Volume Title: Foreign Trade Regimes and Economic Development: Egypt

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Volume Publisher: NBER

Volume ISBN: 0-87014-504-5

Volume URL: http://www.nber.org/books/hans75-1

Publication Date: 1975

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Chapter URL: http://www.nber.org/chapters/c4055

Chapter pages in book: (p. 137 - 157)

Chapter 6

Basic Characteristics of Egyptian Agriculture

In Part Two we study the effects within agriculture of government intervention in prices, production, and foreign trade. We have emphasized that in an economy like that of contemporary Egypt it makes little sense to select the controls at the border (tariffs and other trade taxes, import and export licensing, foreign exchange restrictions, and so forth) for special study without considering the concurrent controls in the interior. The latter have usually been designed with some regard to the former and vice versa, and each may be intended to reinforce or neutralize particular effects from the other set of controls.

Agriculture in Egypt is characterized by a number of special features that critically influence the impact of government controls. Although descriptions of Egyptian agriculture can be found in a number of publications,[1] this chapter provides a brief summary, for the benefit of the general reader, of those of its characteristics relevant to the problems under review. We also present some new estimates of supply (area response) elasticities and a general description of quantitative regulations directed specifically at agriculture.

OUTPUTS, INPUTS, AND VALUE ADDED

Table 6–1 shows the production account of agriculture for 1965. It is a gross account; seeds and fodder are agricultural outputs the value of which is included in field crops, and natural manure and eggs for hatcheries appear as both output and input. On the other hand, the expenditure by public authori-

TABLE 6–1
Production Account, 1965
(mill. £E)

Receipts			Payments		
Field crops (incl. fodder)	383.9		Seeds	20.7	
Vegetables	45.5		Chemical fertilizers	40.6	
Fruits, etc.	22.6		Natural fertilizers	36.2	
			Insecticides	4.6	
Total plant production		452.0	Fodder	53.5	
			Eggs for hatcheries	1.6	
			Fuel	11.0	
Dairy products	42.3		Maintenance and depreciation	3.9	
Meat, etc.	41.7				
Poultry	24.1				
Natural fertilizers	36.2		Total intermediary inputs		172.1
Fish and game	13.7				
Total animal production		158.0	Net value added		437.8
Total output		610.0	Total inputs (incl. profits)		610.0

SOURCE: "Estimates of National Income from the Agricultural Sector, 1965," Central Agency for General Mobilization and Statistics (CAGMS), 1964 (in M. Clawson, H. H. Landsberg, and L. T. Alexander, *The Agricultural Potential of the Middle East*, Elsevier, New York, 1971, p. 280).

ties for operating the irrigation and drainage system is not included among the costs. Current government expenditure for indirect services to agriculture and irrigation was estimated at £E4.4 and 4.6 million, respectively, or a total of £E9 million in 1959–60.[2] These "hidden" production costs amount to about 7 percent of the value of produced intermediary inputs (including feed and seed), or 2½ percent of value added at that time. They are difficult to distribute by crop.

Table 6–2 presents detailed information for 1965 on area, production, value ex farm, exports, and imports of major field crops (covering more than 90 percent of the total crop area). They are divided into summer, winter, and autumn crops, and crops that are either perennial or can be grown at any time of the year. This table also gives some impression of the substitution possibilities.

Substitution between outputs often implies substitution between inputs, since input requirements differ substantially between crops (at given prices).

Sugar cane and cotton are heavy fertilizer consumers, whereas beans, lentils, and clover need relatively little fertilization. Cotton needs nitrates, beans and clover need phosphates. Crops have also very different requirements for other inputs: water, draught-power, labor, etcetera. Substitution between inputs for a given crop is also possible, of course. It should be added that, although soil quality and climatic conditions are unusually homogeneous in the Nile Valley and the Delta, there are nevertheless significant differences between regions with regard to soil characteristics, temperature, and water supply, and a change in the acreage for a particular crop may by itself imply changes in the input coefficients.

THE IRRIGATION SYSTEM

Apart from a narrow strip of poor land along the Mediterranean Sea where barley, figs and a few other crops can be grown on rain-fed land, Egyptian agriculture is based entirely on irrigation with water from the Nile. The modern irrigation system in the Nile Valley and the Delta is dependent upon the control of the river itself.[3] With the new Aswan High Dam (completed in 1971), the Nile's control has been brought to the absolute maximum as far as Egypt is concerned.

Before the Aswan High Dam began modifying the water flow in 1965, evening out the difference between water levels during the flood season and the rest of the year, about one-sixth of the total cultivated area was still under basin irrigation (the ancient method), with only one crop per year (mainly in Upper Egypt). Now that the High Dam is completed, basin irrigation should virtually disappear, and much more water is available during the first half of the year. In 1963 the total cropped area (not including certain vegetables) was 10.4 million feddan[4] on a cultivated area of 6.1 million feddan,[5] with the number of crops per year thus averaging 1.7; on areas with perennial irrigation two crops per year are typical.

Before the modern irrigation system was initiated a century ago, basin irrigation predominated and Nile silt was the only fertilizer (aside from natural manure). The silt was fertile, giving very high yields for most crops. With basin irrigation, the silt is deposited on the soil; with perennial irrigation, it tends to settle in the canals. The introduction and expansion of perennial irrigation and continuous cropping and the predominance of cotton, in particular, made the application of chemical fertilizers a necessity.

