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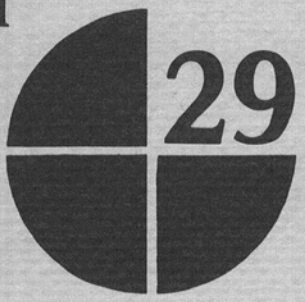

GOVERNMENT POLICY AND FOOD IMPORTS: THE CASE OF WHEAT IN EGYPT

Grant M. Scobie

December 1981

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FOREWORD

During the next few decades, tremendous demands will be placed on the foreign-exchange-earning capabilities of developing countries. These countries need to pay for rapidly increasing food imports and, in addition, for the capital goods they need to import to sustain economic growth. Intensive pressure will also be placed on the real incomes of low-income people, particularly if the real price of food rises in response to the rapid growth of demand. That pressure, in turn, will increase the pressure for consumer food subsidies, aided by a growing realization that food subsidies are labor subsidies in the same sense that interest rate subsidies are capital subsidies. In contrast, constraints on foreign exchange availability, savings rates, and the availability of government revenues will press for containment of food subsidy costs. These forces are neither simple nor well understood. Their importance will increase.

Much of IFPRI's research is focused on the background factors, the conceptual elements, and the empirical record of food subsidies. Import policy is a major component of these.

This research report by Grant Scobie is a major step forward for IFPRI's work in this important area. It concentrates on the interaction of government policy and wheat imports. Data for Egypt sheds light on many of the issues related to their interaction. Because the size of food subsidies and wheat imports is much larger in Egypt than in other developing countries, it is possible to measure relationships that are often masked in other countries.

This research is related to specific analyses of food subsidies and their effects currently under way at IFPRI. That work will allow more conclusions about how international trade and domestic food policies interact. Other work at IFPRI is refining our knowledge of the relationship between food prices and availability, on one hand, and poverty, nutritional status, and employment on the other. From these works will come a basis for policies that pursue objectives of growth and equity more effectively and more humanely.

John W. Mellor

Washington, D.C.
December 1981

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SUMMARY

> Much of the work of economists is concerned with the future, with forecasts and planning. But forecasts are trivial and planning is useless unless they are based on fact; and facts which are at our disposal are facts of the past. . . . The purpose of analysis, applied to those facts is the explanation of what has happened—the explanation that is, of economic history. . . . So even if our business is with forecasts of what is likely to happen or with probable results of policies to be adopted now, historical analysis comes first.
>
> Sir John Hicks
> *Causality in Economics*

In a number of less-developed countries (LDCs) food imports have been rising for various reasons. In some cases the increase reflects rapid population growth or the slow growth of domestic food production; in others, rising incomes and the associated demand for livestock products; and in others, a response to world market prices.

The objective of this study is to develop and illustrate an economic model of food imports. The results provide some insight into the principal structural relationships that underlie the determination of food imports. Many national and international food policy problems require knowledge about the responses of imports to varying circumstances. Debate on such matters as international reserve stocks, schemes for providing compensatory funds for food imports by LDCs, or the impact of world price variability on domestic consumption in LDCs requires information about the behavior and determinants of imports.

There are a number of salient features of food imports among lower-income LDCs. First, food imports often comprise a significant proportion of total import expenditures. For this reason it is likely that decisions concerning the allocation of foreign exchange to food imports are made jointly with those governing spending on other imports and adjustments in the level of foreign exchange reserves.

Second, food imports by LDCs almost universally are under the control of a state authority; private external grain trade is typically prohibited. Third, food imported under concessionary terms as foreign aid may represent an important part of total supplies. And finally, decisions on the internal pricing of food crops to both producers and consumers are likely to reflect possibilities for substitution in both production and consumption, the more so when the shifts in resource allocation (as between food and export crops) have implications for the foreign account.

The econometric model developed in this study endeavors to reflect these features by placing the import of food in the context of the overall balance-of-payments adjustment mechanism and by focusing explicitly on government policies and receipts of foreign aid. The degree of intervention of the government in setting internal prices is specifically addressed. Importance is attached to identifying the factors that motivate and constrain government policy.

