibi, NBER Working Paper No. 48, New York, 1975, Tables 2 and 5.

a. With deduction of 10 percent trade and transport margin.

b. Calculated at normal yields of lint and seeds.

after deduction of land rental. It should be recalled that in 1961 the maximum rentals were considerably lower than hypothetical market rentals; the residual surplus to capital and management thus includes part of the true rent of land for both owner-cultivator and tenant (unless he pays black market rentals). The maximum-rental policy (with a ban on short-term tenure and other measures to give the tenant a more secure position) was designed to resolve the special income-distributional problems between tenants and owners.

All Egyptian farmers, even the smallest peasants, hire labor, but for very small peasants, whether owner-cultivators or tenants, income calculated on the assumption of no hired labor may be fairly representative. In its price policies the government certainly had the small peasants in mind; it is more difficult to know whether it was concerned with small owner-cultivators, small tenants, or both. The special measures taken to regulate the tenant-owner problem suggest that the government mainly looked to the small owner-cultivator in its price policy.

Table 7–7 shows a remarkable similarity in the income per feddan for all crops of owner-cultivators with no hired labor. Rice, millet, sesame, peanuts, summer corn, wheat, barley, beans, and lentils are all within the range of £E20–30. Cotton income was much higher, almost £E57 per feddan. Cotton, however, should be evaluated together with a one-cut crop of clover (berseem), and it should be taken into account that cotton *plus* a one-cut clover crop occupy the field for twelve months, while the crops listed above are in the fields for only about six months. On a six-month basis, cotton *plus* clover would not yield much more than £E30 per feddan. A similar argument applies to cane, which is in the fields twelve months per year; calculated on a half-yearly basis, the income from cane is £E29 per feddan. The only crops with income per feddan on a half-yearly basis that deviate substantially from the £E20–30 per feddan level are winter onions and chick-peas, occupying the fields seven to eight months and yielding an income of more than £E40 on a half-yearly basis; but these are minor crops. For tenants with no hired labor, the differences in income from various crops are more pronounced.

At international prices, incomes of owner-cultivators (and even more so, of tenants with no hired labor) *would* have differed substantially and a pronounced income inequality among the various types of growers (classified by crop) would have arisen. Rice farmers, in particular, would have gained much, but cane growers would have lost. And beans would have become a rather poor crop. Cane would have been grown (voluntarily) only on a small area at the international prices in 1961, and for tenants both beans and autumn corn would have caused losses, although these two crops might have been grown for subsistence consumption.

Thus, the introduction of international prices for efficiency reasons would have had serious consequences for income distribution among farmers. The government would probably not have been able to handle this problem by any other means (direct subsidies, for instance). It is in the light of these circumstances, together with the low response elasticities for most crops, that we should appraise the government's policies in regard to relative domestic agricultural prices. Also, its additional measures of direct and indirect interference with acreage were probably less taken with a view to efficiency than as an emergency response to compelling demands for an expansion of exports.

FINAL REMARKS

The discussion in this chapter has been concerned mainly with the relative prices of agricultural output, although costs have, to some extent, been brought into the picture as well. The emphasis has been on the effects on the allocation of land among crops. There remains the problem of the absolute level of profitability in agriculture and its implications for income distribution between rural and urban populations and for progress in agriculture. As indicated in the beginning of this chapter, the absolute level of private profitability in agriculture declined somewhat until 1964–65. From then on, the intersectoral terms of trade between agricultural and manufactured products moved definitely in favor of agriculture, yet profitability seems to have remained poor to the end of the sixties. The consequences for income distribution of this development are obvious.

It is less clear how this may have affected investment and growth in agriculture. With the present institutional setup, initiative in regard to both innovation and investment is divided between the individual farmers, the cooperatives, and the government. The individual farmers probably tend to react to profitability as in any other institutional setting, but with initiative limited by the powers given to cooperatives and government. The taxation of agriculture, typical of the price policies during most of the sixties, must have deterred both innovation and investment on the individual level. On the other hand, the government might well have had a full understanding of the higher level of profitability at international prices and, hence, promoted innovation and carried out investments to increase agricultural production. Such has, indeed, been the policy of the government: the Aswan High Dam and the piped drainage project are the most conspicuous examples, and the introduction of new varieties of cotton, corn, and wheat could also be mentioned. Yet, it is uncertain to what extent government initiative has replaced the circumscribed iniative of individual farmers. About the activities of the cooperatives little systematic information is available. Altogether, since the country has been involved in war during most of the period under review, with general detrimental effects on all development efforts, it is probably impossible to single out the effects on agricultural development of price, trade, and production regulations.