The consumption of chemical fertilizers increased rapidly, and at the beginning of the sixties Egypt had one of the highest nitrate fertilizer inputs (measured by nutritional content per acre) among LDC's. With the completion of the High Dam, almost all the silt is being deposited as sediment in the new

TABLE 6–2

Major Field Crops, 1965

Crop	Acreage (000 feddan)	Quantity (000 MT)	Value ex farm[a] (000 £E)	Exports (000 MT)	Imports (000 MT)
Summer					
Cotton, lint[b]	1,900	508	149,542[c]	330	—
Cotton, seeds	1,900	961	6,267	—	—
Rice	842	1,783[d]	39,453	330	—
Corn	931	1,599	46,242	—	137
Millet	441	739	20,588	—	134[e]
Onions, incl. green	144	319	4,595	—	—
Peanuts	55	51	4,537	—	—
Sesame	52	22	2,294	—	—
Autumn					
Corn	520	542	16,472	—	—
Rice	6	6	116	—	—
Millet	59	67	1,804	—	—
Winter					
Wheat	1,144	1,272	57,297	1	1,230[f]
Barley	125	130	4,426	1	4
Beans	433	432	20,732		
Lentils	89	61	5,150	76[g]	6[g]
Chick-peas	12	9	835		
Helba (fenugreek)	52	37	2,380	—	—

Lupin	16	13	806	—	—
Onions, incl. green	50	373	4,348	170	—
All year					
Sugar cane	129	4,736	3,400	16[h]	44[h]
Berseem (clover)[i]	2,493	n.a.	60,767	—	—

SOURCES: *El iqtisad el zirai* [*Agricultural Economics*], Ministry of Agriculture, Cairo, July 1968; and *Trade Yearbook*, FAO, Rome, 1965.

a. Including value of straw and stalks.
b. Including lintners.
c. Calculated as value of unginned cotton minus value of seeds at official price.
d. Paddy.
e. Cereals not elsewhere specified.
f. Not including flour.
g. All pulses.
h. Refined and raw sugar, at raw basis.
i. Including seeds.

lake to the south of the dam and has almost completely disappeared from the irrigation water; preservation of fertility has thus required a further increase in the use of chemical fertilizers. In accordance with plans, fertilizer input did, in fact, increase substantially from 1960–61 to 1965–66 (nitrates, by 77 percent, phosphates, by 82 percent), but fell somewhat thereafter, due partly to the war in 1967 and partly to the foreign exchange shortages starting around 1965–66. Fertilizer input must have been suboptimal since 1966, and this circumstance may have influenced crop yields negatively.

The basic problem in Egyptian irrigation has always been the provision of an adequate water supply for the profitable summer crops, particularly cotton, rice, and summer corn. The flood time lasts from the end of July to October–November, and there is, practically speaking, always sufficient water for autumn and winter crops (sown in August and November–December, respectively). The supply during the first half of the year depends partly upon the previous year's flood level and partly upon storage possibilities.

Before the closure of the river by the High Dam in 1965, rice cultivation fluctuated sharply with the level of water supply in May and June. At a low level of supply, the rice acreage would be low, and acreages of other crops, especially corn, would be expanded instead. Rice may also be cultivated as an autumn (flood) crop (sown in August), but the yield of autumn rice is poor. Corn may be cultivated as a summer crop, when it yields much more than in autumn. However, summer corn, too, is dependent upon an abundant water supply. Hence, a low flood one year and a low water supply during the following spring implied a decrease in the acreage of high-yielding summer rice and an expansion of low-yielding autumn corn, with land fallow from May to August. In modern times the effects on the rice and corn crops constituted the most important implication of variations in the water supply. Since the erection of the High Dam, thanks to its large storage capacity, the water flow can be kept almost constant. A substantial expansion of the rice area and a substantial shift from low-yielding autumn corn to high-yielding summer corn have been the most conspicuous agricultural gains from the High Dam.[6]

The irrigation system is largely controlled by the government, and its technical characteristics seem to make a relatively centralized form of regulation essential. In fact, the irrigation system—with respect to both investment outlays and current operation—has always been a government responsibility, with the implication that the government cannot be neutral in regard to conditions of cultivation.

Water is distributed free, and irrigation costs are partly paid from the public budget. Advocates of market forces have recommended that irrigation water be priced, but so far nobody has been able to design a system that would work from a technical and administrative point of view. The introduction by the British of the uniform land tax, based on rental value, at the

beginning of this century was partly motivated as a payment for water. At present, however, the land tax, based on assessments of 1949 and perforated by numerous exemptions, has little relation to water supply.

CROP ROTATION

With land under continuous crop cultivation, crop rotation takes on paramount importance. Egyptian peasants are well aware of this, and for ordinary field crops they have traditionally applied rotation systems, with cotton grown once every two or three years. Cotton tends to exhaust the soil as to nitrates, and is therefore grown after berseem (Egyptian clover, the major animal feed), which builds up the nitrate content of the soil; but even then, it is widely believed, in the longer run cotton could probably not be grown every year. Opinions have been strongly divided with respect to the long-run feasibility of the two- and three-year system, but the prevailing (official) attitude favors the three-year rotation.[7] It has been argued by British cotton breeders, however, that with adequate fertilization cotton could, indeed, be cultivated every year without detrimental long-term effects on fertility. The economically optimal rotation must, of course, also depend upon relative output and input prices, and with improved technology, particularly improved fertilizing, a wider range of rotations than those traditionally applied may become available. In practice both two- and three-year rotations are applied by farmers.[8, 9]

Examples of modern rotations follow.

Two-Year System

Rotation

First year: Clover (from last year, one cut)–cotton–wheat.

Second year: Wheat (from last year)–rice (or, at low water supply, fallow, followed by autumn corn, or millet)–clover (to next year), etcetera.

Three-Year System

Rotation

First year and second year: Same as above, except that beans would be planted instead of clover at the end of the second year.

Third year: Beans (from last year)–rice (corn, millet)–clover (to next year), etcetera.

The crop rotation problem has relevance for the present study in two respects. First, substitution between crops is only possible if it is feasible to change the rotation. If the technically feasible rotations are limited in number, the possibilities of substitution among crops are limited as well. Moreover, it takes time to shift from one rotation to another one.

