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The purpose of this paper is quite specific: we shall attempt to modify earlier calculations of private and social returns of several rotational sequences in Egyptian agriculture by treating berseem as a traded good, rather than as a non-traded good. In estimates of the social returns for rotations that include berseem, we shall use an international price based on the price of feedstuffs that are nutritionally equivalent to berseem.

We provide a brief background in Part I, summarize the earlier study in Part II, and explain our single modification of it in Part III.

I. Introduction

The allocation of resources in Egyptian agriculture is influenced by a large number of rules and regulations that cause the prices of outputs and inputs to diverge substantially from the prices that prevail in world markets, and from the prices that would prevail in Egypt if relatively free competition existed. These include price controls, marketing quotas, acreage requirements, subsidies, and rationing. Circumstances vary from one crop to another. This regulatory system has evolved over several decades, and in many cases present-day circumstances are quite different from those existing when the regulations were adopted. Regulations often remain in force even though they no longer serve their original purposes. This institutional inertia becomes especially important when large changes occur in economic conditions, as has been the case in the decade of the 1970s. Relative prices have changed drastically, and some fixed prices that originally involved subsidies to producers now represent implicit

taxes on producers, and vice-versa.

It is widely recognized that the whole structure of government intervention in agriculture constitutes a major problem of economic policy in Egypt. The matter has been extensively studied both inside and outside of government, and some changes have been made in the structure of rules and regulations, but no major modifications have yet been adopted.

One central issue concerns allocative efficiency. Does the present system foster an allocation of Egypt's 6,000,000 feddans of cropland (or 11,000,000 feddans, allowing for double-cropping) among the various competing uses that results in maximizing the value of the nation's agricultural output? If not, how large is the gain that could be achieved by a reallocation of resources? Although this is a key issue, traditionally emphasized in economic analysis, the policymaker is also concerned with several other aspects and dimensions of the matter. These include:

Distributional effects. Many existing regulations were originally intended to provide a minimum real income to the lower income group, especially the urban poor.

Risk and uncertainty. In view of the large changes that occur in commodity prices on world markets, it may be argued that Egypt cannot afford the risk involved in allowing international prices to direct the allocation of its resources. A sudden change in prices could inflict heavy cost on the nation.

Food self-sufficiency. This issue is related to the one above, but it deserves separate mention because of the attention it is receiving in Egypt at the present time. Some argue that Egypt should make certain that domestic production of basic foodstuffs is maintained at some minimum level. Others argue that food can be imported and that the important issue concerns export capacity — the ability to finance needed imports. Risk is clearly an issue

in this debate.

Budgetary implications of any change in policy. Existing regulations influence government revenues and expenditures in several ministries and agencies. Conflicts of interest often arise within government when changes are proposed.

Implications for economic growth. The present system evolved at a time when it was widely believed that the agricultural sector should be taxed to provide resources for expansion of the non-agricultural sectors. There is now much doubt about the need for a real transfer from agriculture in order to foster economic growth.

The discussion of agricultural price policies is therefore complicated because of the need to consider these (and other) multiple objectives. The real issue is whether a different set of price policies would enable policymakers to achieve whatever combination of objectives they have selected as their social, political, and economic target. It is also possible that greater allocative efficiency is compatible with these other objectives, provided suitable institutional adjustments are made. For example, higher farmgate prices to encourage increased production of particular products can be used along with subsidized supplies to urban consumers (preferably with a ration), provided the budgetary problems can be dealt with. Production incentives can be made compatible with distributional equity.

In any event, one reason for the current emphasis on agricultural price policies is that farmers have responded to the existing system of regulations in ways that sometimes run counter to the government's declared objectives. Fairly large shifts in the allocation of cropland have occurred during the last decade or two. Perhaps the most dramatic of these are (a) a 30 percent decline in cotton area despite government regulations to require farmers to plant cotton, (b) an increase in area

devoted to fruits and vegetables, whose prices are less closely controlled, and (c) the expansion in long-season berseem. It appears that farmers are calculating revenues and costs from alternative uses of their resources, and making choices in order to improve their net incomes. This is, basically, a hopeful sign because it suggests that policymakers may be able to use price incentives to achieve their objectives. The cumbersome, complicated structure of detailed rules and regulations might be replaced with a much simpler set of instruments for influencing price, and greater reliance placed on market forces. However, the immediate reaction in government in the face of market response is often to impose tighter controls and still more regulations in order to force compliance with the government's policies. When the incentive structure implicit in the set of rules and regulations is inconsistent with the government's objectives, conflicts and tensions tend to arise.

