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AND CONTROLLED AGRICULTURAL PRICES IN EGYPT
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Estimating Welfare Impacts from Food Subsidies and Controlled Agricultural Prices in Egypt*

B. Delworth Gardner, Dyaa K. Abdou, Sonia Aly, Rasmia Moustafa El-Sayed, Adel Moustafa, Sobhy Ismail and Richard Green

Introduction

If one is to understand Egypt's food situation, the various policies and institutions that comprise it must be carefully described. This would include the statutory and administrative moorings of the policy, and whether or not the policy is being carried out as intended. It would also include a description of the consequences of the policy; the effects on consumption and nutritional adequacy, on the distribution of income and wealth, and especially on the efficiency of the economic system. What is the impact on incentives, property rights, productivity of resources, and the overall standard of living? How does the policy relate to government budgets, the availability of foreign exchange and the balance of payments?

While these descriptions are indeed necessary for understanding and policy indicating improvement, they are not sufficient conditions for an improvement in societal welfare. In addition, 1) there must be some integration of various policies into a meaningful whole; otherwise the relevant parts are so numerous and interrelated that the whole will be lost in the descriptive detail of the parts, and 2) there must be some evaluative framework that would permit the parts to be compared and aggregated so that overall better or worse can be ascertained. Without such integration and evaluation, planning decisions must be piecemeal.

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and incomplete. One government agency will be primarily interested in consumers, another in producers, still another in the effects on the government budget, and yet another in the impact on the foreign exchange balance, etc. Such posturing is completely rational given the responsibilities of various ministries and agencies. In this environment, integration and evaluation will occur anyway sooner or later in some fashion, but without an objective framework, decisions will be influenced primarily by political criteria such as which agency has the most clout in reaching a final decision. There will be no assurance that the "national interest" will be looked after.

No one has yet devised an evaluative framework for indicating national welfare. The reasons are rather apparent. Some considerations relevant to the "welfare" of the nation are noncomparable and therefore cannot be incorporated in a single criterion where they can be weighed according to their importance. For example, how does one compare national security and an egalitarian income distribution or even bring them into a common framework? It is inevitable that trade-offs among these types of broad social goals must be evaluated by top-level government officials elected or appointed to make these difficult evaluations.

At a lower level of aggregation, however, economists have developed a framework for evaluating whether or not resources are being allocated efficiently. This is extremely significant. Efficient resource allocation means that the aggregated net benefits of consumers and producers in the economy will be at a maximum. This can easily be translated into per capita real income and standards of living, items of critical concern to developing countries particularly. As argued above, economic efficiency is not the only important social goal and thus can never be considered sufficient. But information yielded by this framework should be of tremendous value to decision makers as they struggle
to integrate many social goals into a unified policy. For example, what is the impact of Policy A on the average level of real income, or what standard of living must be foregone if Policy B is changed in some specified way? These are the types of resource allocation questions that can be answered by economic efficiency analysis.

This paper is a brief statement of first principles for developing and implementing such a framework in the area of food policy. It is a discussion of the economic logic underpinning an efficiency analysis of food pricing and subsidies.

**Some Elemental Theorems of Efficient Resource Allocation**

Resource allocation can be described and evaluated in either product or factor markets. Products are outputs from any productive process and are generally consumed or utilized by ultimate consumers. Bread, cars, the services of physicians, are examples of products. Factors are inputs into the productive process and are supplied by their owners. Examples are land services, human labor, machines, and energy fuel. The problem itself will usually dictate whether it is expedient to look at an efficiency issue in the product or the factor market or both. They are often convertible into each other, and one has been called the "dual" of the other. If the problem is to analyze whether or not resources are being efficiently allocated to the production and consumption of rice, the product market is the correct choice. On the other hand, if the problem is to ascertain whether or not Egypt's labor is being efficiently allocated, the labor factor market is the relevant one.

Since our principal concern at this conference is food, a product, we shall confine our discussion of efficient resource allocation to a product market situation.

The efficiency norm which must be satisfied if resources are efficiently
allocated to any product is that the marginal valuation of all consumers for that commodity must equal the marginal opportunity costs of supplying it. Why is this so?

If the marginal valuation of consumers exceeded the marginal supply costs of producers, resources could not be efficiently allocated since additional supply would be worth more than it costs and suppliers should be induced to increase the supply. Likewise, if marginal supply costs were greater than the marginal valuations of consumers, the existing supply could not be freely sold and producers would be induced by falling prices to reduce the supply to efficient levels.