Second, it may be argued that we should, in principle, consider rotations

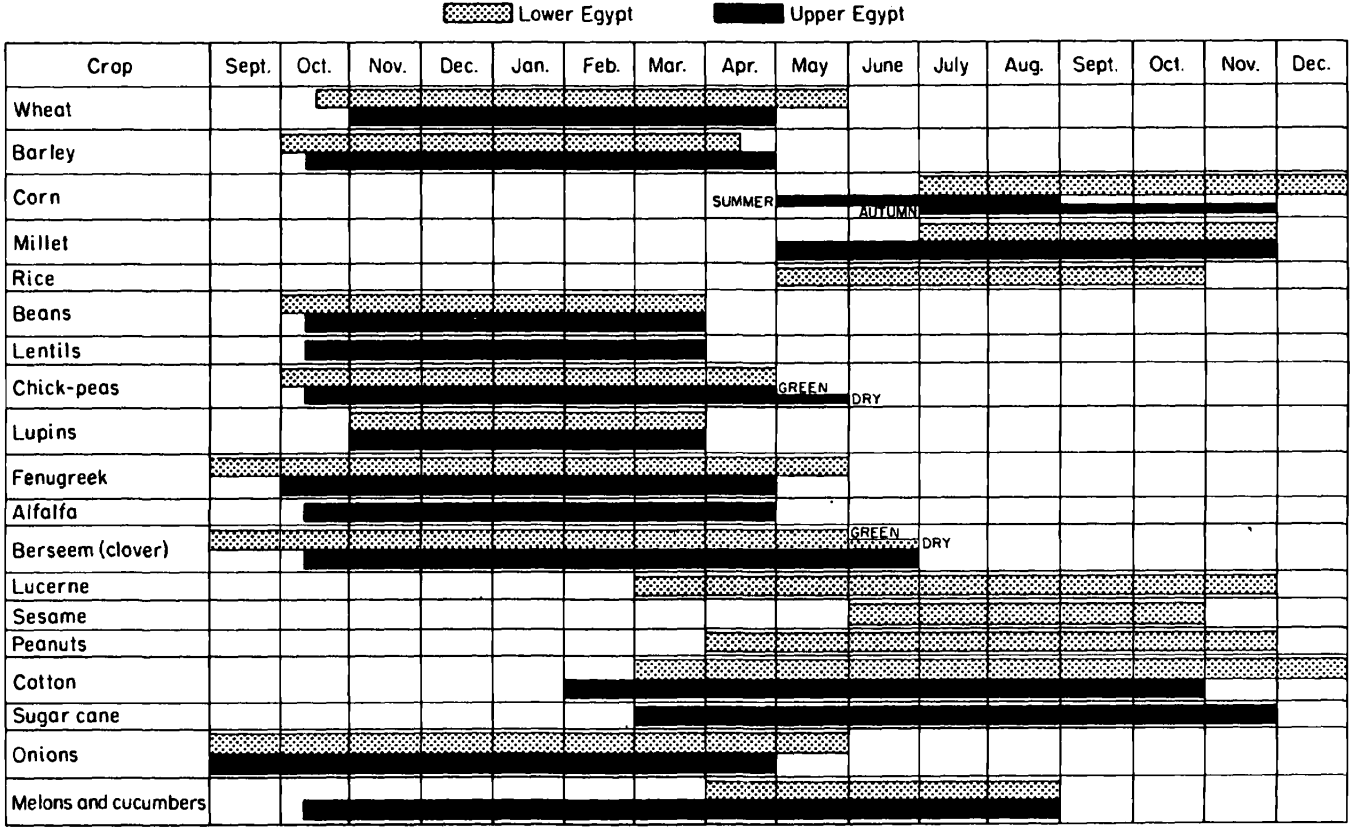
rather than particular crops when discussing protection, profitability, competitiveness, etcetera. For a given rotation, the individual crops are joint products. But if a large number of alternative rotations are feasible, substitution may be almost smooth.

The possibility of continuous cropping and the necessity of crop rotation complicate the appraisal of Egyptian agriculture in regard to optimality because we find both competition and complementarity between crops. Summer (autumn) and winter crops tend to be complementary simply because the summer is too hot for certain crops and the winter too cool for others. Yet summer and winter crops may overlap and thus compete for land (cotton grows from February–March to October–November, wheat from November to April, and corn, from July to December). Other crops are complementary from a fertility point of view (cotton as against clover and pulses). Competitive crops may not be equally competitive with respect to the basic inputs of land, labor, and water. Two crops that compete for land may not compete seriously for labor, not only because input coefficients differ but also because input seasons differ. Cotton and corn are a good example: the growth periods in the Delta are March to October–November for cotton and May to October, or July–August to December, for corn (summer and autumn corn, respectively); the inputs of land do overlap in time, whereas the inputs of labor do not because most labor input takes the form of soil preparation and sowing at the beginning of the growth period and of harvesting at the end. The seasonalities and hence the competition for inputs form an intricate jigsaw puzzle and play an important role in evaluating the relative profitability of crops and rotations. Chart 6–1 gives an impression of the crop seasons in Lower (Delta) and Upper (Nile Valley) Egypt. (The graph dates back to 1914, but it is the best we could find and the seasons have not changed significantly.) It should not be overlooked, however, that the seasons are not absolutely rigid, although they are geared to climate (mainly temperature) and irrigation cycles. Seeding of cotton in the Delta may, for instance, be postponed until April, albeit with detrimental results for yields, yet another substitution possibility to complicate the picture even further.

The rigidity of the crop rotation is difficult to ascertain, and opinions seem to differ widely. If it were true, for example, that cotton cannot be grown more often than every third year for purely technical reasons in the long run, there would be an upper limit of at most one-third of the cultivated area at which the long-run marginal costs of growing cotton become forbidding. At this upper limit cotton export taxes, for instance, would have no direct influence upon resource allocation and would only affect income distribution. The fact is, that the cotton acreage has never exceeded about one-third of the total cultivated area. This could be due to lack of imagination and know-how, insufficient availability of fertilizers, or persuasion and direct interference by

CHART 6–1

Dates of Sowing and Harvesting Important Egyptian Crops



the authorities, and does not necessarily mean that a three-year crop rotation is a physical necessity. As mentioned before, however, both three- and two-year rotations have, in fact, prevailed for crops other than sugar cane, fruits, and vegetables.

