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# **AGRICULTURAL DEVELOPMENT SYSTEMS EGYPT PROJECT**

**UNIVERSITY OF CALIFORNIA, DAVIS**

**CONCEPTUALIZING MACRO AND INTERCOMMODITY LINKAGES  
IN EGYPTIAN FOOD AND AGRICULTURAL POLICY: DEALING  
WITH INTERDEPENDENCIES AND TRADE-OFFS IN ADS  
AND RELATED RESEARCH\***

by

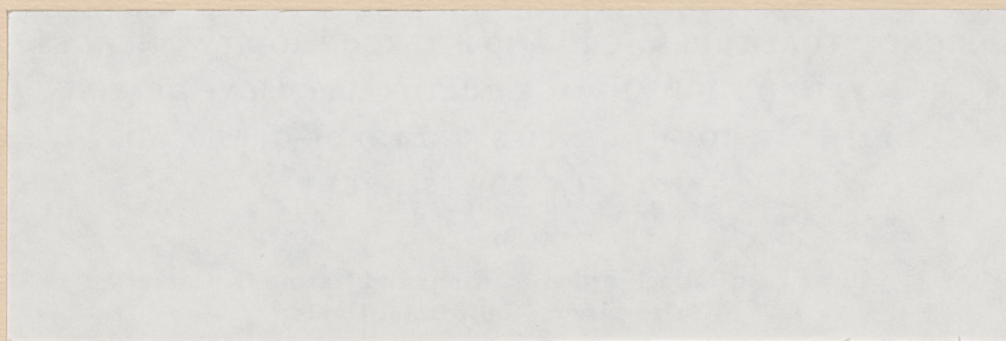
**Alex F. McCalla, Gordon A. King, and Harold O. Carter  
University of California, Davis**

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"Conceptualizing Macro and Intercommodity Linkages in Egyptian Food and Agricultural Policy: Dealing with Interdependencies and Trade-offs in ADS and Related Research"\*

Alex F. McCalla, Gordon A. King, and Harold O. Carter\*\*

I. Introduction

The food and agricultural policy of any nation is in a constant state of flux, influenced by political and economic forces that change over time. This is particularly true for Egypt where a multiplicity of policy interventions occur in attempts to accomplish many goals, some of which are conflicting and therefore involve policy trade-offs. Agricultural and food sector policy in Egypt is most frequently conducted on a commodity basis with a complex array of producer, consumer, and trade price interventions, input subsidies, acreage and cropping pattern mandates, and public sector enterprise involvement. Thus, with food and agriculture policy implicit and explicit intercommodity policy linkages and trade-offs abound.

To further complicate the picture, the importance of the agricultural sector to the general economy means that macro-sectoral linkages must also be understood in effective policy analysis. The Egyptian agricultural sector in 1981-82 provided nearly a fifth of G.N.P., over a third of the gainful employment and was a significant factor in fiscal and foreign exchange budgets. This paper presents an attempt to better understand these latter two linkages with food and agricultural policy. This is necessary because the bottom line in national policy making necessarily revolves around the basic question--what is the appropriate role of the food and agriculture sector in Egypt's policy?

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To address this question in an analytical framework, policy analysts need to know several things:

1. What are the goals of Egyptian food and agricultural policy?

Minister Wally, in a recent paper, has outlined seven objectives (pp. 52-58):

- a. Maximization of net national agricultural product.
- b. Social equity.
- c. Ability of agriculture to achieve food security.
- d. Increasing net agricultural export receipts.
- e. Generation of gainful employment opportunities.
- f. Conservation, development, and maintenance of agricultural economic resources.
- g. Supply requirements of industries vertically integrated with agriculture.

These goals obviously are qualitative in nature and are constrained by broader national goals and the availability of financial resources.

2. What is the current situation with respect to the composite of current policies? Here, much ADS work is relevant as we note later in the paper.

3. What are the alternative paths of approaching the objectives? Here, understanding the path to a given end is at least as important as understanding the ultimate impact of alternative policy actions. The most recurrent theme in recent research on Egyptian food and agriculture policy, including most ADS work, has been to analyze the resource distortion effects of current price and other types of intervention and to conclude that Egypt would be better off by adopting a market policy with "world prices" prevailing. But surely in the real policy world such major structural changes in policy are unlikely. Much more likely are incremental changes, commodity

by commodity. Under this approach, the path and the interconnections with other policies are crucial, even if the ultimate end were a "free market" policy. However, it is important to understand these distortions even though this paper emphasizes financial tradeoffs. In fact, it is because of intervention that these tradeoffs are important.

4. What would be the impact (ultimately in quantitative terms) of these alternative courses? Here, the policy analyst must choose the appropriate form of economic analysis. Clearly, the problem is general equilibrium, dynamic and uncertain (stochastic). Thus, economists' minds turn to thoughts of models which embody these characteristics. The literature is full of macro models with agricultural equations, input-output models, sectoral programming or simulation models and all manner of simultaneous econometric models with varying degrees of specificity. But in our judgment to jump to a model before we fully understand current policies (almost always on a single commodity basis) and the linkages and trade-offs between existing programs, is clearly premature. We do not deny the need for models that deal simultaneously with direct and cross-effects and allow us to identify trade-offs, but before adapting a particular methodology we should seek a conceptual understanding of these linkages. Given that most policy analysis in ADS and elsewhere is partial equilibrium and commodity focused, the question is--can we build from understanding commodity specific policy intervention, using partial equilibrium analysis, towards understanding intercommodity and macro linkages? This is the modest objective of this paper using fiscal and foreign exchange trade-offs as the focus.

The paper proceeds as follows: Section II discusses the legitimacy of considering domestic budget and foreign exchange implications of sector policy. It identifies the changing importance of agriculture in these budgets

and discusses briefly the interested parties. Section III presents a generalized conceptualization of the trade-off function between the domestic budget (L.E.) and the foreign exchange budget (Fx). Section IV analyzes, mainly drawing on ADS research, the character of the actual functions in the cotton, wheat, and meat programs. Section V uses these functions to explore the direct and cross-effects of hypothesized program changes. Section VI presents some very tentative implications of the analysis. Section VII looks in more detail at the spectrum of ADS research and how it relates to these macro linkages. Section VIII discusses some implications for future research and Section IX contains some brief conclusions.

## II. Why Fiscal and Foreign Exchange Trade-offs?

We postulate three reasons for considering this trade-off. First, the policy process involves numerous constituent groups and many ministries. The medium of interaction between these groups is financial. Second, currency inconvertibility makes separate treatment of domestic and foreign currency necessary. Third, the food and agriculture sector is important in both budgets. Each is discussed briefly.

Most policy analysis is concerned with impacts of policy change on various target variables. These include farm income--level and distribution--rural consumer welfare, urban consumer welfare, impact on the national budget, impact on foreign exchange balances and impacts on national income growth. Policy is implemented by various Ministries. In Egypt, a partial list could include: The Ministry of Agriculture (MOA), Ministry of Supply (MOS), Ministry of Irrigation (MOI), Ministry of Industry (MOIn), Ministry of Planning (MOP), Ministry of the Economy (MOE), and the Ministry of Finance (MOF). These Ministries have differing interests in the impacts of

policies on the above variables. A partial identification of possible strong interests is illustrated in Table I. Obviously, all have general interests in all variables.

TABLE I. INTERACTIONS OF INTEREST GROUPS AND ACTION AGENCIES

	MOA	MOS	MOI	MOIn	MOP	MOE	MOF
Farmers	S		S				
Rural Consumers	g	g					
Urban Consumers		S		g			
Urban Workers				S			
Budget Costs					g	g	S
Foreign Exchange					g	S	g
National Growth					S	g	g

S = Strong Concern and Major Responsibility  
g = General Concern.

The common thread linking these variables and agencies are financial. Thus, each agency in its own way is concerned about financial flows, however, the weights that each would attach to changes in financial variables could be quite different. Thus, policy analysis must include policy makers' weights.

Second, in a country such as Egypt where domestic currency (Egyptian Pounds--L.E.) are not fully convertible to various foreign currencies, the availability and value of domestic currency and foreign exchange are unlikely to be the same. The absence of an active foreign exchange market for L.E. means that the marginal valuation to Egyptian policy makers of a L.E. versus a U.S. dollar, for example, may be different and will clearly vary over time. Thus, imbalances in the domestic budget should be treated separately from imbalances of foreign exchange. In the domestic case, budget balance can be

altered by reducing expenditures, raising taxes--implicit and explicit--and printing money. In general, the latter course is inflationary. Foreign exchange balances can be changed by expanding exports, contracting imports or altering the exchange rate. However, given inconvertibility and a general policy of pegging the exchange rate to hard currencies renders adjustments in exchange rates difficult. Thus, in our judgment it is appropriate to treat them separately.