One purpose of economic analysis is to show how such conflicts can be resolved or removed.

II. The "Policy Study on Pricing and Taxation": A Partial Summary

An interesting study of agricultural prices was made in 1979 by the Economic Studies Unit in The Ministry of Economy, under the title Policy Study on Pricing and Taxation of Major Alternative Agricultural Crops.[1] We shall refer to this paper as the Policy Study on Pricing. This paper calculates and compares net returns to farmers and net returns to the economy, for nine different crop rotations involving important agricultural crops. (For brevity, we shall refer to these as private returns and social returns.) This use of rotations is an interesting innovation, reflecting the nature of Egyptian agriculture. Nearly all of the cultivated land is capable of double cropping, but some crops can be grown only in winter, others only in summer. Furthermore, some sequences (winter

and summer) are feasible while others are not.

Consequently, the farmer is constrained in his crop choices to those that satisfy the rotational restrictions. For example, maize and rice are both summer crops; thus the farmer cannot choose a maize/rice rotational sequence. Also, long-season berseem is not compatible with cotton because cotton has a long growing season (eight months), but short-season berseem is said to be a necessary predecessor crop to cotton because it has nitrogen-fixing characteristics that are important for cotton.[2]

The authors of the Policy Study on Pricing selected nine of the many rotational sequences that farmers could choose. For these nine, they calculated private and social returns per feddan. For private returns, actual farmgate prices were used for outputs and inputs; for social returns, international prices adjusted to farmgate levels were used for traded items. In both cases, production cost estimates of the Ministry of Agriculture were used. These estimates purport to represent the average cost per feddan to cultivate each crop, broken down into several components: rent, wages, animal power, fertilizer, insecticide, seeds, machinery, etc. The validity of these estimates may be questioned, but we shall use them as a basis for our work. We want to examine the influence of a single modification--namely, a change in the method used to value berseem.

The results obtained in the Policy Study on Pricing are summarized in Table 1. The figures refer to 1978. The most striking things about Table 1 are the large divergences between private and social profitability and the variation in this divergence for the various crops. The rank correlation coefficient for the two lists is near zero. Price distortions for both outputs and inputs have produced a situation in which some of the crops that are most attractive from a social point of view are not very profitable to the farmer. Consequently, farmers resist government efforts to persuade or force them to plant these crops (such as cotton

Table 1

Comparison of Private and Social Returns

to Certain Rotations

Crop(s)[a]	Net Revenue To Farmers (Private Returns)		Net Revenue to the Economy (Social Returns)	
	Rank	L.E. per feddan	Rank	L.E. per feddan
Berseem/Rice	1	260.5	4	415.5
Berseem/Maize	2	255.4	6	256.2
Sugar Cane	3	129.4	2	533.2
Soya beans/Maize	4	126.7	8	109.5
Broad beans/Maize	5	118.6	9	92.2
Berseem/Cotton	6	112.1	3	470.9
Onions/Maize	7	97.3	1	882.0
Wheat/Rice	8	88.3	5	293.6
Wheat/Maize	9	83.1	7	134.3

[a] Each sequence includes a winter crop and a summer crop, except sugar cane, which occupies the land all year.

Source: Policy Study in Pricing and Taxation, op. cit.

and wheat), preferring others (such as berseem and sugar cane) that are more profitable. That, in general, seems to be the moral of Table 1. It might be even stronger if other alternatives such as fruits, vegetables, and dairy products were included in the list.

However, some examples in Table 1 are quite strong! The social returns to Onions/Maize are L.E. 882 per feddan, but the private returns are only L.E. 97, making this a rather unattractive option to the farmer. The low buying price for onions set by the government, which has a monopoly on onion exports, is the main cause of this disparity. Similarly, the large disparity between the social returns (L.E. 471) and private returns (L.E. 112) to Berseem/Cotton is largely a result of the low buying price for cotton set by the government. The farmgate cotton price was increased about 20 per cent in 1979, raising the private returns to L.E. 167 and shifting the Berseem/Cotton rotation to third place in terms of private returns. It remains to be seen whether that action will reverse the decline in area planted to cotton.