Rice cultivation requires an abundant water supply, and as noted above, fluctuated strongly with the water supply in May and June prior to 1964. Quite apart from the possibility that greater reliance could have been placed upon pumping water to the rice fields in the northern part of the Delta, one also wonders whether these fluctuations were a technical necessity or partly resulted from the management of the irrigation system. The storage facilities in the Delta give the authorities some flexibility in regulating the water supply to the fields in May and June regardless of the concurrent discharge of the Nile. Until the beginning of the sixties, the short-term management of the system was subordinated to the water requirements of cotton, while rice was treated as a residual crop. Before World War I, when the irrigation system was originally designed, rice was generally a poor crop except in the salty lands of the North, where it was relatively the best crop. But the relative profitability of rice has increased over time (both yield and price have improved in relative terms), and the long-term investment policy for irrigation has led to an uptrend in rice cultivation. The question with respect to earlier performance is, however, whether it was necessary to let rice be the residual on an annual basis. The answer is that rice probably could have been kept more stable at the expense of cotton and corn. When the rice prices on the world market began rising around 1960, a substantial crop expansion took place that was not related to high flood levels but, rather, to the storage facilities in the Delta.

We shall return to these problems in connection with individual crops. At this point we only emphasize that the limitations on crop rotation in Egypt may be less rigid than sometimes assumed, but that, at least until the beginning of the sixties, the authorities may have tended to plan agricultural production within too narrow a technical frame. The latter was, after all, largely outlined by British hydrological and agronomical engineers at a time when the technology of irrigation was less developed than, and the relative profitability of crops different from, today.

Finally, let us note that fruits and vegetables (except onions) are in most cases cultivated in areas outside the standard rotations of field crops. Vegetables tend to be cultivated around the big cities, while fruit plantations can be found everywhere except in the northern part of the Delta. Although the natural conditions for growing vegetables and fruits and the proximity to the European markets might make these crops very profitable under conditions of free trade (in Egypt as well as in Europe), this study did not include them, since price and cost data were missing or entirely inadequate. This is unfortu-

nate also because both crops have shown relatively fast growth during the last twenty years and are more important than some of the crops we did include. The area of vegetable cultivation (not including onions) increased from 252,000 feddan in 1952 to 495,000 feddan in 1961 and 706,000 in 1970, while the area planted with fruit trees increased from 94,000 feddan to 137,000 feddan and 232,000 feddan over the same period.

SUPPLY (ACREAGE) ELASTICITIES FOR FIELD CROPS (1913–1961)

Appendix A reports on an attempt to estimate supply (or acreage) responses with respect to profitability (price), total area, total labor, and total water input for a number of field crops. The estimates were based on data for the years 1913 to 1961, with due regard to area controls. The response functions —of the Nerlove type—were set up primarily to help in the appraisal of the cropping pattern after 1961 (see Chapter 7). As a by-product, the average short- and long-term elasticities set out in Table 6–3 were obtained. It should be emphasized that these are not partial but total elasticities. They were calculated on the (estimated) reduced forms of a complete general equilibrium model for agriculture. Thus, the elasticities take into account all repercussions on other crops and are constrained by actually existing total acreage, labor force, and water supply.

Two features stand out as rather remarkable.

1. Generally, the short-term price elasticities are low—for the basic food crops (corn, millet, wheat, onions, beans, and lentils) even close to zero. There are four possible explanations for the very low short-term elasticities: our elasticities are "total" with individual crop area responses constrained by the total crop area; rigidities in the crop rotation—it takes time to shift from one rotation to another even when alternative rotations are available; rigid operation of the irrigation system; and the fact that some of the basic food crops are essentially subsistence crops.

2. The long-term elasticities for all the big crops—cotton, rice, corn, millet, and wheat—as well as onions and lentils are small, too, and close to the short-term elasticities. Once more the fact that our elasticities are "total" may be the explanation. Rotational rigidities, on the other hand, can hardly explain low long-term elasticities, but the phenomenon adds to our suspicion that the government's operation of the irrigation system has, indeed, always tended to freeze cropping in a rather rigid pattern.

For *cotton* (lint and seed as joint products) the short- and the long-run elasticities are 0.25 and 0.30, respectively, both highly significant. Nerlove[10] and, in particular, Krishna[11] have obtained much higher elasticities for the

TABLE 6–3
Average Elasticities of Crop Acreages

Season	Estimate	Elasticity with Respect to Price or Yield: Short-Term	Elasticity with Respect to Price or Yield: Long-Term	Long-Term Elasticity with Respect to: Total Crop Area	Long-Term Elasticity with Respect to: Labor	Long-Term Elasticity with Respect to: Water Supply
Summer–Autumn						
Cotton	I.V.2	0.25[a]	0.30[a]	0.79	0.07	−0.17
Rice	I.V.1	0.41[b]	0.49	0.30	0.61	1.39
Corn	I.V.1	−0.02	−0.02	1.59	−0.26	−0.04
Millet	I.V.1	0.05	0.09[b]	−1.16	0.77	0.32
Winter						
Wheat	I.V.2	0.03	0.04	0.33	0.36	−0.27
Onions	L.S.	0.13	0.25[b]	6.01	−0.60	1.12
Barley	I.V.2	0.25[a]	4.99[a]	−0.49	−2.15	−8.89
Beans	I.V.1	0.17	0.67	0.91	−0.96	0.21
Lentils	I.V.1	0.17	0.30	−0.02	0.29	0.14
Helba	I.V.2	0.33[a]	3.64[a]	7.94	−4.31	0.00
Perennial						
Cane	I.V.2	0.11[a]	0.81[a]	4.17	−1.12	0.29

NOTE: The elasticities presented here were obtained from the estimates chosen for the area predictions in Chapter 7. The price elasticity is equal to the corresponding *F*-value elasticity times one *minus* the crop's weight in *F*. The elasticities are based on mean values of acreage and *F* for the period 1913–1961. The response functions do not assume constant elasticities. L.S. denotes ordinary least squares estimate, I.V.1 and I.V.2 denote instrumental variable estimates, steps 1 and 2, respectively.