Third, the food and agriculture sector has a very important role in both budgets. Egyptian agriculture has historically been an important source of domestic fiscal resources (Nassar, El-Amir and Moustafa and Habashy and Fitch) principally through implicit taxation by maintaining producer prices low relative to international prices. Also, in recent years the cost of food subsidies has escalated rapidly (FAS/USDA). Thus, food and agricultural policy is important on both the revenue and expenditure side of the annual budget, although the trend in recent years has been towards increased net fiscal costs. Historically, Egyptian agriculture has been a major source of foreign exchange earnings, principally through cotton. However, in recent years oil exports, tourism, the Suez Canal and worker remittances have become the dominant sources of foreign exchange. At the same time, imports of food have escalated rapidly leading, in recent years, to a net foreign exchange deficit (Ingram).

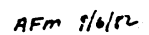
Thus, while the historic net contribution role in both budgets has shifted to net cost positions, the sector remains a very important part of Egyptian public finances. This has led Khedr to raise a number of interesting questions regarding future strategies. Thus, it seems clear to us that national policy makers in the Ministry of Finance, the Ministry of the

Economy, and higher level economic coordinating bodies may well be very interested in the trade-off involved between L.E. and Fx which results from potential changes in food and agriculture policy. Thus, we focus our initial attention on that trade-off. This requires a detailed understanding of programs in terms of fiscal and foreign exchange implications. It turns out that we can build on static-partial equilibrium commodity analysis and that we can simultaneously look at traditional measures of producer and consumer benefits and cost. Before turning to that we sketch a conceptual outline of the trade-off functions.

### III. A Conceptual Introduction to Macro Trade-offs

Income-expenditure accounts can be influenced in four ways, by changes in commodity programs--namely increasing or decreasing income or increasing or decreasing expenditure. In Figure 1, we represent this spectrum on the vertical axis. Net pound (L.E.) costs increase as we move down from the origin and conversely, net revenue increases as we move upwards. On the horizontal axis we represent changes in net foreign exchange balances (Fx)--increasing to the right of the origin, increasing deficits to the left of the origin. Thus, programs falling in the northeast quadrant would be ones where both foreign exchange and L.E. earnings are positive. The southeast is where Fx is positive but domestic currency costs are negative and so on. Programs to the right of the origin involve exports, to the left imports. Programs above the horizontal axis are net revenue generators, below are net L.E. cost activities.

We are interested in knowing, for example, how would the trade-offs between Fx and L.E. change with a change in a program parameter, say, support or requisition price paid to producers. For a program such as cotton, one



would expect that as the requisition price (and quantity) is raised, production would increase, increasing export availability ( $+Fx^C$ ) but also increasing domestic acquisition costs in terms of L.E. ( $-L.E.^C$ ). Thus, we would expect a function (C-C) with a negative trade-off between increased Fx earnings and increased L.E. costs. A movement from A to B would result from the hypothesized increase in requisition quantity and requisition price. The exact shape of the function would depend on the actual program and we will derive it in the next section. Clearly, the relative changes in foreign exchange earnings ( $+Fx$ ) and increase domestic costs ( $-L.E.$ ) depends on the shape of the function.

Similarly, in the wheat program an increase in the price paid for domestic production should increase production increasing domestic acquisition costs but, with given consumer prices, should decrease foreign exchange costs. Therefore, the wheat trade-off function would fall at least in part in the southwest quadrant (W-W). The change (increase) in producer price should move us from P to Q resulting in increased pound cost ( $-L.E.^W$ ) but less foreign exchange cost ( $+Fx^W$ ). Again, magnitudes depend on the shape of the function.

Each of these functions is constructed on a ceteris paribus assumption but, in fact, they are clearly related by production substitution. Suppose, given a fixed land base, that when cotton production rises (because of a program change) wheat (via a series of substitutions) becomes less profitable and the supply shifts to the left. Without changing the wheat support price (at say, P) the trade-off function rotates through P as in W'-W'. Shifts in wheat supply to the left (i.e., reduced supplies) move us from P towards R because production decreases (lessening L.E. acquisition cost but increasing Fx costs). Conversely, a shift in supply to the right (from, say, a decrease

in vegetable prices) would move us along  $W'-W'$  towards S (we will demonstrate the nature of the change in the next section). Obviously, a change in the wheat program could impact on the cotton function if the elasticities of substitution are different from zero. We have not shown it to minimize diagram clutter. Thus, the net effect of a change in the cotton program ( $A \rightarrow B$ ) would result in a gain in  $F_x$  in cotton but an increase in  $F_x$  cost in wheat and an increase in domestic costs for cotton ( $-L.E.^C$ ) but a decrease in domestic costs for wheat ( $+L.E.^W$ ).

We also would be interested in knowing what happens if world prices change. An increase in the world cotton price would shift  $C-C$  to the right to  $C'-C'$ . A decrease would shift it in the opposite direction. Also, if, say, the domestic price of bread to consumers were increased, demand would contract reducing the cost of domestic subsidies and reducing imports, thereby reducing  $F_x$  costs. Thus  $W-W$  would shift to the right to  $W''-W''$ . Obviously, we could explore other changes as well, such as reduced PL480 in shipments (on wheat) or a change in the allocation and/or price of cotton going to domestic mills, but this is sufficient to introduce the general approach--a set of trade-off functions, movement along which represents the direct effect of a program change and shifts and rotations of which represent the cross-effects of other programs. We now proceed to derive functions from actual programs.

#### IV. How Do These Functions Actually Look?

In this section we use simple supply and demand diagrams, with program parameters included, to derive actual (given our diagrams) trade-off functions. We do three cases--cotton, wheat, and meat.

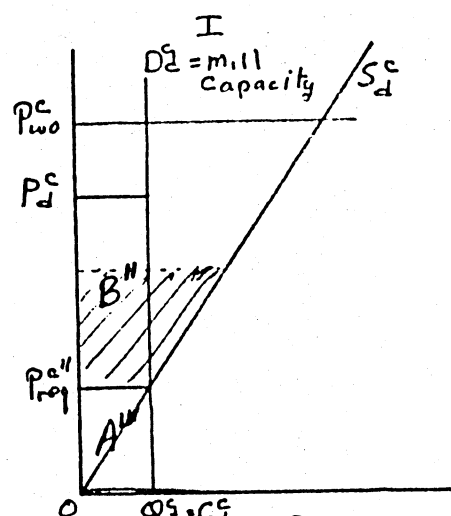
### Cotton

The cotton program is depicted in Figure 2. We begin by postulating a positively sloped supply function. Evidence suggests that, even given cotton requisitions, farmers do respond to price (Sarris, El-Amir, Mansour, Moustafa, and Ghazal). Thus, to get an increased requisition quantity, requisition price must rise. We hypothesize a perfectly elastic world demand function at  $c$  world price ( $P_{wo}^c$ ) based on the findings of Monke and Petzel who found significant interfiber length competition in world markets. This questions the conventional notion that Egypt can behave as a monopolist in the extra long staple (ELS) market. Even if the world demand function is not perfectly elastic it does not significantly alter the analysis. Finally, we assume that the allocation to domestic mills is constrained by mill capacity and is sold at a fixed price (above requisition, but below world price) (Ikram, pp. 264-5). This shown as  $D_d^c$  in all panels.

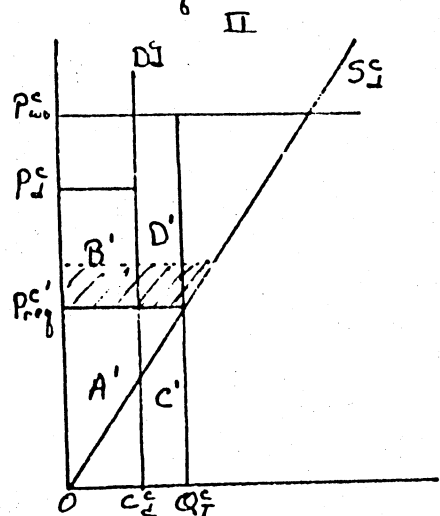
We begin with Panel III which represents the current program. Requisition price ( $P_{reg}^c$ ) is below domestic mill price ( $P_d^c$ ) which, in turn, is less than world price ( $P_{wo}^c$ ). Producers produce  $0-Q_T^c$  is exported at world price. Revenue to the Egyptian Government in L.E. is  $A+B$ . Costs in L.E. are  $A+C$  (assuming Egyptian farmers are paid in pounds). Net cost is  $B-C$ . Foreign exchange earnings are  $C+D$ .  $B-C$  and  $C+D$  are the coordinates of point III on the Fx-LE diagram and is one point on our trade-off frontier.