The marginal valuation of consumers is not some hypothetical figure reflecting their fanciful desires, but reflects their actual willingness and ability to pay for the commodity. If price of the commodity were the method of denial utilized to determine who gets the commodity in the market, then the marginal valuation would be the price. If some other method of denial, such as a ration book, is utilized then the fixed price of the rationed commodity cannot be assumed to represent the marginal valuation since the consumer may well want more of the product than the ration book allows but cannot get it. If he could, it would be unnecessary to ration the commodity. Only in free markets, where the consumer is free to take whatever quantity is desired, can we assume that the market price represents the marginal valuation of consumers.

The marginal opportunity costs of producing good Y are the marginal values of the resources utilized to produce Y had they instead been used to produce the most valuable alternative to Y, say good X. Opportunity cost is a conceptually powerful but empirically difficult concept. If resources are actually used to produce Y, who knows what they would have been worth hypotheti-
ally in producing X? Fortunately, if we assume that the producer and supplier of Y is rational, we can infer opportunity cost under certain market conditions. In a free competitive market, price is the marginal revenue the supplier receives from selling Y. The price of Y must equal or exceed the marginal opportunity cost of supplying Y or the resources would be bid away to produce something else.

Of course, the marginal valuation by consumers is related to the quantity consumed and is governed by a well-known economic law—the law of diminishing marginal utility. This law states that successive units of a commodity bring less additions to the total satisfaction of the consumer than previous units. The implication of this law is that the curve showing marginal valuations (the demand curve) is a function of quantities consumed and slopes downward.

The curve of marginal opportunity costs (the supply curve) is governed by another law, known as diminishing marginal returns, or diminishing marginal productivity. It asserts that as resources are shifted away from alternative uses to produce a commodity, resources with lower opportunity costs will be taken first; and as production increases, resources with higher opportunity costs will be utilized to produce marginal quantities of the commodity. The implication is that the curve of marginal opportunity costs slopes upward as a function of the quantity of output.

In a market where suppliers are free to sell all they wish and demanders are free to purchase all they wish, if the quantity demanded equals the quantity supplied, the market is in equilibrium. Then the price represents both the marginal valuation of consumers and the marginal cost of producers.

If only the real world were this simple, our efficiency problem would be a simple one. Unfortunately, the real world is much more complex, and includes such things as prices fixed by government and trade policies, ra-
tioning, subsidies, mandatory supply controls, and quota deliveries. Our challenge is to apply our basic efficiency logic and tools discussed above to the real world that exists and infer what the efficiency losses are of policies being utilized. As we shall see, we can say a great deal.

Our team in ADS has studied three prototype commodities: 1) wheat products—representing subsidized but unrationed commodities, 2) rice—representing subsidized and rationed commodities, and 3) broadbeans—representing subsidized and semi-rationed commodities. In the latter case, "semi-rationed" means that the rationed entitlement varies depending on the availability of supplies.

Our primary aim in this paper is to explicate the logic of efficiency analysis as a "welfare" criterion. Let us proceed by applying the criterion developed above to each of the three commodities. In the process we shall indicate data needs and estimation problems.

Some Commodity Analyses

Wheat Products

The current situation for wheat and wheat products in Egypt is characterized by heavy subsidies and growing consumption on the demand side, and stagnant domestic production and growing imports on the supply side.\(^1\)

Consider figure 1 which is a graphical representation of the wheat situation in 1980-81. D represents the aggregated marginal valuations for consumers of wheat products converted to raw wheat equivalents. S stands for the marginal opportunity costs of producing raw wheat domestically. \(P_c\) is the weighted average subsidized price of wheat products to consumers converted to raw wheat equivalents. \(P_p\) is the price received by domestic producers in the domestic market and also is the marginal value of home-produced autoconsumption. \(P_w\) is the world border price paid for purely commercial imports converted to Egyptian pounds at the official exchange rate. Of course, in making this conversion the
Figure 1 - Wheat Products
higher shadow exchange rate might have been used. The effect of using the shadow exchange rate would be to raise the world price. Later in this paper we utilize the official rate because official government studies usually do. However, we would prefer the shadow rate on theoretical grounds since, as an approximation to a free market rate, it represents better the real opportunity costs of using scarce foreign exchange to make international purchases.

With these tools we can conceptualize the resource allocation problem and make some empirical estimates of welfare efficiency losses associated with existing policies.