SOURCE: Appendix A.

a. *t*-value > 3: short-term, profitability variable; long-term, lagged area.

b. *t*-value > 2: short-term, profitability variable; long-term, lagged area.

United States and India, respectively. Using simpler functions, however, other authors have also come out with relatively low elasticity values for the Egyptian cotton area. Thus, for the period 1870–1913, Bresciani-Turroni found an elasticity of 0.4; for the years 1915–1941, Nour El Din obtained an (average) elasticity of 0.2; Stern, using all the years from 1913 to 1937, came up with an elasticity of about 0.4; and, excluding twenty-four years with area restrictions between 1913 and 1959, one of the authors of this volume, unlike the other three who disregarded area restrictions, estimated an elasticity of only 0.09.[12]

Rice is the only major crop with a substantial short-term price elasticity, 0.41; its long-term elasticity is only slightly higher. It may cause surprise that

rice should have the highest short-term price elasticity among the crops studied here. It is usually assumed that rice cultivation is largely determined by the available water supply. Water is, indeed, an important determinant of the rice acreage (see Table 6–3); both short- and long-term elasticities of rice acreage with respect to water are high. The short-term price elasticity is based on a coefficient for relative output value per feddan (F) that is significantly different from zero only at the 95 percent level, and therefore it cannot be excluded that the true price elasticity is much lower than 0.41. However, the substantial short-term price elasticity may be due to the circumstance that rice is partly grown in the northern part of the Delta, where salinity is substantial and thus, on the one hand, the standard rotations are less appropriate and, on the other, the extensive margin of cultivation is more flexible than in the rest of the Delta and the Nile Valley. This, however, does not explain why the long-term elasticity should only be slightly higher than the short-term elasticity. The government's management of the irrigation system may be responsible for both features (see below).

Corn, millet, and wheat have negligible price elasticities, both short- and long-term. For corn the elasticities are even negative. For both corn and millet the natural explanation is that these crops are subsistence crops, mainly grown for the farmers' own consumption.[13] But for wheat this explanation is hardly satisfactory. A substantial part of the wheat crop is sold in the market, and before 1900 wheat was an important export crop.

Barley and *helba* (fenugreek) differ from the other crops in having sizable short-term elasticities and high long-term elasticities.[14] For barley the explanation is probably that this crop is mainly grown in the northern part of the Delta and along the coastal strip. It is thus partly grown outside the standard rotations, where the extensive margin of cultivation is flexible. Helba is mainly grown in the valley, but being a very small crop it has no important place in the rotations and may for that reason be easily adjusted to changing profitability.

Sugar cane has a very low short-term, but quite a substantial long-term, elasticity. This feature is easy to explain. Cane remains on the fields for up to three years (and thus yields two or three crops), and it may take three years until it is replaced by another crop. Moreover, the largest part of the cane area is cultivated under contract with the (government-controlled) factories, which fix both prices and acreage. The remainder is produced for the free market and sold to small private molasses factories. In the long term, however, the sugar factories, too, have to pay enough to call forth the supplies they want to buy—hence the relatively high long-term elasticity.

We note, finally, that the explicit inclusion of animal feed (clover) and fruits and vegetables, which may themselves have higher elasticities (at least in the long run) than field crops, might have increased elasticities somewhat

for the field crops listed in Table 6–3. Independent observers believe that the rapid increase of both vegetable and fruit acreages during the last two decades is a response to rising relative prices, and that the same is true of the expansion of the clover area during the sixties.

QUANTITATIVE RESTRICTIONS IN AGRICULTURE

Even apart from the inevitable government intervention in the management of the irrigation system and in the problems of externalities related to plant diseases, agricultural policies in Egypt have made much use of quantitative regulation in regard to production, prices, and foreign trade. With foreign trade almost completely nationalized since 1961 and run by government organizations, both prices and quantities supplied are open to direct government intervention. And, although agriculture is almost exclusively based on small, privately owned farms (since 1969, the maximum area is 50 feddan per owner and cultivator), it is now organized in a way that permits centralized control of both prices and cultivated areas, at least for major crops.

Production Restrictions.

Production restrictions were already in use at the end of the last century, when cultivation of tobacco, a big and lucrative crop, was prohibited for purely fiscal reasons (while imports could be taxed effectively, domestic production evaded taxation on a large scale).[15] Area limitations were frequently applied to cotton from World War I onward to enforce the allegedly optimal three-year rotation, to prevent cash-hungry peasants from exhausting the soil (see Appendix A, Table A–1), and also, allegedly, to take advantage of Egypt's monopolistic position in the long staple market. It has been argued, on the other hand, that it was Egypt's supply-limiting policy that was at least partly responsible for the introduction of long staple production in the Sudan, Peru, and some other countries. And when, in the thirties, synthetics appeared as a serious competitor to long staple cotton, there was little basis left for the optimum tariff argument with respect to Egyptian cotton.[16] The increasing input of chemical fertilizers, at the same time, seems to have put an end to the soil exhaustion argument.