In essence, the findings of the Policy Study on Pricing strongly confirm the view that agricultural price distortions are large enough to cause serious misallocations of resources in Egypt, and that the nation would benefit from a reduction of these distortions. These results also indicated that farmers were acting rationally in choosing to plant berseem despite some governmental disapproval. Berseem/Rice and Berseem/Maize ranked first and second in private profitability, though only fourth and sixth in social returns, among these nine.

III. A Single Modification: Treating Berseem as a Traded Good

As mentioned above, in calculating social returns the Policy Study on Pricing treated berseem as a non-traded good. Thus, the actual farmgate

price was used for both private and social returns. If this price was in fact higher than the international price of equivalent feedstuff (adjusted to farmgate level), then the result is to overstate the social returns to crop rotations that include berseem. And conversely, if the actual price was lower than the international price.

In order to investigate this issue, we must first determine the substitutability of other feedstuffs for berseem. If Egyptian farmers reduce their output of berseem by 10 tons, how much imported feed will be required to replace it? This turns out to be a rather complicated question. The answer varies according to whether the animals are being used for work, for milk production, or just for meat. In Egypt, they are used for all three purposes, though in varying proportions by different farmers and we shall assume a composite of the three uses. The answer also varies according to the type of imported feedstuff that is chosen. Numerous alternatives exist, and we shall simply select a representative one.

Our approach is to determine a particular alternative feed that is nutritionally equivalent to a given amount of berseem, and that is available in Egypt and thus substitutable in practice - though of course an increase in imports would be involved in the event of a reduction in berseem production.

We have been informed that in terms of starch equivalent and digestible protein, two major dimensions of nutritional adequacy, one ton of a feed concentrate will supply about the same food value as ten tons of berseem.[3] However, in order to supply necessary bulk and roughage, the animals must also be fed one ton of a fodder such as rice straw or wheat straw along with the feed concentrate. Thus,

our estimate is that:

1 Ton of Concentrate + 1 Ton of Rice Straw	is substitutable for 10 Tons of Berseem.

Of course feed concentrates vary in composition. The mixture on which the above equivalence is based is in use in Egypt and is known as co-op feed. Its ingredients are:

Cotton seed meal	45%
Maize	20%
Rice bran	20%
Wheat bran	9%
Molasses	3%
Limestone	2%
Salt	1%
	100%

This concentrate contains about 20 per cent protein. Other feeds are also used; farmers often use cottonseed cake (cusp) as a food supplement when forage is insufficient or energy is needed.

To estimate the international price of the berseem substitute is not an easy task. There is no single "correct" price because the appropriate feedstuffs to be substituted will vary with the farmer's purpose — whether he wishes to produce meat, milk, or energy. A more detailed analysis should consider each output separately, and make calculations based on the most suitable mixture of feedstuffs to achieve that given objective.

However, as noted above, we shall assume a composite objective and estimate a single international price for a specific berseem substitute. To begin with, we shall treat the roughage (rice straw) as a non-traded good and simply use the farmgate price as reported by the Ministry of Agriculture. In 1978, the farmgate price of rice straw was L.E. 5.76 per ton.[4]

The world price of our standard feed concentrate was about L.E. 64 per ton in 1978.[5] This estimate is based on the dollar price converted at the parallel exchange rate of $1.43 = L.E. 1.00. We add L.E. 6 per ton for distribution costs,[6] giving us a farmgate price of about L.E. 70 per ton. (Feed concentrates were being sold in Egypt at a subsidized price of L.E. 30-35 per ton in 1978, but supply was limited and preference was given to certain groups of users. Small farmers were unable to buy the subsidized feed. The free-market price is reported to have been about double the subsidized price, or about L.E. 70 per ton.)[7]

Combining these two components of the berseem substitute, we obtain an estimate (L.E. 5.76 + L.E. 70.00) of L.E. 75.76 for a quantity sufficient to replace 10 tons of berseem, or L.E. 7.58 per ton of berseem.

Finally, we shall adjust for the nitrogen-fixing value of berseem. Since this benefit is lost if berseem is not cultivated, it should be allowed for in calculating the social returns. According to Ministry of Agriculture estimates, a ton of berseem adds 0.4 kg. of nitrogen to the soil. The international price equivalent of 0.4 kg. of nitrogen in the form of fertilizer was L.E. 0.15 in 1978.