In Panel II requisition price and quantity are lowered with the allocation to domestic mills remaining unchanged. Net L.E. position improves--less acquisition costs and higher profits on domestic sales--and foreign exchange earnings decline, yielding point II on our function. In Panel I price is reduced to just produce for domestic mill capacity. The result is no Fx earnings but a substantial profit in L.E. This is shown at

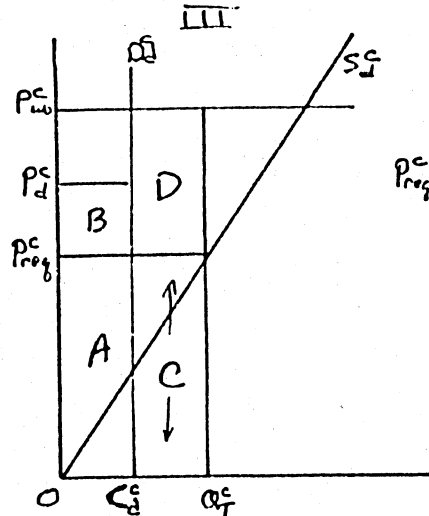
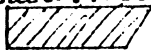
Figure 2 - COTTON - IMPACT OF CHANGES IN DOMESTIC PROGRAM



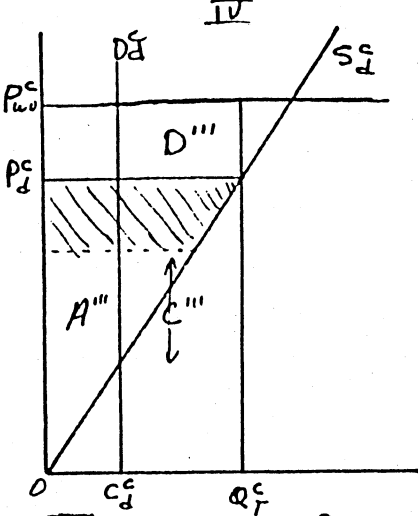
**I - Domestic  $P^c_n$  for Domestic Use**  
 $+L.E. = A'' + B''$   
 $-L.E. = A''$   
Balance L.E. =  $B''$   
 $+Fx = 0$   
 Producers lose



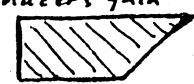
**II - Lower Reg. Price**  
 $+L.E. = A' + B'$   
 $-L.E. = -A' - C'$   
Balance L.E. =  $B' - C'$   
 $+Fx = C' + D'$   
 Producers lose  
 Consumer unchanged



**III - Current Program**  
 $+L.E. = A + B$   
 $-L.E. = -A - C$   
Balance L.E. =  $B - C$   
 $+Fx = C + D$



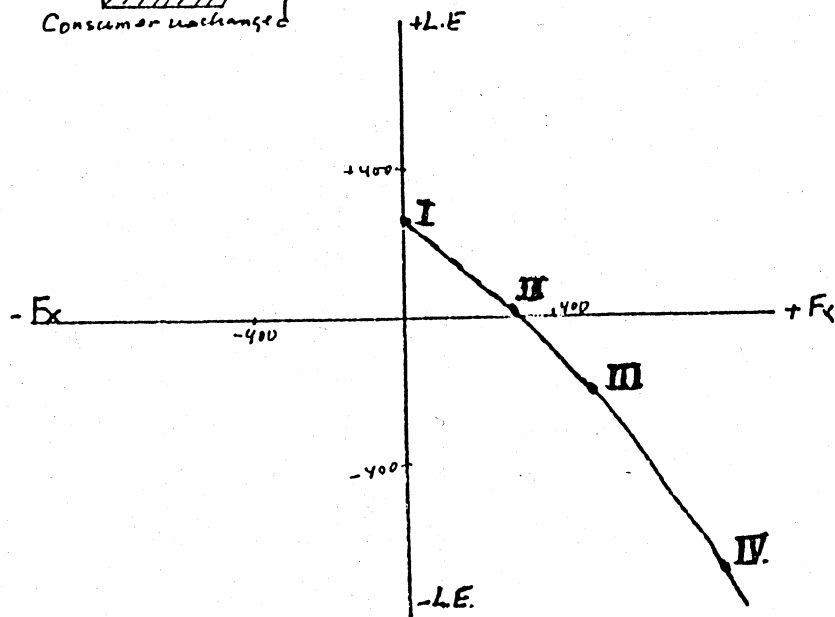
**IV - Increased Reg. Price**  
 $+L.E. = A'''$   
 $-L.E. = -A''' + C'''$   
Balance =  $-C'''$   
 $+Fx = C''' + D'''$   
 Producers gain



**I → II → III → IV** with increasing producer price.

Legend

$P^c_{wo}$  = World Price of Cotton  
 $P^c_d$  = Price to Domestic Mills  
 $P^c_{req}$  = Requisition Price to Pdrs  
 $Q^c_T$  = Requisition Quantity  
 $D^c_d$  = Domestic Mill Demand = Capacity  
 $S^c_d$  = Domestic Supply  $F^n$

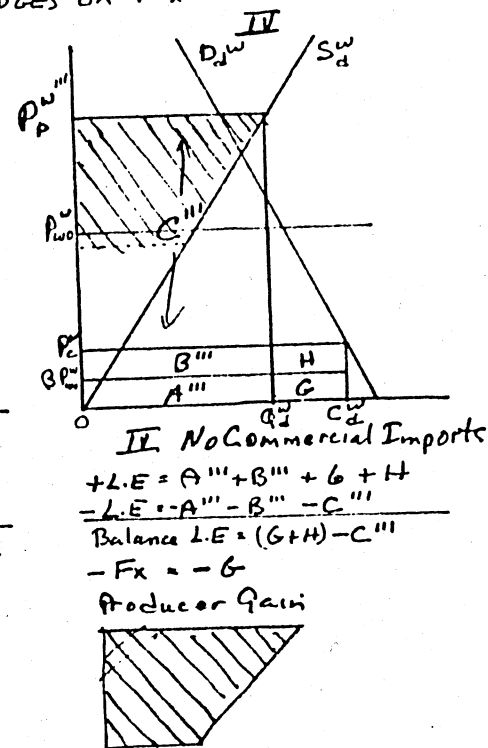
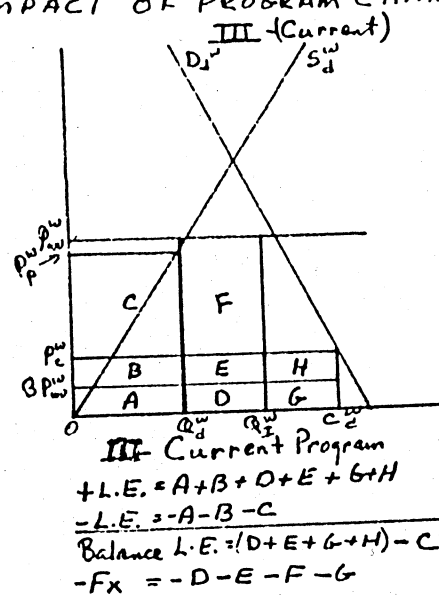
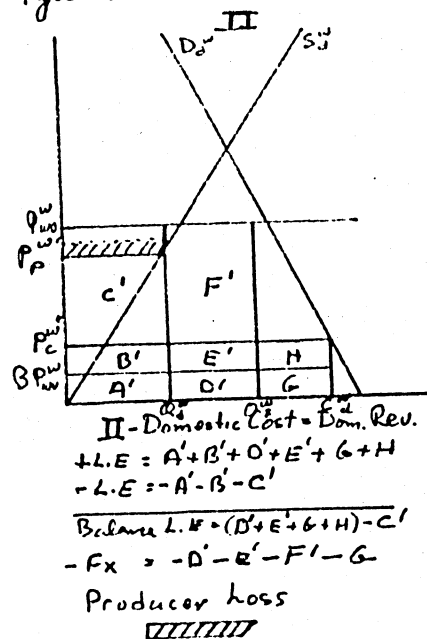
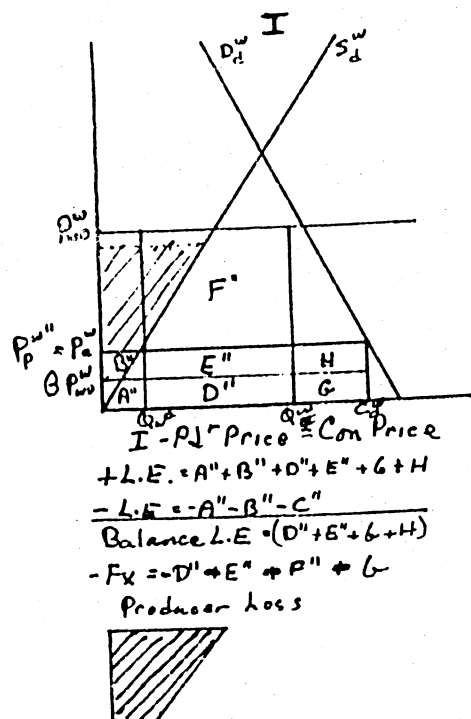


point I. Finally, if requisition price is increased to, say, domestic mill price (Panel IV), production increases as do exports (+Fx) but domestic costs also increase yielding point IV. A-B-C-D are four points on a continuous trade-off function with movement from A  $\rightarrow$  D occurring with increased requisitions and requisition price, the principal policy instrument of the Egyptian government. Static producer losses or gains are shown also as the cross hatched areas. We leave for later the question of what happens to the trade-off function if the domestic mill allocation and/or price were changed. Similarly, we defer the question of what happens if prices of other commodities change causing changes in the direct trade-off function.