Another factor was also to enter the picture. From ancient times to the end of the nineteenth century Egypt had always been a wheat exporter. With the growing population, the country found itself unable to satisfy the domestic demand for wheat at the prevailing low prices without imports; therefore,

area restrictions for cotton were in force both during World War II and the 1953–1960 period, coupled with prescriptions for wheat acreage as an import substitution device. (Cotton and wheat cultivation overlap in February, March, and April, and wheat can be grown every year.) The restrictions on the cotton area and the prescriptions for wheat were not much respected by the farmers except, perhaps, during the first year or two: "The *minimum* area fixed by law for wheat throughout 1955–1959 . . . was exactly the *maximum* fixed for cotton, but in actual fact the wheat area—designed to be higher than or at least equal to that of cotton—was 19 percent lower."[17] Chart A–1 in Appendix A shows all years with cotton area restrictions from 1913 to 1961; only some of these indicate a clear impact of the restrictions. The area prescriptions were abrogated in 1960, and the export taxes were by and large formally abolished during 1959 and 1960 (as described in Chapter 2). Beginning with 1962 they were reintroduced de facto through the price policies of the Cotton Commission (see below).

Whereas simple area prescriptions thus may have had only a minor impact on actual cultivation during most of the fifties, other developments, not unrelated to the land reforms of 1952, slowly created possibilities for extensive government control over the production of major crops. In connection with the redistribution of land, the Ministry of Agriculture instituted an ingenious compulsory common crop rotation system for the new farmers on reform estates. The system was originally invented by the British during the interwar period and applied to the Gezira project in the bifurcation of the White and Blue Nile in the Sudan, whence the Egyptians took over the idea. It aims at combining the advantages of private ownership and small farmers' initiative with some large-scale economies in irrigation, soil preparation, financing, and trading, and gives the individual farmers land in different parts of the area under common rotation. The three-year rotation system (as usual, favored by the ministry) would thus imply that farmers be given land in three different places, each one under a different crop. In this way large areas can be grown with the same crop, while the individual small farmer will experience on his three plots of land the same rotation he would apply individually, and always have a food crop for the family, a feed crop for the buffalo, and a cash crop for his expenses. Soil preparation, including ploughing, and irrigation may become more rational, taking advantage of large-scale economies in these processes (even with traditional technology), and mechanization becomes possible, whereas seeding, weeding, fertilizing, and harvesting (so far) are left to the individual owner. Seeds and fertilizers with other chemicals are provided by the cooperative of the particular area concerned, which thus controls plant varieties and fertilizer input, extends credit in case of need,[18] and takes care of marketing of major crops. All decisions are, in principle, taken by the council of the cooperative, formally elected by democratic methods,

whose chairman (usually an agronomist) however, is appointed by the ministry. It is believed that de facto it is the chairman, and thus ultimately the ministry, who is the real decision maker, at least in matters of importance for cultivation.[19]

All observers seem to agree that the compulsory rotation system on the land reform estates has been as conducive to productivity in Egypt as it had been in the Sudan. While these estates constitute less than one-sixth of the total cultivated area, the government, inspired by the success of the system, started experimenting in the mid-fifties with cooperation along the same lines outside the reform estates. In the opinion of the government these experiments proved successful,[20] too, and at the end of 1964 the system (still without redistribution or consolidation of ownership of holdings) was virtually extended to the whole country. Each village is now organized into a cooperative where membership is compulsory.

The intention of the government was to use the cooperative system for controlling production of major crops. Detailed rules were laid down for cultivation of cotton and some other crops (beans and barley), prescribing the varieties that should be grown in the individual regions of the country and the amounts of seeds and fertilizers to be used per feddan.

The Ministry of Agriculture estimates the total area allotted to all major crops. In this sense, the country has had an annual plan for crop acreages since 1960. The plans were released by the Ministry of Planning for the (budget) years 1960–61 to 1964–65 and 1966–67. For 1965–66 and all budget years after 1966–67, the acreage plans do not seem to have been released. Until 1963–64, however, these plans were (except for rice) little more than passive forecasts of the farmers' expected behavior. It was not until the agricultural year November 1964–October 1965 that the government possessed the administrative machinery—the cooperative system—to impose its acreage plans upon the farmers.

Apparently the government has used this system mainly for controlling the total cotton acreage and its distribution by staple length.[21] The acreages for most other crops, except rice, wheat, and sugar cane seem to reflect the choice of the farmers, given the adjustments they have to make to fulfill the cotton acreage requirements. Rice, of course, has continued to be influenced by the government's management of the irrigation system, and the cultivation of sugar cane has been tightly controlled. Apart from these crops it is difficult to assess the impact of government control through the cooperative system.[22]

Wholesale Trade and Prices.

Wholesale trade in cotton is carried on by a special Cotton Organization; it handles purchases from agricultural cooperatives, storage, exports, and sales

to domestic industry. Wholesale trade in cereals, sugar, and some other foodstuffs is in the hands of the Ministry of Supply, which also takes care of imports of food and its distribution to retail trade. Domestic trade in vegetables, onions, fruits, poultry, and the like is mainly handled by private business, although a network of government retail stores (so-called cooperative stores) has been established. Also, there are free markets where surplus quantities of grain can be sold by the farmers. The supply of manufactured inputs—mainly fertilizers, pesticides, and fuel—is entirely in the hands of government organizations.

Since World War II the government has fixed prices for its purchases from producers or has established support prices for major crops. Until 1964 such prices were fixed mostly to stabilize both farm income and the domestic cost of living, and their level was chosen to strike a desirable balance between rural and urban income; allocational considerations seem to have played a secondary role. It is not clear how these policies, over all, have affected rural-urban income distribution, but until 1964 they certainly helped to stabilize domestic prices and may have had consequences for allocation of resources in agriculture. With control over both price and supply, the possibility cannot be excluded that, for any particular commodity, the country may be off the demand, as well as the supply, curve. During the second half of the sixties, in addition to area prescriptions, compulsory sales (in various proportions) of certain food crops (rice, wheat, onions, ground nuts, beans, and lentils) at low official prices to village cooperatives were introduced, with the possibility of selling surplus output at higher prices in the free market. Actual deliveries, however, tended more and more to fall short of requirements, and the system was changed in 1969.[23]

In recent years production at predetermined prices has been introduced for cane, rice, onions, tomatoes, and other crops. Contracts are concluded before sowing and stipulate delivery of specified quantities, at defined standards and specified prices.[24] This is a particularly important innovation from our point of view because it tends to break the lag between prices and production (see below). This system is not compulsory and its extent is not known to the authors.