Adding that amount gives us a final estimate of L.E. 7.73 as the international price equivalent of our berseem substitute. This may be compared with the actual farmgate price of L.E. 12.21 per ton for berseem in 1978, as used in the Policy Study on Pricing calculations.

Our next step is to recalculate the social returns per feddan for the crop rotations that include berseem. This is done in Table 2, in which all data remain the same as in the original Policy Study on Pricing calculations except for the berseem price. The lower price for berseem of course reduces the social returns of all these rotations, as shown in Table 3.

Table 2

Net Revenues to the Economy of Alternative Crop Rotations at International Prices (L.E. per feddan)

		Berseem/Cotton	Berseem/Rice	Berseem/Maize
Winter Crop (berseem)	Equivalent international price per ton at the farm	7.73	7.73	7.73
	Revenue per feddan at international prices	92.76	185.52	185.52
	Average cost of production at international prices of traded inputs	83.87	83.87	83.87
	Net revenue at international price	8.89	101.65	101.65
Summer Crop	Equivalent international price per ton at the farm	719.00	143.39	100.85
	Revenue per feddan at international prices	617.97	319.19	169.18
	Average cost of production at international prices of traded inputs	209.72	112.86	122.16
	Net Revenue	408.25	206.33	47.02
Net Revenue of the Rotation at International Prices		417.14	307.98	148.67

Table 3

Social Returns to Certain Crop Rotations

(L.E. per feddan)

	Crop(s)	Original Estimate in the Policy Study on Pricing	Revised Estimate
1.	Onions/Maize	882.00	882.0
2.	Sugar cane	533.2	533.2
3.	Berseem/Cotton*	470.9	417.1
4.	Berseem/Rice*	415.5	308.0
5.	Wheat/Rice	293.6	293.6
6.	Berseem/Maize*	256.2	148.7
7.	Wheat/Maize	134.3	134.3
8.	Soya beans/Maize	109.5	109.5
9.	Broad beans/Maize	92.2	92.2

* Rotations affected by change in price of berseem.

The reduction in social returns per feddan is especially marked in the two rotations involving long-season berseem. Berseem/maize declines almost 50 per cent, and at its new level it is only slightly above wheat/maize. Oddly enough, however, the change in the price of berseem does not alter the rank order of the nine rotations on the basis of social returns.

We are forced to conclude that, somewhat to our surprise, even a substantial change in the international price equivalent of berseem does not significantly affect the relative social profitability of these nine rotations. The important conslusion of the Policy Study on Pricing--namely, that Egyptian price distortions have produced a bias in favor of long-season berseem and against cotton--still seems valid. But when that distortion is removed, through use of international price equivalents and the calculations of net social returns, berseem is still a fairly attractive alternative. In particular, its relative standing is not significantly altered by the modification we have introduced--namely, to treat berseem as a traded good with an international price equivalent of its own.

We must also acknowledge that even this modest conslusion rests upon a rather slender and uncertain factual basis. The crucial estimate is that made for the international price equivalent of a berseem substitute. This estimate, which we put at L.E. 7.73 per ton, is not as firmly based as we would like. It is substantially influenced by the choice of assumptions. For example, we used rice straw (L.E. 5.76 per ton) instead of wheat straw (L.E. 37.20 per ton), but rice is grown only in the delta and rice straw is not available to all farmers. If we use wheat straw in our calculations, and take the United States farm price of a comparable feed (L.E. 104.90 per ton) as our basis, the international price equivalent of the berseem substitute rises to L.E. 14.36 per ton.[8] This is an 86 per cent increase over the estimate used above.

The official estimate of the price of berseem (L.E. 12.21 per ton) is itself a highly uncertain number: there is no well-organized market for berseem; much of it is utilized on the farm by the farmers themselves; some is sold by simply letting cattle graze in the fields for a given period of time; and regional and seasonal variations are large. Furthermore, the Ministry of Agriculture's official price series has been erratic: the price went from L.E. 8.64 in 1977 to L.E. 12.21 in 1978, and then back to L.E. 8.64 in 1979.