#### Wheat

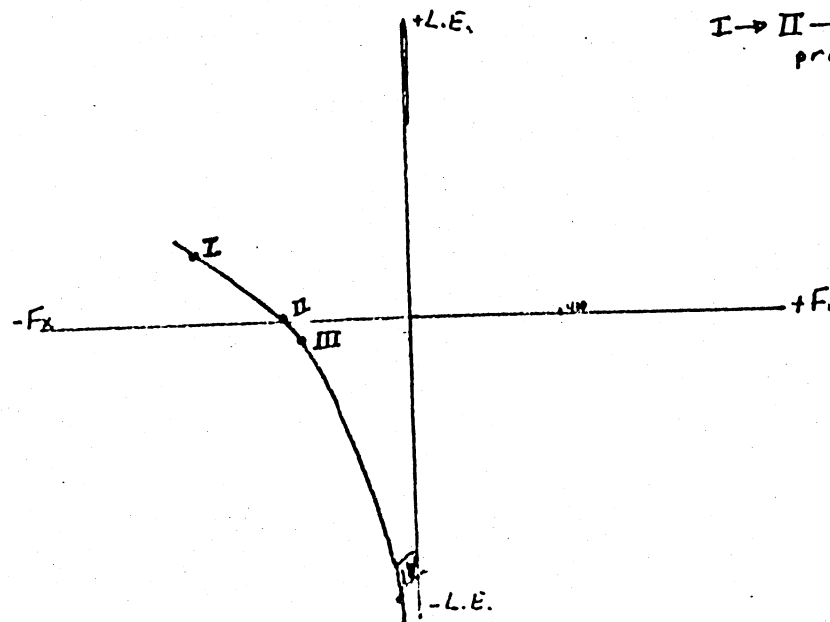
We can proceed with a similar analysis of wheat. Our presentation depends heavily on a paper by de Janvry, Siam and Gad. Our depiction of the program is in Figure 3. We begin with the current program in Panel III. Egypt is eligible for PL480 wheat on long-term dollar terms. In terms of current foreign exchange cost it is very low priced. We identify this as some factor  $\beta$  of world price ( $\beta P_{wo}^w$ ) and as de Janvry et al. argue it is below domestic consumer price. Given then that domestic sales of PL480 wheat generate L.E. profits, we assume the government will import all that is available. It should be noted however that if the U.S. did not divert grain in the PL480, world commercial prices could be lower, reducing foreign exchange costs of commercial imports. This quantity is  $Q_I^w - C_d^w$ . Its cost in terms of foreign exchange is G, its revenue in L.E. is G+H. Policy makers have kept a fixed consumer price for a period of years. We assume this is socially fixed at  $P_c^w$  and this determines domestic consumption ( $C_d^w$ ) given the given the demand function  $D_d^w$ . The policy question then becomes how much to

Figure 3 - WHEAT - IMPACT OF PROGRAM CHANGES ON Fx + L.E. BALANCES



Legend:

$P_w^w$  = World Price of Wheat  
 $P_w^w$  = Internal Price to PLF  
 $P_c^w$  = Subsidized Price of Bread  
 $BP_w^w$  = Current cost of PL 480 wheat imports  
 $D_d^w$  = Domestic Demand  
 $S_d^w$  = Domestic Supply



produce domestically and how much to import commercially. The critical policy variable then is the domestic support price to Egyptian producers ( $P_p^w$ ). As it rises, domestic production substitutes for imports, yielding our Fx-L.E. trade-off.

In Panel III (our depiction of the current program),  $O-C_d^w$  is consumed at  $P_c^w$  yielding L.E. revenue to the government of  $A+B+D+E+G+H$ ,  $O-Q_d^w$  is produced given support price of  $P_p^w$  with an acquisition cost of  $-A-B-C$ . The net L.E. balance which is  $(D+E+G+H)-C$  which, consistent with de Janvry *et al*'s findings, is modestly negative.  $O_d^w-Q_I^w$  is imported at world price ( $P_{wo}^w$ ) at a foreign exchange cost of  $D+E+F$  and  $Q_I^w-C_d^w$  is imported under PL480 at a current foreign exchange cost of  $G$ . Therefore,  $(D+E+G+H)-C(<0)$  and  $D+E+F+G(<0)$  give us the coordinates of point III on our trade-off function.

As with cotton, we then change the domestic producer price of wheat to trace out our function. In Panels II and I producer price is lowered yielding points II (breakeven on L.E.) and I on the frontier. In Panel IV producer price is raised to eliminate commercial imports which, as we would expect, greatly increases the domestic L.E. cost of the program. Thus, the function goes through these points. As we increase producer price we move from I towards IV showing a decrease in foreign exchange costs but an increase in domestic costs. Again, changes in producer welfare are shown in the cross hatched areas relative to the current program. We defer analysis of changes in world price, consumer price, and shifts in the wheat supply function until later.

#### Meat

Our analysis of the meat program is even more stylized, but it gives an additional function to work with which is particularly important given that

berseem substitutes for many crops in the Egyptian cropping pattern. We begin by accepting Habashy and Fitch's conclusion that the domestic meat industry is subsidized. Therefore, given that there are red meat imports, this means that domestic prices are kept higher than world prices by protective measures. Whether the measure is a tariff, an overvalued exchange rate, or a quota which is auctioned off, is not important as the the results are analytically the same. We assume for this analysis that meat is marketed in private markets. Thus, the Egyptian government gains L.E. revenue from the protective device and expends Fx balances for imports.

Panel III of Figure 4 depicts the current situation--domestic price is  $P_d^m$  which determines production ( $Q-Q_p^m$ ) and consumption ( $O-C_T^m$ ). This leaves an import gap of  $Q_p^m - C_T^m$  which is imported at  $P_{wo}^m$  with a Fx cost of A. Importers are required to pay the tariff equivalent in L.E. which is B. Thus -A and B are coordinates of point III on our trade-off function. In Panels II and I we lower protection so that in Panel I world price prevails, giving us point I where there is no L.E. revenue and higher Fx costs. In Panel IV we depict self-sufficiency (banning imports) which returns us to the origin with no revenue or foreign exchange costs. Again, as before, we depict producer and consumer gains and losses relative to the current program.

We could go on but these are sufficient examples to illustrate the use of trade-off functions in looking at interprogram effects. We can now put our three functions together in Figure 5 in preparation for the following analysis. Under current programs cotton earns  $+Fx^c$  and costs  $-L.E.^c$ ; wheat costs  $-Fx^w$  and  $-L.E.^w$ ; and meats costs  $-Fx^m$  but earns  $+L.E.^m$ . In the next section we now begin to explore direct and cross-effects of program change.