On the supply side the situation is complicated by the existence of concessionary sales, such as US PL-480 and French sales, at costs to Egypt far below world market commercial prices. What the real costs of these concessionary programs are has been hotly debated because of impacts on domestic producer incentives and efficiency. We cannot settle these issues here. Suffice to say that if there were no concessionary sales to consider, the minimum cost supply curve for the Egyptian economy would be curve abc. After quantity 0 \( q_p \) (point b) real resource costs would be lower from importing than from producing wheat domestically. If concessionary sales were available at real costs that fall below segment ab, then the minimum cost supply must include these imports.

Perhaps the most meaningful framework for evaluating the efficiency of existing policy can be introduced by asking the question: Suppose the domestic price were not controlled and were permitted to rise to world market levels. Who would gain and who would lose and how do these average out for the economy as a whole?

Under current policies, with the subsidized price to consumers at \( P_c \) and no rationing, consumers elect to consume quantity 0 \( q_c \). They capture enormous amounts of consumer surplus (the area under D and above the price \( P_c \)). With the
producer price at \( P_p^- \), the domestic production is \( 0 q_p \), implying that quantity \( q_p \) \( q_c \) must be imported. If all of this were commercial imports, the import bill would be \( P_w(q_p q_c) \) and is paid by the citizens in implicit and explicit taxes. If concessionary sales come into the picture, then part of the bill is paid by US and French citizens.

In contrast, if the price were at world market levels, domestic producers would expand the quantity supplied to \( 0 q_p \) and consumers would contract the quantity demanded to \( 0 q_c \). Imports would be reduced to quantity \( q_p q_c \). It is obvious that consumers of wheat products would lose consumers surplus, producers would gain producers surplus (the area above the supply curve and below the producer price) and taxpayers would gain from a much lower import bill. What can we say about the efficiency of overall resource use efficiency?

The shaded area \( \text{(1)} \) would be a net gain to the economy as a whole, because quantity \( q_c q_c \) is consumed under current subsidized policy and would not be if the subsidy were removed. This quantity costs the economy more (if these are commercial imports) than they are worth to the consumers. The amount of the cost-above-worth is area \( \text{(1)} \). This is a dead-weight resource misallocation in the economy.

On the supply side, quantity \( q_p q_p \) now imported, could be produced with lower resource costs by domestic producers. The world price is above the supply curve, showing that import costs are higher than domestic marginal opportunity costs of growing wheat. This assumes that the increase in domestic output would displace commercial and not concessionary imports (a reasonable assumption). Thus area \( \text{(2)} \) is also a dead-weight loss to the economy since it represents the excess of real resources used to import wheat rather than having it produced domestically. Obviously, the total efficiency losses are the sum of areas \( \text{(1)} \) and \( \text{(2)} \).
When it comes to making empirical estimates of these dead-weight losses, certain problems arise. We have data that permit us to estimate quantities $q_p$, $q_c$, and imports and associated prices. But what would those quantities be if the prices $P_c$ and $P_p$ were $P_w$? To get an answer we would need the demand and supply curves as drawn in the figure. These we do not have, and estimating them directly is most difficult since good time series data of prices and associated free market quantities are not available.

If we had estimates of elasticities of demand and supply, we could extrapolate points on the demand curve upward from point $(P_c, q_c)$ and upward on the supply curve from point $(P_p, q_p)$ until their intersection with $P_w$. This would give us the required points $(P_w, q_c)$ and $(P_w, q_p)$. Other researchers, inside and outside of Egypt, have made these elasticity estimates and we simply took a range for estimating the associated welfare efficiency losses.

The empirical estimates for efficiency losses for wheat products for 1980 appear in Table 1 for various assumed elasticities of demand and supply. If the upper end of the ranges of elasticities are valid, the welfare-efficiency costs exceeded 237 million pounds in 1980, or about 6 L.E. per capita, that could have gone into improved living standards. Demand-side losses (area$^1$ in figure 1) are much higher than supply-side losses (area$^2$) because: 1) the heavily subsidized price to consumers is much farther below the world price than is the producer price, and 2) because of the need to import such large quantities of wheat and flour to meet consumption requirements, the quantities are much larger on the demand side than the supplies produced by domestic producers. The welfare loss is a direct function of both the price disparity with the world price and the quantities misallocated.