If this price was abnormally high in 1978, one could make a case for the position that in recent years the domestic price of berseem has been below its international price equivalent (in terms of a substitute feed), and therefore that the calculations in the Policy Study on Pricing understate the social returns for rotations including berseem. Given such a wide range of possible positions, we think the issue must be regarded as unsettled. Thus we are doubtful about the factual basis for the present policy stance, which is to discourage the cultivation of berseem. It may be that farmers are serving not only their private interests but also the public interest when they plant berseem.

As we have noted above, much of the appeal of berseem to Egyptian farmers derives from its role as an input in the production of meat and dairy products. Prices of these products are largely uncontrolled, and they have been rising rapidly in recent years. By planting berseem, farmers are able to take advantage of these favorable prices. The calculations for the nine crop rotations chosen for the Policy Study on Pricing paper do not fully capture this incentive. What is needed is a calculation of the net returns to farmers from meat and dairy products. Because of import restrictions, domestic prices of these products are higher than world prices, so once again price distortions enter the picture.

The income elasticity of demand for meat and dairy products is higher than for the staple grains that comprise the bulk of the consumer's diet. Rising incomes have thus been accompanied by rising demand for meat and dairy products. Farm households, whose own rising incomes have been supplemented in many cases by remittances from family members who are working in foreign lands, have also chosen to increase their consumption of meat and dairy products. Through the cultivation of berseem, farm households can supply themselves with more of these products than they could buy with the proceeds of other crops. They can also sell part of their output at attractive free-market prices. The appeal of this allocation of the farmer's resources is obviously enhanced by the set of public policies that results in high prices for meat and dairy products and low prices for alternative agricultural products.

We do not have enough data to calculate the private and social returns for animal products, but in his study of agricultural price policies Cuddihy made some calculations that are relevant.[9] He estimated the effective rate of protection for meat products to be about 180 per cent in 1976/77. This calculation was based on subsidized prices for feed concentrates, but even if world feedstuff prices are used the effective protection rate was still 155 per cent. This is a powerful incentive to produce meat and dairy products.

This incentive exists despite the fact that meat and milk output per head of cattle are low in Egypt. Both could be substantially increased through proper breeding and other improvements in animal husbandry. Similarly, the yields of forage crops, including berseem, could probably be increased.

However, government officials seem doubtful about the wisdom of

expanding animal products, partly because of the rather rigid limits on Egypt's arable land and the absence of any range-land for grazing cattle. There has been a reluctance to use Egypt's high quality irrigated cropland for forage crops. At present, year-round forage crops such as alfalfa are permitted only in the "new lands." As we have seen, long-season berseem is discouraged by official policy, though without much success.

Our study leaves us with no definite conclusion about the net economic benefits of meat and dairy production in Egypt, or about the cultivation of berseem. However, price policies do appear to impart a bias in favor of these activities — a bias that runs counter to the government's official attitude. Government urges farmers not to grow (long-season) berseem, but its price policies appear to provide incentives for them to grow it.

Footnotes

1 An unpublished paper issued in mimeographed form by the Economic Studies Unit of The Ministry of Economy, Government of Egypt. Undated.

2 It may be that some of these rotational constraints are less rigid than is commonly believed by Egyptian agriculturists. Nitrogen can be supplied in other ways, and cotton is certainly grown elsewhere without berseem. Indeed, in some parts of Egypt farmers are now planting other crops than berseem to precede cotton.

3 We are indebted to Professor Mohamed El Ashry, Department of Animal Production, Ain Shams University, for advising us on these matters. Professor El Ashry is of course not responsible for our interpretations and uses of this information.

4 Wheat straw was considerably more expensive - L.E. 37.20 per ton - partly because it has alternative uses as a construction material (in composition board and in brickmaking).

5 This situation is based on data for a variety of animal feeds in the UN Yearbook of International Trade Statistics and the FAO Commodity Trade Yearbook.

6 In the Policy Study on Pricing only L.E. 1.15 per ton is allowed for distribution costs of imported fertilizer. This strikes us as extremely low.

7 William Cuddihy, Agricultural Price Management in Egypt, World Bank Staff Working Paper No.388. April 1980, p. 101.

8 The average price paid by U.S. farmers for a standard dairy concentrate (20% protein) was about $150 per ton in 1978. U.S. Department of Agriculture, Agricultural Prices. Converted at $1.43 = L.E. 1.00, this means L.E. 104.90 per ton. The full calculation is (104.90 + 37.20) ÷ 10, plus 0.15 for nitrogen, equals L.E. 14.36 per ton.