Figure 4- RED MEAT - IMPACT of CHANGING TARIFFS on FX & L.E. BALANCES

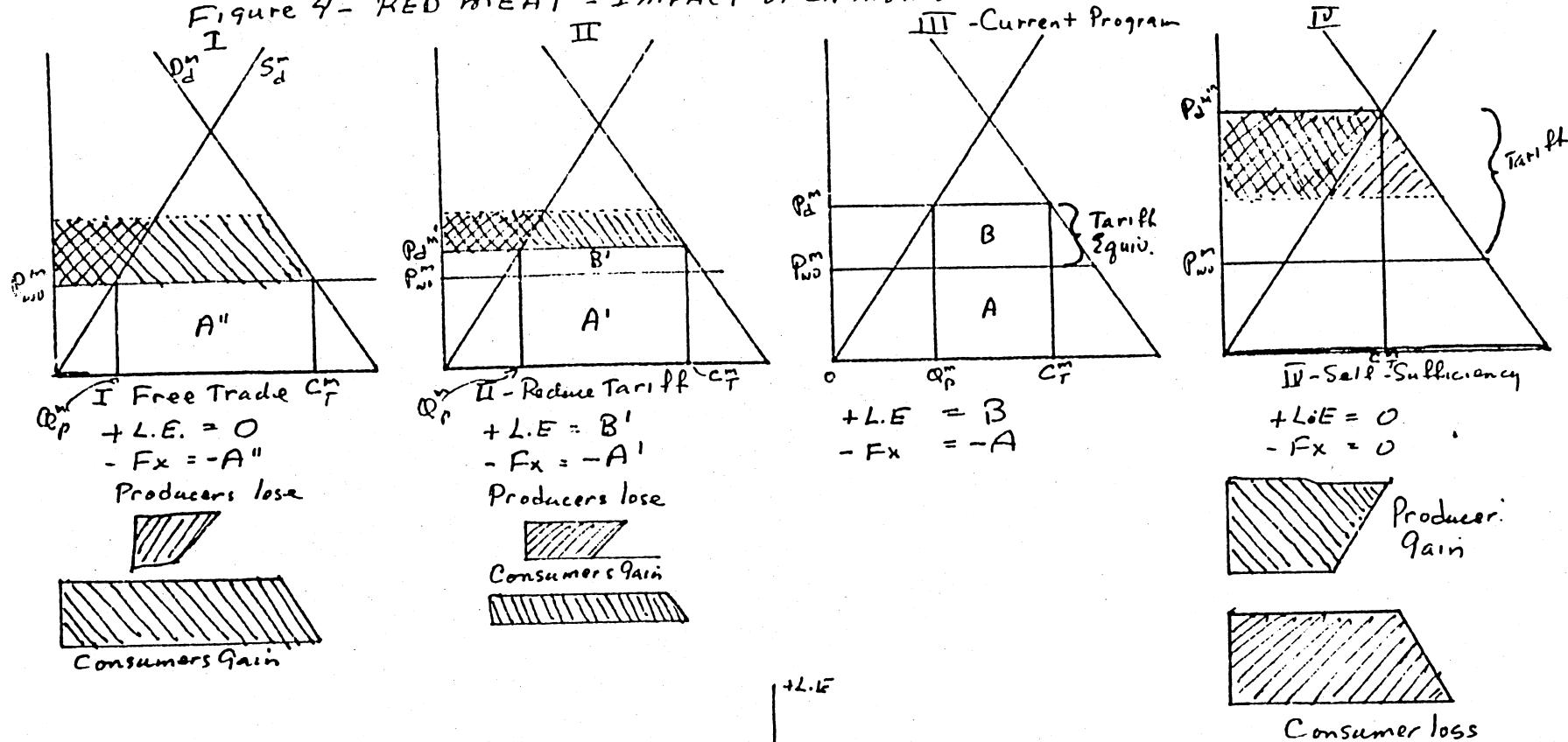
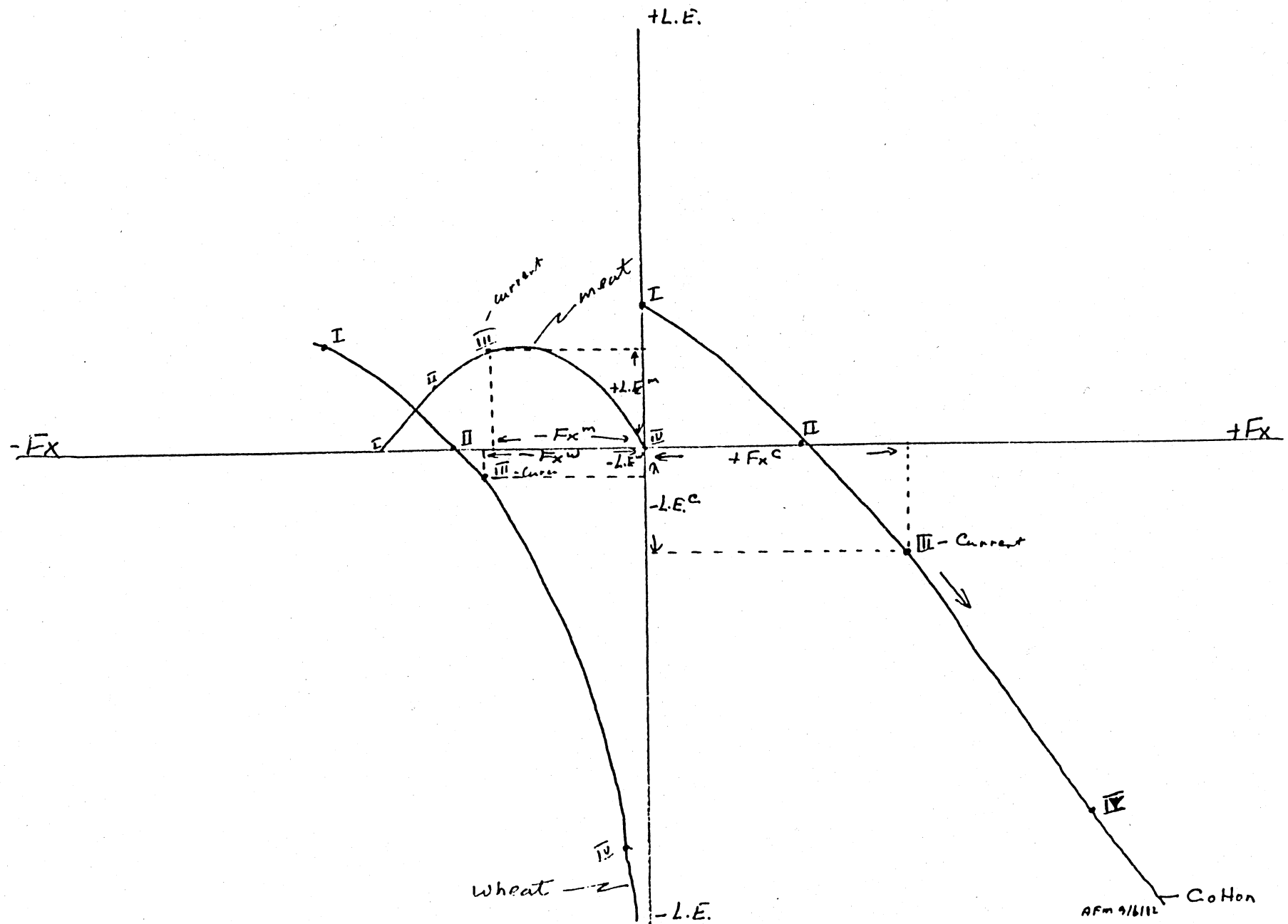


FIGURE 5 -  $F_x$  - L.E. TRADE-OFF FUNCTIONS - COTTON, WHEAT + MEAT



## V. Using The Analysis

We are now interested in seeing how we can use this technique. Suppose the foreign exchange earnings from remittances and oil decline because of the global recession and the Government of Egypt wants to explore what would be the implications of increasing the requisition (and requisition price) of cotton to expand exports and increase foreign exchange earnings. We can read the direct effect of that change directly off our cotton trade-off function in Figure 5. An increase in requisitions would increase production and increase exports. This would move us southeast along our function from point III towards, say, point IV. Foreign exchange earnings would increase as would L.E. costs. If the function was econometrically estimated, we could directly determine the ratio  $\frac{+\Delta Fx^c}{-\Delta L.E.^c}$ . Given policy maker weights on the relative

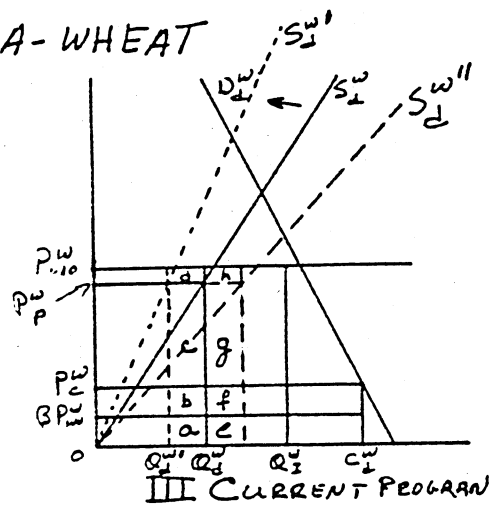
importance of availability of domestic currency vis-a-vis increased foreign exchange, something could be said about the desirability of the change.

But that would only look at the direct effects of the change. Clearly, with an aggregate land constraint, an increase in cotton feddanage means a reduction in feddanage of other crops. Thus, we must also explore the cross-effects of a change.