It will be understood that the determinants of producer prices for outputs differed considerably from crop to crop during the sixties. At one extreme are crops like cotton (lint as well as seeds), which the authorities purchase in their totality at prices fixed by the government itself. Sugar cane, cultivated under contract with the factories, belongs to this category. At the other extreme we have crops with free price formation; clover (berseem) and other feed crops (not included in our estimates) are by far the most important items in this group. Between these extremes we find most of the other field crops, cereals and pulses, with producer prices influenced by both the government and domestic market forces. When the Ministry of Supply purchases cereals

and pulses it is always at prices fixed by the government. For some cereals (rice and wheat) and pulses there was compulsory delivery of certain proportions of the crops at very low prices until 1969. Other deliveries to the government are voluntary, and farmers (usually via the cooperatives) have the option of selling directly to private wholesale or retail dealers. For some crops there are organized markets in Cairo and Alexandria. Price formation in these markets, however, is constrained within rather narrow limits by government prices for purchases from producers, on the one hand, and on the other, by the maximum retail prices for products based on these crops (bread, flour) or for the crops themselves (pulses, for instance). The latter prices are often low and subsidized to the extent retail trade is based on government supply.

Rents.

An unusual feature, finally, is maximum rent for agricultural land, introduced in 1952 and kept unchanged since then. Tenancy is important: in 1960 about half the area was cultivated by tenants. Short-term tenancy was abolished in 1952, and it has become increasingly difficult for owners to evict tenants. Rents predominate, although some share-cropping takes place.[25] The maximum rents, based on land tax assessments made in 1949, should correspond in principle to market rents in that year.[26] Market rents in 1952–53 may also have been below that level due to the collapse of the Korean boom. But since then agricultural output has more than doubled in value, and the maximum rents are entirely out of line with hypothetical market rents.

Wages.

There are also statutory minimum wages for rural labor, but they have never been enforced except in public works. By the mid-sixties, rural wages reached the statutory level, but that was the result of a strong demand for such labor and quite unrelated to the existence of statutory wages.

Shortages and Black Markets.

It might be expected that an economy with both price and quantity controls would have extensive black markets. This has increasingly been the case since the second half of the fifties for certain manufactured products as well as for housing, but only to a minor extent for food and other agricultural products. The government has geared its food import and export policies to the domestic demand-supply situation; imports and exports have tended to be determined as residuals. Rationing at low prices has been applied only to some

goods (tea, sugar, vegetable oils, kerosene), with free sales permitted at high prices.

Shortages of food have nevertheless occasionally occurred: rice, fat, and meat are examples. Such shortages have usually arisen in connection with unexpected import difficulties or crash export programs (related, for instance, to repayment of Russian loans), and black markets in food have emerged on such occasions. Black markets are in most cases imperfect, however, and it is in the nature of things that reliable black market price data are hard to obtain. Black market rents for land (and housing) played a minor role in the fifties, but are now the rule rather than the exception. They are often paid for the right to obtain (or cancel) a rental contract in the form of a "bon de sortie," which represents the capitalized value of the difference between the hypothetical market rent and the prescribed maximum rent and is difficult to translate into an annual rental. Moreover, systematic information is not available.

NOTES

1. C. Issawi, *Egypt in Revolution,* London, 1963; B. Hansen and G. Marzouk, *Development and Economic Policy in the U.A.R. (Egypt),* Amsterdam, 1965; D. Mead, *Growth and Structural Change in the Egyptian Economy,* Homewood, Ill., 1967; M. Clawson, H. H. Landsberg, and L. T. Alexander, *The Agricultural Potential of the Middle East,* Elsevier, New York, 1971. On cotton, see, in particular, E. R. J. Owen, *Cotton and the Egyptian Economy, 1820–1914,* Oxford, 1969.

2. *General Frame of the Five-Year Plan for Social and Economic Development,* July 1960–June 1965, Cairo, 1960, p. 141.

3. W. Willcocks and J. I. Craig, *Egyptian Irrigation,* Vols. 1 and 2, 3rd edition, London and New York, 1913 (see also 2nd edition, London and New York, 1899), contains a wealth of detailed technical and economic information about the Nile and the irrigation system. Problems related to the change in the system after the Aswan High Dam are discussed by W. F. Owen, "Land and Water Use in the Egyptian High Dam Era," *Land Economics,* Vol. 15, No. 3, August 1964.

4. One feddan = 1.04 acres = 0.42 ha.

5. Official data show an increase from 1964 to 1969 in the total crop area of 474,000 feddan, with a growth in the cultivated area of 392,000 feddan (*The Development of the Agricultural Sector,* CAGMS, 1971). Accepted at face value, these figures imply that the crop area has increased mainly through land reclamation and only to a minor extent through conversion from basin to perennial irrigation. However, the relatively slow growth of the crop area may be related to the strong uptrend in fruits and vegetables, which are only counted as one crop per year.

6. While the rice area expanded from 695,000 feddan in 1960 to 1,140,000 feddan in 1970, summer corn went up from 128,000 to 1,153,000 feddan and autumn corn went down from 1,698,000 to 351,000 feddan.

7. C. H. Brown, *Egyptian Cotton,* London, 1955, Chapter 1. See also E. R. J. Owen, op. cit., p. 191.

8. Total cultivated area was about 6 million feddan in 1960. At that time about 0.9 million feddan were dependent upon basin irrigation and thus not suitable for cotton. In

addition, 0.1 million feddan were under sugar and 0.1 million under fruit. Rotations with cotton were thus probably applied to less than 5 million feddan. With a 3-year rotation, this would imply a cotton acreage of 1.6 million, with a 2-year rotation, of about 2.4 million. The cotton acreage has frequently reached 1.9–2.0 million feddan, indicating that the two rotation systems have been applied to about the same extent. C. H. Brown, op. cit., Ch. 1, himself an outstanding cotton breeder who worked for many years in Egypt, claims that systematic experiments that could settle the issue as to which rotation is more efficient have never been made (1955). Before World War I, 2-year rotation prevailed; see J. I. Craig, "Notes on Cotton Statistics in Egypt," *L'Egypte Contemporaine*, Vol. 2, No. 6, March 1911.