**Rice**

The rice situation$^2$ is considerably more complex than for wheat and re-
Table 1. Welfare Losses of Subsidy and Producer Price Programs for Wheat, 1980

<table>
<thead>
<tr>
<th>Assumed Price Elasticities of Supply</th>
<th>Supply-side Losses</th>
<th>Demand-side Losses</th>
<th>Total Social Welfare Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Welfare Loss L.E.</td>
<td>Assumed Price Elasticities of Demand</td>
<td>Welfare Loss L.E.</td>
</tr>
<tr>
<td>0.66</td>
<td>59,456,000</td>
<td>-0.50</td>
<td>177,740,000</td>
</tr>
<tr>
<td>0.50</td>
<td>41,344,000</td>
<td>-0.50</td>
<td>177,740,000</td>
</tr>
<tr>
<td>0.25</td>
<td>18,344,000</td>
<td>-0.35</td>
<td>133,153,000</td>
</tr>
<tr>
<td>0.10</td>
<td>6,873,000</td>
<td>-0.10</td>
<td>41,749,000</td>
</tr>
</tbody>
</table>
quired a more complex analytical model. Rather than describing the model in diagrammatic detail, we will simply indicate the differences in the rice and the wheat models and present the results of the welfare efficiency losses.

Rice producers are required to deliver a quota to the government, generally proportional to the land area planted to rice. If the quota is not delivered, producers are likely to be fined. They receive a price for quota that is generally above the consumer price of rationed rice but below the border world price. With the collected rice, the government supplies the rationing system and exports a small amount.

Farmers generally produce more than the quota and can use this production for home consumption and/or sales in a free local market. Prices in the local rural markets tend to be higher than producer prices on the quota. We would argue that the free market price is the relevant supply price which guides production decisions at the margin. That is, to the extent that farmers have the freedom to allot area to various crops and to apply other inputs to various expected crops, it is the free market price of rice relative to the prices of other commodities that will govern resource allocation. Supplies going to home consumption and the rural free markets are thus derived as the difference between the total production and the mandatory deliveries of quota and are functions of the free market price.

It appears that rural and urban markets for rice are quite different. Urban consumers meet their demands primarily from subsidized and rationed rice and additional quantities made available by the government at a fixed price substantially above that for rationed rice but below the free market and world prices. Rural consumers satisfy their demands from rationed rice, home-produced rice and the local free markets. For these reasons we modeled urban and rural demand separately.
Another difference between wheat and rice is that while Egypt has been an importer of wheat for some time, traditionally she has been an exporter of rice. This means that the opportunity cost of domestic consumption is the foregone ability to earn foreign exchange at the rate of the world price for every ton not exported. Thus, in the case of rice: 1) demand-side efficiency welfare losses are suffered by the economy because exports of rice are foregone in order to make rice available to domestic consumers at prices that reflect marginal valuations below the world price, and 2) supply-side losses occur because at the margin, even in the free domestic rural markets, producer prices are below world market levels. Thus Egypt could add to its real national income by increasing rice production and exporting it. Table 2 contains our estimates of these welfare costs at various assumed elasticities of demand and supply.

These losses are not nearly so large for rice as for wheat products. The existence of the free market for rice greatly mitigates the welfare losses. Since the free market price is above the government procurement price on quota deliveries, marginal and even average returns to producers are enhanced. Also, rural rice consumers can satisfy part of their demand for rice from the free market, and although the price to them is higher than for rationed rice, they are still better off than would be the case if the market did not exist. Taxpayers (Egyptian citizens) are better off because the free market exists than without it, because the higher rural free market price constrains consumption and allows small exports which produce higher revenues than supplies are worth if consumed domestically.

In the final analysis, consumers of rice, especially urban consumers who get the bulk of the subsidy benefits, gain from the existing policy. Producers lose because they are paid far less for quota rice than the world price, and
<table>
<thead>
<tr>
<th>Assumed Price Elasticities of Supply</th>
<th>Supply-side Losses</th>
<th>Demand-side Losses</th>
<th>Total Urban and Rural Welfare Loss L.E.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.10</td>
<td>370,000</td>
<td>-0.12</td>
<td>urban 268,000</td>
</tr>
<tr>
<td>0.25</td>
<td>944,000</td>
<td>-0.31</td>
<td>urban 677,000</td>
</tr>
<tr>
<td>0.44</td>
<td>1,667,000</td>
<td>-0.31</td>
<td>rural 625,000</td>
</tr>
<tr>
<td>0.50</td>
<td>1,900,000</td>
<td>-0.31</td>
<td>rural 1,577,000</td>
</tr>
<tr>
<td>0.75</td>
<td>2,913,000</td>
<td>-0.059</td>
<td>urban 1,042,000</td>
</tr>
</tbody>
</table>
somewhat less even in the free market. Citizens generally lose because rice is consumed domestically at lower marginal valuations than the world price that could be obtained from exports.