In Figure 6 we derive the cross-effects of program changes. We drew our original supply functions simply as a function of that commodity's price, e.g., the quantity of wheat produced  $Q_d^w$  as a function of the producer price of wheat  $P_p^w$  [ $Q_d^w = f(P_d^w)$ ] other things constant. Really, the supply function of wheat should be written as  $Q_d^w = f(P_d^w, P_{reg}^c, P_d^m, \dots)$  where other prices are shifters of the wheat supply function. To determine the cross-effects we need now to explore what happens to the wheat supply function when there is a change in, say, cotton program prices (assuming through a complex cropping pattern adjustment positive changes in cotton feddanage have a negative impact

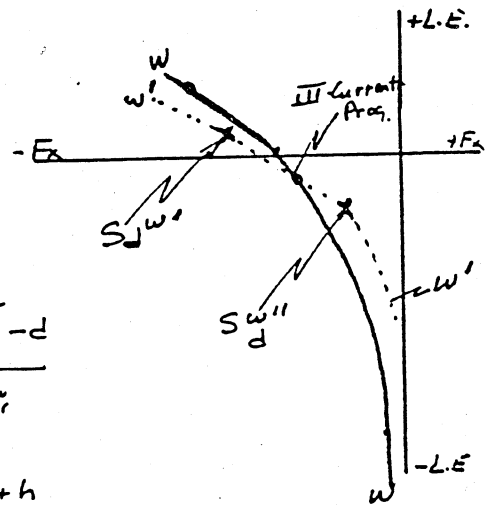
Figure 6 - CROSS EFFECTS OF PROGRAM CHANGES

## A - WHEAT

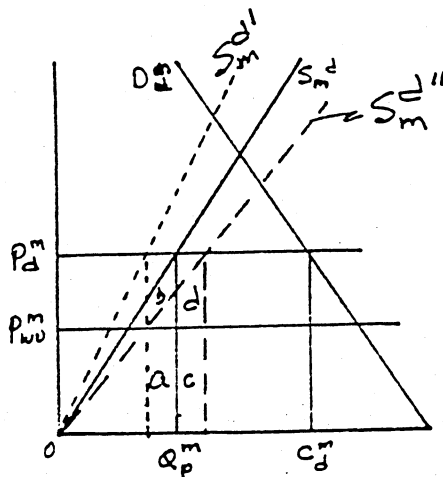


- 1) Supply shifted to left =  $S_w'$   
 $+L.E = a + b + c$   
 $-Fx = -a + b - c - d$

- 2) Supply shifted to right =  $S_w''$   
 $-L.E = e + f + g$   
 $+Fx = e + f + g + h$

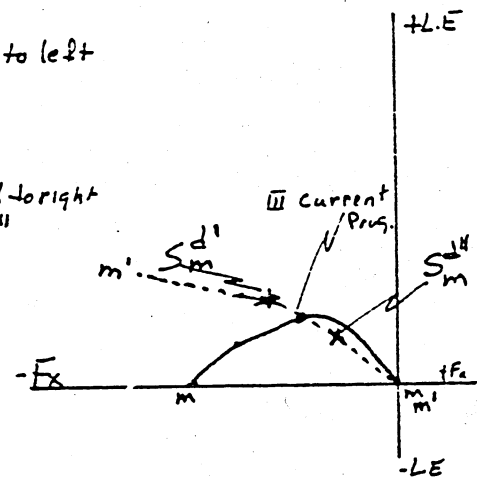


## B - MEAT

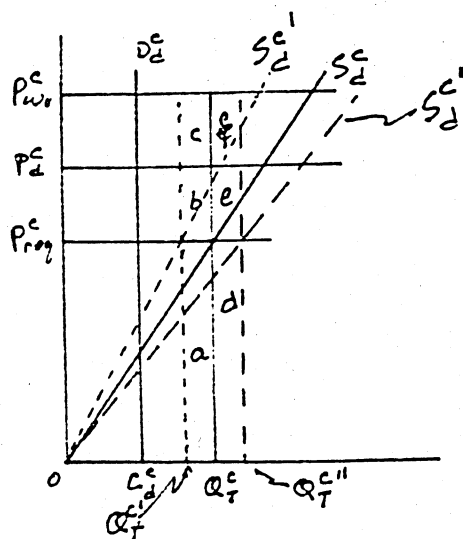


- 1) S shifted to left =  $S_m'$   
 $+L.E = b$   
 $-Fx = -a$

- 2) S shifted to right =  $S_m''$   
 $+L.E = -d$   
 $+Fx = c$

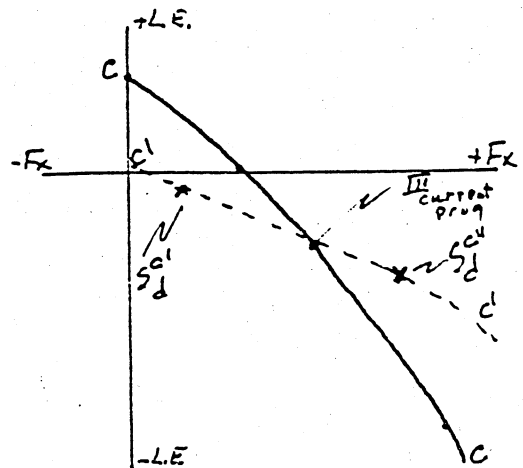


## C - COTTON



- 1) S to left =  $S_c'$   
 $+L.E = a$   
 $-Fx = a + b + c$

- 2) S to right =  $S_c''$   
 $+L.E = -d$   
 $+Fx = d + e + f$



on wheat feddanage, i.e.,  $\frac{dQ_d^w}{dP_{reg}^c} < 0$ ). Thus we want to explore  $Q_d^w = f(P_d^w, P_{reg}^c, P_d^m, \dots)$  which is the change in wheat production with a change in the cotton program assuming the wheat program remains unchanged. This we illustrate graphically in Panel A of Figure 6. An increase in the program price of competing crop shifts the wheat supply function to the left, i.e.,  $S_d^w \rightarrow S_d^{w'}$ . The result is a reduction in domestic production (and L.E. costs) and an increase in imports,  $-Fx$ . This point is a point on a new trade-off frontier,  $S_d^{w'}$ . A fall in the price of a competing crop shifts the supply of wheat to the right ( $S_d^{w''}$ ) and has the opposite effect  $+L.E.$  and  $-Fx$  and yields point  $S_d^{w''}$  on our new function. Repeats of this would trace out a new trade-off frontier  $W'-W'$ , which is a function rotated through the original program point (III on  $W-W$ ).

We repeat the exercise in Panel B of Figure 6 for red meat. Shifts in the meat supply function change the shape of the trade-off function. Contractions of supply (shifts to the left) lead to both increased  $Fx$  cost and L.E. revenue. Expansion of supply contracts both relative to the function traced out as a result of the direct effects of changes in the level of protection of meat producers. The new trade-off function is the dotted line  $m'-m'$  in Panel B.

In Panel C we repeat the exercise for changes in the cotton L.E.- $Fx$  trade-off function for changes in other program parameters. Again, supply shifts rotate the  $Fx$ -L.E. trade-off function through the current program point III to trace out the function  $c'-c'$ . Repeating a similar set of adjustments in the allocation to domestic mills traces out a similar shaped function as  $c'-c'$  moving to the southeast as allocations to domestic mills decrease.

We are now ready to explore the potential usefulness of our analysis to look at both the direct and cross-effects of a particular program change. We start in Figure 7 with a hypothesized increase in the cotton requisition (and requisition price). The direct effect is to move along the L.E.-Fx trade-off function from III to III' resulting in an increase in foreign exchange earnings of  $+Fx^C$  and an increase in domestic currency cost of  $-L.E.^C$ . But an expansion of cotton supply hypothetically shifts, to the left, supply functions of berseem (and therefore meat) and wheat (through indirect cropping pattern adjustments). Thus we move to a new point X' (from X) on the meat function and to point Y' (from Y) on the new wheat function. The cross-effects increase tariff revenue from meat ( $+\Delta L.E.^m$ ) but also increase meat imports and foreign exchange costs ( $-\Delta Fx^m$ ). Wheat production falls reducing domestic acquisition costs ( $+\Delta L.E.^w$ ) but increasing imports ( $-\Delta Fx^w$ ).

The direct and cross-effects of the change in the cotton program can be summarized as follows:

$$\begin{aligned}\Delta Fx &= +\Delta Fx^C - \Delta Fx^w - \Delta Fx^m \\ \Delta L.E. &= +\Delta L.E.^m + \Delta L.E.^w - \Delta L.E.^C\end{aligned}$$

In the absence of empirical estimates of our functions we do not know whether there are net gains or net losses in either foreign exchange earnings or budgetary outlays in L.E.