9. Willcocks, op. cit., 1899, pp. 379–382.

10. Marc Nerlove, "Estimates of the Elasticities of Supply of Selected Agricultural Commodities," *Journal of Farm Economics*, Vol. 38, No. 2, May 1956.

11. Raj Krishna, "Farm Supply Response in India-Pakistan: A Case Study of the Punjab Region," *Economic Journal*, Vol. 73, No. 291, September 1963.

12. See C. Bresciani-Turroni, "Rélations entre la récolte et le prix du coton Egyptien," *L'Egypte Contemporaine*, Vol. 19, 1930; S. Soliman Nour El Din, "A Statistical Analysis of Some Aspects of Cotton Production and Marketing with Special Reference to U.S.A. and Egypt," Ph.D. dissertation, London University, 1958; Robert M. Stern, "The Price Responsiveness of Egyptian Cotton Producers," *Kyklos*, Vol. 12, 1959, and "The Price Responsiveness of Primary Producers," *Review of Economics and Statistics*, Vol. 44, May 1962; B. Hansen "Cotton versus Grain: On the Optimum Allocation of Agricultural Land," *Seminar on Economics and Industrialization of Cotton*, Ministry of Scientific Research, Cairo, 1964.

These results do not necessarily imply, of course, that area restriction tends to increase elasticity. There are many other differences among these studies. However, the government has at times imposed restrictions to keep up prices and may have reacted more strongly than the farmers would have done.

13. As has recently been shown, risk considerations imply that the sign of the response of a subsistence crop's acreage to price changes is uncertain; see V. F. Nowshirvani, "Land Allocation under Uncertainty in Subsistence Agriculture," *Oxford Economic Papers*, Vol. 23, No. 3, November 1971.

14. The high long-term elasticities appeared in the I.V. estimates only. The L.S. estimates resulted in relatively low long-term elasticities for all commodities, although also here barley and helba came out with the highest long-term elasticities, 0.75 and 0.85, respectively. See Appendix A, Table A–2.

15. Willcocks commented in 1899 that this "is a very distinct hardship to the poor in this country, and in estimating the great advantages conferred on the country by the British occupation this fact must always be remembered as counting on the opposite side. The absolute prohibition of so valuable and suitable a crop can never be considered as anything but a makeshift while there are sound financiers in the country." (Willcocks and Craig, op. cit., 1899, pp. 385–386.) Independence in 1936 did not lead to any change in this burden on the poor, nor did the revolution of 1952. Only now is the government contemplating the readoption of tobacco cultivation.

16. Export taxes existed since 1840, but the rates were low (1 percent since 1869) and the taxation thus without serious consequences. In the early 1920s a production tax was levied on cotton, but tax rates were quite low.

17. *Economic Review*, Central Bank of Egypt, Vol. 1, No. 2, p. 217.

18. Farmers are obliged to purchase the minimum amounts of fertilizers stipulated; they can purchase in excess of these amounts at higher prices. See Ezz El Din Hammam

Ahmed and M. G. Abu El Dahab, *Fertilizer Distribution in the Arab Republic of Egypt*, OECD, Paris, 1972, p. 35.

19. D. Warriner, *Agrarian Reform and Community Development in U.A.R.*, Cairo, 1961.

20. No evidence seems to have been published.

21. No systematic account has, to the best of our knowledge, been published about the way in which the government operates through the cooperatives. A detailed verbal description of the modus operandi of the cotton acreage allotments to one of the authors by a high civil servant who was involved for several years in the system at the top level indicates that it is not really a question of a centralized command system. The procedures were described as follows:

At the beginning of each agricultural year, the Ministry of Agriculture, together with export, foreign exchange, and other authorities, decides upon a plan for the areas to be cultivated with various varieties of cotton that year. It subsequently enters into discussions with the directors of agriculture for the individual provinces and reaches agreements with them about a plan for each province. Together these plans may bring about a revision of the original plan. Each provincial director then takes up discussions with the district inspectors of his province, and plans are drawn up for the individual districts. Once more a revision of the total may evolve. Finally, the individual inspector meets with the village cooperatives in his district and reaches agreement with each village about its cotton cultivation. These agreements—which again may imply a revision of the total—are signed by the individual cultivators, who, however, have the right to appeal to a higher authority for a revision of their "contracts"; such appeals are often approved.

The whole procedure can perhaps best be described as a stepwise bargaining process, and it is not clear who has the upper hand in the negotiations at the various levels. It is obviously a long way from the original top-level allotments to the final obligations of the cultivators. Evasion by the cultivators is, finally, a possibility that should not be ruled out, but it is not considered important. Nonfulfilment related to shortages of seeds of prescribed varieties is believed to have been of importance on some occasions.

22. Each farmer has a "farm holding card," issued by the Ministry of Agriculture, which "identifies the location of the farm, its size and the crop rotation pattern prescribed for it—these being the basis for the fertilizer quota." (H. Ahmed and A. El Dahab, op. cit., p. 11.) The fact that each farmer is prescribed a rotation pattern does not imply that all crop acreages are centrally planned.

23. N. Saad, "Structural Changes and Socialist Transformation in Agriculture of the U.A.R., Egypt," *L'Egypte Contemporaine*, Vol. 55, 1968, p. 285, Table 8 gives prices for compulsory and noncompulsory deliveries of wheat, rice, and onions.

24. N. Saad, op. cit., pp. 284–285.

25. *Agricultural Economy*, Ministry of Agriculture, Cairo, 1961, pp. 22–23.

26. As with all other assessments for tax purposes, there may, of course, have been deviations from market values in individual cases and on average.