NOTES

1. Data are available for before 1961 and after 1964, but on the cost side only with classification by operation. For our purpose, classification by input category (labor, commodity, etc.) is needed, and this classification has only been published for the years 1961–1964.

2. See B. Hansen and K. Nashashibi, "Protection and Competitiveness in Egyptian Agriculture and Industry," NBER Working Paper No. 48, New York, 1975.

3. Small quantities of cane for direct consumption are, of course, traded internationally; but the price of such cane can hardly be considered significant for the crop as a whole.

4. Since we are dealing with many small producers, we can generally assume that ERPs express degrees of protection, with cotton at the alleged upper limit as possibly the only exception.

5. 1961 was a year with an exceptional cotton crop failure. Our calculations assume that cotton yields of lint and seed were normal in 1961.

6. We put the word taxation between quotation marks because the difference between average domestic and international prices has not been fully collected as revenue for the government; part of it has gone directly to consumers.

7. Something similar must hold true for all countries that normally protect food grain production.

8. This circumstance is now generally recognized in the literature on effective protection. See, for instance, J. Bhagwati and T. N. Srinivasan, "The Theory of Effective Protection and Resource Allocation," working paper, Department of Economics, M.I.T., January 1971.

9. See, for instance, E. O. Heady, N. S. Randhawa, and M. D. Skold, "Programming Models for the Planning of the Agricultural Sector," in I. Adelman and E. Thorbecke, *The Theory and Design of Economic Development*, Johns Hopkins University Press, Baltimore, 1966.

10. *Economic Bulletin*, National Bank of Egypt, Vol. 15, No. 4, 1962, p. 267; *Economic Review*, Central Bank of Egypt, Vol. 3, No. 4, 1963, p. 410.

11. *Economic Bulletin*, National Bank of Egypt, Vol. 18, 1965.

12. To account for the positive long-term effect, we would expect the lagged water supply to have a substantial positive coefficient, whereas, in fact it has a small negative coefficient (see Appendix Table A-2).

13. There were complaints at this time that the government had difficulties in getting farmers to plant the full cotton allotment. Prediction 1 for 1968 points to an acreage of 1.4 million feddan. The allotment was about 1.6 million, with actual acreage close to 1.5 million feddan. This fact could be taken as an indirect test of the reliability of prediction 1.

14. One might wonder to what extent the relatively high short-term price elasticity for rice acreage reflects the irrigation authorities' response to rice prices back in time rather than the farmers' response. But if that were the case, prediction 1 should not have gone wrong in 1962–1964. If, however, the authorities reacted to international prices from 1961 on, which (considering the looming foreign exchange crisis) is quite

plausible, we should, perhaps, look at prediction 2 instead, which explains actual acreage perfectly from 1962 to 1964.

15. As mentioned earlier, a system of contractual rice growing with predetermined prices was introduced in the sixties. It should tend to change the lag structure of the model, but since we do not know to what extent rice has been grown on such contracts we have not been able to take it into account.

16. This possible mis-specification concerns all crops, of course, but takes on primary importance only in regard to rice.

17. The linearity of our response functions is suspect at this point.

18. W. F. Owen, "Land and Water Use in the Egyptian High Dam Era," *Land Economics,* August 1964. Note that if straw had been included in the calculation of relative output value, F_{wheat}, wheat would stand out as an even better crop.

19. Intervention with beans has mainly taken the form of legal specifications as to which varieties are to be grown in the various regions.

20. J. Bhagwati and B. Hansen, "Should Growth Rates be Evaluated at International Prices," in *Development and Planning, Essays in Honor of Paul Rosenstein-Rodan,* J. Bhagwati and R. S. Eckhaus, eds., London, 1972, pp. 53–68.

21. Equation (7) disregards costs and nontraded outputs and is based upon nominal rates of protection; this is the case also with our predictions. The estimates of ERP in Table 7–1 do take these circumstances into account. This fact is of little consequence for our comparisons, however, because the ranking of nominal rates of protection in 1963 according to Table 7–3 is identical with the ranking of ERP in 1963 according to Table 7–1, the only difference being that rice and cane are interchanged at the bottom. The rank correlation coefficient between nominal and effective rates of protection in 1963 is 0.994.

22. There are well-known objections to social welfare functions with such properties. Our assumptions, however, present a proxy description of the conditions of production in agriculture and not of any social welfare function. Around the optimum our assumptions are very reasonable.

23. See pp. 188–189 of this volume.

24. Strictly speaking we measure only the difference between totals of optimal and actual acreages. But the government might, of course, conceivably impose the correct total acreage but impose it on the wrong lands. This kind of misallocation we cannot observe by our method.

Part Three

Protection, Controls, and Competitiveness in Egyptian Industry