We repeat the analysis once more to demonstrate the use of the approach. Here we look at the direct and cross-effects of eliminating implicit or explicit tariff protection of domestic meat producers. The analysis is in Figure 8. The removal of the implicit tariff from meat moves us along the meat Fx-L.E. frontier from X to X' resulting in a loss of tariff revenue of  $-L.E.^m$  and an increase in foreign exchange costs of  $-Fx^m$ . The fall in

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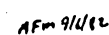
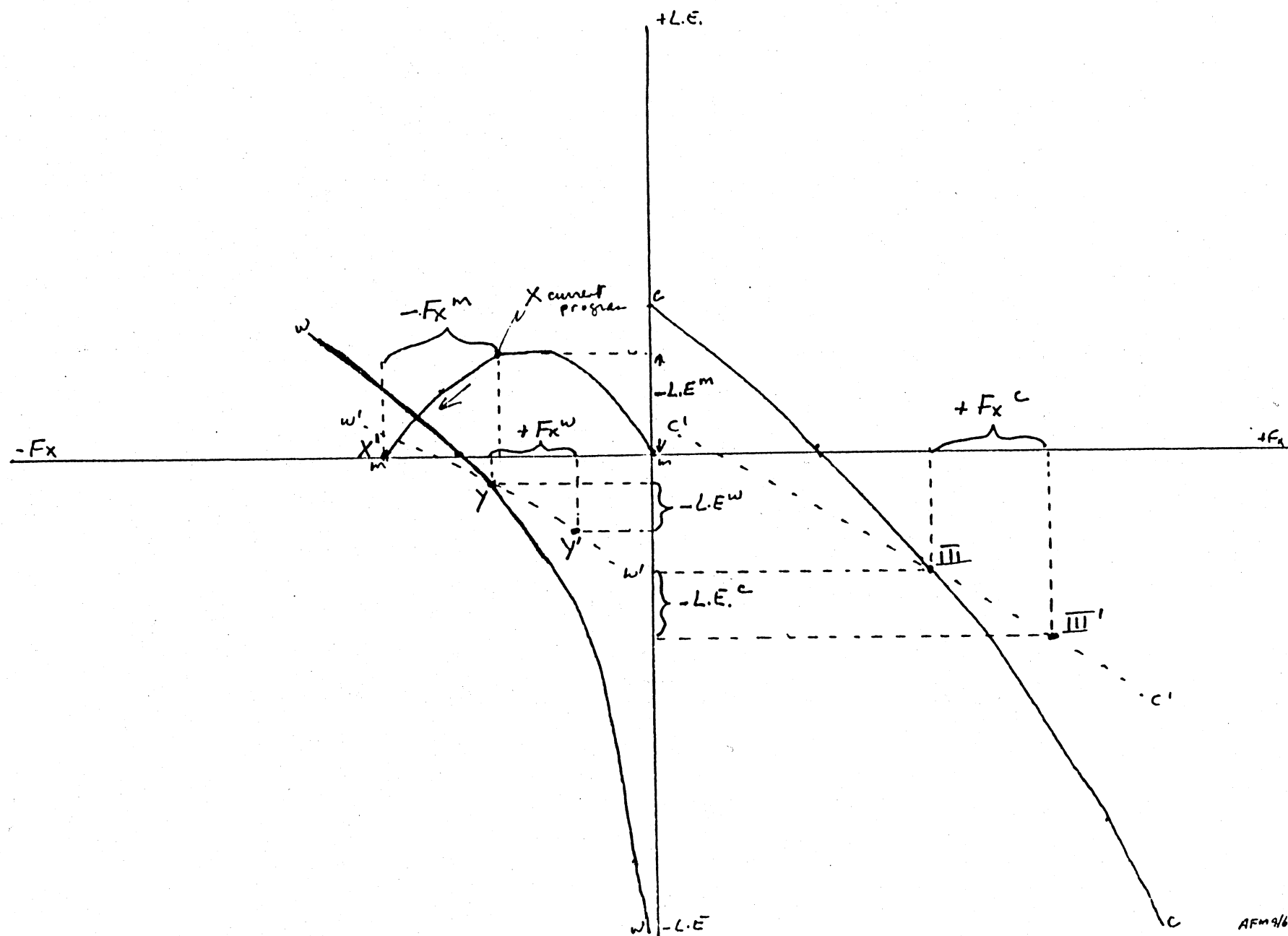


Figure 8 - DIRECT + CROSS EFFECTS OF REMOVAL OF MEAT TARIFF.



domestic meat prices makes berseem less profitable and farmers shift feddans into wheat and cotton among other crops (constrained, of course, by rotational requirements). This moves us along the new trade-off function for wheat from Y to Y' as wheat production increases, acquisition costs increase by  $-L.E.^W$  but foreign exchange costs decrease by  $-Fx^W$ . Similarly, for cotton we move southeastward along the new function C'-C' from III to III' increasing production and therefore exports (assuming the allocation to domestic mills remains constant)  $+Fx^C$  but increasing domestic acquisition costs by  $-L.E.^C$ . The net effects are as follows:

$$\Delta Fx = +Fx^C + Fx^W - Fx^m$$

$$\Delta L.E. = -L.E.^m - L.E.^W - L.E.^C$$

The net effect on foreign exchange balances is indeterminate a priori, however, in this case all effects on the domestic budget move in the same direction, i.e., to increase net costs--tariff revenue is eliminated and acquisition costs of increased cotton and wheat production rise.

We could go on, but these are sufficient to illustrate the direct and cross-effects. We can, however, now go back to our static partial analysis and also pick up impacts on producers (farmers), rural and urban consumers, and on resource use efficiency (impacts on GNP). These are summarized for the two cases in Table 2. As is clear, we can make few definitive a priori statements about even effects on individual targets let alone say anything about aggregate net impacts. If we were to go further and look at simultaneous changes in more than one program the outcomes become more uncertain a priori. However, in our judgment the approach is still quite useful as we discuss in the next section.

TABLE 2. IMPACTS OF SINGLE PROGRAM CHANGES

Changes		Impacts	Farmers	Rural Consumers	Urban Consumers	L.E.	Fx	GNP
Case I	Increase In Cotton Requisition Price: other programs unchanged	Direct Effects: Cotton	+	0	0	-	+	?
		Cross-effects: Meat	-	0	0	+	-	?
		Wheat	-	-	0	+	-	?
		Net	?	-	0	?	?	?
Case II	Remove Tariff on Red Meat Imports: other programs unchanged	Direct Effects: Meat	-	+	+	-	-	+
		Cross-effects: Wheat	+	+	0	-	+	+
		Cotton	+	0	0	-	+	+
		Net	?	+	+	-	?	+

+ = increased producer surplus; increased consumer surplus; positive change in net balance of L.E. or Fx accounts.

- = decreased producer surplus; decreased consumer surplus; negative change in net balance of L.E. or Fx accounts.

0 = no change.

? = outcome uncertain a priori

## VI. Implications of Analysis

Despite the apparent inconclusiveness of the a priori conclusions possible from this approach, we still believe it has a number of useful outcomes. First, it focuses explicitly on what must be an important trade-off for macro policy makers, particularly if the balance situation in one budget differs from the other, say, a large domestic budget deficit and significant foreign exchange surpluses. Adjustment of domestic program parameters could assist in simultaneously improving both situations. But more importantly, it should help agricultural policy analysts to make these implications explicit in their analysis. In our review of all ADS working papers very few embodied these trade-offs in their analysis but yet most could have, with minor effort.

Second, the analysis allows us to look at both direct and cross-effects of program changes and forces us to understand the implications of the cross elasticities for individual commodity analysis. While the approach is not fully a general equilibrium one, it is considerably more than a single commodity partial approach. It ought to be obvious that a succession of cross-effects could have one of three impacts on the net outcome--to wit (a) accentuate the direction of change; (b) offset change so as to negate the outcome; or (c) more than offset the direct effect and move us in the "wrong" direction. Yet all too often we do partial policy analysis as if there were no second round effects. This approach forces us to take them into account and at least identifies the expected sign of the change.

Third, and related, it points to the crucial importance of understanding, and where possible measuring, cross elasticities of both supply and demand. Fourth, even in the simple cases we considered it is clear that qualitative policy analysis has limited use in predicting actual outcomes. It may,

however, be of critical importance in sorting through the conceptual maze which must precede empirical analysis. The bottom line, of course, is that empirical estimates are essential in reaching policy conclusions. Fifth, a relook at Table 2 tells us not only the point made above--namely, the need for numbers--but also points out that the weighting given each of the targets (e.g., farmers, consumers, budget balance) by policy makers could radically alter outcomes. All of the welfare analysis done within and outside ADS implicitly implies equal weightings. But if urban consumers get a weighting of two while farmers get a weighting of one, results would clearly vary. Sixth, the approach is useful in exploring the path of change from incremental changes in one or more policy variables. While it builds on partial analysis of individual programs, it has more policy applicability simply because it is not limited to exploring the direct effects of one change. Most frequently the single commodity approach looks at the welfare effects of changing from the current "distortion" to a market with world prices prevailing. Such analysis, while having intrinsic, if not spiritual, interest to neoclassical economists, is of limited practical value in and of itself.

Finally, if nothing else, the approach forces us to try to deal simultaneously with at least some of the myriad of variables that enter into real policy decisions. Further, it should be an intermediate step to building better empirical models which would allow definitive policy conclusions.

## VII. ADS and Macro Linkages

In the process of working on our activity and in developing this paper, we have reviewed all working papers and project reports for all activities in the economics subproject. Our objectives were two-fold. First, we wanted to

familiarize ourselves with the project output. Secondly, we wanted to explore the policy implications of ADS research and to see how it could contribute to Egyptian national policy making. When we began our activity (Policy Analysis) we developed a schematic of how the Egyptian Food and Agricultural Sector fitted in the broader policy context. This is reproduced as Figure 9. We define the five components of the sector in traditional fashion--physical resources, inputs, production, marketing, and consumption. Within the sector there are public and private actors. The sector operates in a policy context which consists of (a) policies directed explicitly at food and agriculture; (b) the broader national social and economic context; and (c) the international environment. The latter two could be conceived of as constraints on food and agricultural policy.