Since rice growers on average have lower incomes than urban consumers, and rural consumers have lower incomes than urban consumers, the current policy adds to inequality in the distribution of income. Eliminating the quota and the rationing system presently in use and allowing free markets for rice to operate unfettered in both urban and rural markets would not only be more efficient, but would also contribute to greater equality in the distribution of income.

Broadbeans

Prior to 1980-81, bean producers were also faced with a mandatory quota, but it was abandoned and the government now relies on voluntary deliveries. Because of the disparity between free market and government producer prices, however, only small quantities are being delivered to the government. Most of the requirements of the rationing and government distribution system must be supplied from imports, which are purchased commercially from a number of countries.

Prices paid to producers by the government are generally below the world border price. Thus, supply-side welfare losses are suffered because if the free market price were at the level of government producer prices, additional domestic production could be produced at lower real resource costs than are incurred by importing. On the other hand, if producer prices in local markets were above world market levels, domestic production would cost more in real resources than importing and welfare losses would be sustained.

The bulk of domestic production is consumed at home or is sold in free local markets. Prices vary among governorates, but we know of no systematic study of these prices. Unofficial reports indicate that free market prices are above
world market border prices, however. If so, supply-side losses would occur from excessive domestic production.

Since the free market price also is assumed to reflect the marginal valuations of consumers, demand-side welfare losses will occur if the world price is below the free domestic price. Since the world price represents the marginal opportunity cost of supplying beans to the economy, this cost is lower than the marginal consumer valuation, suggesting resource misallocations. If the government imported more beans and simply sold them in the free market, the demand for domestically-produced free market beans would fall, reducing the free market price. The result would be a reduction in the efficiency losses.

Table 3 contains a summary of supply-side and demand-side welfare losses under various assumptions about producer prices and supply and demand elasticities. These losses tend to be lower than for wheat but higher than those for rice.

If the free market producer and consumer price is actually above the world price: 1) producers gain since imports are not allowed to compete to the extent needed to bring these prices together, 2) consumers gain from the rationing policy at prices below world market levels but lose from the import restrictions since those prices in the free market reflect marginal valuations above the world price and consumers therefore would gain from import increases.

These results have the following policy implications when viewed by the criterion of economic efficiency:

1) If bean producers receive only approximately the government fixed producer price from sales in the free market, this price should be raised to the world price in order to reduce supply-side efficiency losses. On equity grounds they should be raised anyway since producer incomes on average are below the national average.
Table 3. Welfare Losses of Pricing and Trade Policy for Broadbeans, 1980

<table>
<thead>
<tr>
<th>Assumed Price Elasticities of Supply</th>
<th>Supply-side Losses</th>
<th>Demand-side Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assumed Free Market Price to Farmers</td>
<td>Assumed Price Elasticities of Demand</td>
</tr>
<tr>
<td></td>
<td>500 L.E./ton</td>
<td>400 L.E./ton</td>
</tr>
<tr>
<td></td>
<td>2,364,000</td>
<td>697,000</td>
</tr>
<tr>
<td></td>
<td>4,432,000</td>
<td>1,309,000</td>
</tr>
<tr>
<td></td>
<td>6,402,000</td>
<td>1,891,000</td>
</tr>
<tr>
<td></td>
<td>.50</td>
<td>.75</td>
</tr>
<tr>
<td></td>
<td>-.22</td>
<td>.50</td>
</tr>
<tr>
<td></td>
<td>-.75</td>
<td>.75</td>
</tr>
</tbody>
</table>
2) If domestic open market prices to producers and consumers persist at levels higher than border prices valued in pounds at the shadow exchange rate, the government should remove import restrictions from private traders, or increase imports itself.

Summary and Conclusions

Economic efficiency is not the only important societal objective but it is a crucial goal for a nation that wishes to increase its per capita national income. In general, resources will be allocated efficiently when resources are allocated among alternative outputs such that marginal valuations of consumers are equal to marginal opportunity costs to producers. In free and competitive markets, price conveys information about valuations and costs and is the mechanism for coordinating production and consumption. If commodities are heavily subsidized and price denial is replaced by some other denial mechanism, such as rationing, then market signals may not reflect true valuations or costs and incentives will be distorted and resource misallocations will exist.

This paper has shown how existing price and market information may be utilized to infer the efficiency losses inherent with these types of policies. Resources would be more efficiently allocated if prices could move toward world market levels, since in a very profound sense for a country heavily involved in international trade, world market prices reflect the true per unit opportunity costs to the economy of domestic consumption and production. By allowing prices to gravitate toward world market levels, countries can use their resources where they have comparative advantage. Millions of individual decision makers, in a decentralized and free economy, will have incentives to do what is best for them and the country.
Footnotes