On this chart we have superimposed the 22 economies subproject activities to see what kind of coverage we have of the major policy components by ADS activities. It seems clear that most cells have some activity on-going. Some linkages across cells are apparent at least in the intentions of the activities. We return later to discuss future activity.

We also took Minister Wally's seven objectives (listed earlier in the paper) and tried to see how ADS activities related to these objectives. The results of our guesses are in Table 3.

Our summary conclusion is that the dispersion of activities across policy issues and policy goals is quite extensive and much of it is impressive in terms of analysis. In the next section we discuss implications for future research that could influence future ADS activities.

FIGURE 9

## CLASSIFICATION OF ADS ECONOMICS ACTIVITY IN A NATIONAL AND INTERNATIONAL POLICY CONTEXT

ACTIVITY	FOOD AND AGRICULTURAL SECTOR			THE POLICY CONTEXT (Issues and constraints)	
	COMPONENTS	PUBLIC SECTOR ACTORS	PRIVATE SECTOR FIRMS	FOOD AND AGRICULTURE POLICY	NATIONAL ECONOMIC SOCIAL POLICY
1. Rural Labor Supply	PHYSICAL RESOURCES - Land - Water - Climate	Water agencies	Private and joint venture land development companies	- Land distribution policy - Water policy - Investment - Land reclamation - Drainage  - Research (4) (11)	- Investment trade offs - Taxation - Fiscal expenditures - Land use and urbanization (14)
2. Food Subsidies		Public land companies (new lands)			- Policy re foreign investment - Nile water - Sudan - Balance of Payments (B of P)
3. Price Policies and Balance of Trade	INPUT SECTOR - Fertilizer - Seed - Research and Technology - Labor - Pesticides	Public sector firms	Private sector firms - Fertilizer - Seed - Power - Mechanization - Chemicals	- Input subsidies - Credit - Labor supply - Animal power and mechanization (1)	- Investment in domestic pdn - Budget constraint - Labor migration
4. Land and Water Allocation		Agriculture Research Center		(9) ↑	- Foreign exchange allocation to imports - International prices - Import of tech. → - Labor exports - B of P - Remittances
Marketing Potential	PRODUCTION - Food Grains - Fruits and Vegetables - Fibers - Fodder - Livestock	New land farms	- Farmers - International firms - Home consumption	(12) (13) (15) - Prices - Requisitions and quotes - Land allocation ↑	- Budgetary costs - Implicit and explicit subsidies and taxes  (19) →
6. Food Consumption					- Ag. imports - Ag. exports - Foreign exchange - Import restriction - PL 480 - B of P
7. Food Security	MARKETING - Transportation - Processing - Storage - Distribution	Public sector firms - Marketing - Processing - Transportation	Private sector firms - Village markets - Village processors - Transportation	(8) (16) (18) - Price controls - Market allocation - Grading - Transportation Policy - Investment (21) ←	- Food supply - Food quality  (10) →
8. Livestock					(5) - Imports of processed product - Export of processed product - Foreign exchange constraints
9. Mechanization	CONSUMPTION - Population - Income - Prices - Tastes and Preferences	Public food distribution system - Rural stores - Ration stores	Private shops	← (2) (7) → - Food subsidies - Food prices - Food supply (6) (22) ←	- Public sector wages - Food self-suff policy - Budgetary cost - Population policy - Income dist. →
10. Cotton Markets					- Food imports - Foreign exchange costs - Import restriction - B of P (3)
11. Irrigation Evaluation					
12. Farm Efficiency					
13. Coop Improvement					
14. Lakes Development					
15. Poultry Industry					
16. Post Harvest Efficiency					
17. Biogas Evaluation					
18. Citrus Marketing					
19. Economic Efficiency					
20. Policy Analysis					
21. Commodity Systems Analysis					
22. Rural Development and Consumption					

(20)

Table 3 Classification of ADS Economic Activities with  
Ministry of Agriculture Development Objectives

	Maximization of Net Agr. Product	Social Equity	Achieve Food Security	Increase Net Agr. Export Receipts	Generation of Gainful Employment Opportunities	Conservation Development & Maintenance of Agr. Economic Resource	Supplying Requirements of Industries Vertically Integrated with Agr.
1. Rural Labor Supply	C	P	C		S	C	
2. Food Subsidies		S	P				
3. Price Policies and Balance of Trade	P		S	S			
4. Land and Water Allocation	P					S	
5. Marketing Potential	S			P			
6. Food Consumption		P	S				
7. Food Security	C	S	P				
8. Livestock	S		P				
9. Mechanization	P				S		
10. Cotton Markets	S			P			S
11. Irrigation Evaluation	S					P	
12. Farm Efficiency	P					S	
13. Coop Improvement	S		P			P	
14. Lakes Development							
15. Poultry Industry	P		S				S
16. Post Harvest Efficiency	P		S	S		P	
17. Biogas Evaluation							
18. Citrus Marketing	P			S			
19. Economic Efficiency	P					S	
20. Policy Analysis							
21. Commodity Systems Analysis	P			S			
22. Rural Development and Consumption							

<sup>a</sup> "Strategy of Agricultural Development in the Eighties" by Youssef Wally, Minister of Agriculture, Unpublished report, p. 52  
P = Primary emphasis      S = Secondary Emphasis      C = Partial contribution

### VIII. Implications for Future Research

As we have explored the ADS working papers and other work on Egypt we have come to tentatively recognize some areas where more information is needed. These are listed briefly in point form:

1. Policy in a general equilibrium sense, comes together at three levels in any country. The first is at the individual farmer level. In Egypt this involves the farm family as both a producing and a consuming unit and the village within which the family lives. The second level is at the sector level and the third is at the macro level. This paper has tried to make a beginning by looking at the latter two and particularly the last level. However, a necessary precursor to effective policy analysis, including developing meaningful direct and cross supply elasticities, requires a fuller understanding of how the Egyptian farmer makes very complex decisions in a highly regulated policy environment. This could integrate several activities and is of great importance.

2. As is obvious, general or partial general equilibrium analysis requires estimates of intercrop substitutability. Thus, direct and cross elasticities of supply, estimated within the realistic context of village decision making, are of crucial importance to planning and policy analysis. The work by Habashy and Fitch on cropping patterns is a very important first step as are all of the various commodity programs analysis. But they must come together in some dynamic setting that allows policy analysts to explore the direct and cross impacts of policy change.

3. Analogously, we also need to know more about direct and cross elasticities of demand particularly if Egypt ultimately moves in the direction of a more market oriented economy. We recognize, of course, that estimation

of both supply and demand cross elasticities is very difficult but hopefully this paper has highlighted their crucial importance. The Gardner and Abdou paper points out we know quite a bit more about income impacts.

4. Interprogram policy interrelationships are also important to understand as we have shown. It is unlikely that Egypt in one action will abolish price intervention and go to a market economy at "world prices." Rather, what will happen is incremental changes in individual programs. How these changes impact on other programs is crucial. Here, linkages across many activities would be most useful at the next stage, particularly involving "production" and "consumption" oriented research.

5. Understanding how major economic and social forces constrain most micro activity at the farm level is important. Thus, analysis of resources constraints (e.g., activities such as Land and Water Allocation, Irrigation Evaluation, and Lake Development); of labor (Rural Labor Supply); and Institutions (e.g., Improving Coops) are also of vital importance as are the large number of papers which deal with the history and the institutional setting of policy decision making. These contribute to the building of an aggregate understanding of the policy context which in turn is a necessary prerequisite to forward planning.

6. Hopefully, what has been done in ADS and elsewhere, augmented by what is suggested here, will help in developing better conceptually and empirically integrated policy models. Hopefully, they can be aggregated up from diverse yet consistent methodology so that we are not required to preadopt a methodology and then often be constrained by it. A detailed dynamic macro-linkages model is a long way away and may, in fact, almost always be obsolete by the time it is built. However, this doesn't mean that

macro-linkages are unimportant, it rather suggests that we need to constantly strive for more effective ways to integrate the results of partial static analysis in a comparative static framework.

#### IX. Closing Thoughts

What has been presented in the paper is tentative and incomplete. We have completely ignored cross-effects from demand because we assumed consumer programs constant. Clearly, this is not always going to be the case. Also, we have not included growth, although it could probably be done. Third, we have looked at only a limited number of policies and only one at a time. Clearly, future analysis should be able to deal with more programs and simultaneous change. We do believe, however, that it is a useful first step. The trade-off functions we have developed could be estimated and some crude empirical magnitudes developed. Thus would at least help in rendering less true the reported statements of two noted economists--Gunnar Myrdal, "everything is related to everything else making measurement nearly impossible" and Kenneth Boulding, "in policy we often don't know which way is up."

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