The framework is applied to the case of Egyptian wheat imports. Egypt is a major importer in the world wheat market, receives substantial amounts of foreign aid, spends an important fraction of her foreign exchange earnings on wheat imports, and follows an explicit policy of subsidizing domestic consumption.

The study finds that the country's capacity to import is a principal determinant of domestic wheat policies and influences the level and composition of imports. In part, this capacity to import is itself determined by both wheat and cotton policies, emphasizing the simultaneous nature of policy formation.

The marginal propensity to spend foreign exchange on commercial wheat imports is estimated to be about 0.05. From a fall of one U.S. dollar in foreign exchange receipts, expenditure on wheat imports would be reduced by only five cents. This relatively

low value reflects the priority that Egypt gives to wheat imports in its foreign exchange budget. Any compensatory financing, such as might be obtained from the food facility of the International Monetary Fund (IMF), would have little direct impact on food security in Egypt. Its principal contribution would be to stabilize the level of nonfood imports. Egypt has typically allowed its imports of raw materials and intermediate goods to fluctuate in order to maintain food imports. Postponing or forgoing such imports is likely to affect adversely employment and incomes in the nonfarm sector. This finding serves to highlight the relation between national food security policies and the economic performance of the entire economy.

A change in the world wheat price has important and widespread effects in Egypt. Although the price to domestic consumers has been held substantially below the world price, Egypt has not followed a policy of completely insulating domestic prices from changes in the world price. It is estimated that a 10 percent rise in the world price leads to a 5 percent increase in the consumer price. Although this response reflects the trends over the last three decades, it should be stressed that some substantial year-to-year variations in world prices have not been fully transmitted to domestic prices. Nominal prices of wheat have been held constant for relatively long periods in Egypt, but with domestic inflation rates at least as high as those of its trading partners, the real price of wheat to consumers has fallen substantially in the last two decades. This corresponds to a period when the real cost of imported wheat also has been falling, with the notable exception of 1974.

A rise in the world price tends to lead to higher real wheat prices for both Egyptian consumers and producers because it dampens demand and stimulates domestic output. The farm-gate price of cotton is also increased to generate additional export revenues. Simultaneously, the higher world price is accompanied by a fall in shipments of aid wheat, so that despite a modest rise in domestic output, much of the adjustment is taken up by reduced consumption. Although the quantity of commercial imports falls, total expenditures for imported wheat rise as the demand is relatively inelastic with respect to the world price. This pressure on foreign exchange again induces cuts in other classes of imports.

In developing a formal econometric model for imports, considerable emphasis is placed on the history of Egyptian wheat policy. An overview of the wheat sector and its attendant policies during the last two centuries highlights the important features of the sector to which policies have responded and which they, in turn, have influenced. Consistent threads woven in the fabric of Egyptian wheat policy are the importance of cotton and wheat as sources of and claims on foreign exchange, their competition for domestic resources, and Egypt's attempts to control the pricing and distribution of imports and wheat marketing and to maintain low and stable prices to consumers.

The approach adopted in this study involves some obvious but important limitations. First, any generalization of the results to other LDCs based on a solitary case has its attendant dangers. Second, heavy reliance is placed on a quantitative assessment of the historical record. This raises two difficulties. The formal model is limited in its capacity to mirror the richness of the underlying political and economic fabric. Only those that are believed to be key elements can be portrayed. Further, econometric analyses of historical periods in LDCs place a significant, but it is to be hoped not intolerable, burden on the data. The fact that some common significant themes emerge from the analysis should be taken only as evidence that some systematic and consistent forces underlie the observed movements in Egyptian wheat imports.

Current levels of wheat imports are a reflection of domestic pricing policies. The import levels in part determine the country's external balance, and in turn the foreign account is found to influence the setting of those policies. The extensive system of Egyptian subsidies on basic commodities includes a substantial subsidy on bread consumption. It is only through the sale of large quantities of imported wheat that the government is able to hold down the price to consumers. Imported wheat now supplies about 70 percent of total supplies. At the same time growth in domestic output has been modest. A rapidly growing population has placed increasing demands on the very limited supplies of agricultural land. Farmers have shifted resources to the production of higher-value crops and livestock products. This tendency has been accelerated by the producer pricing policy for wheat. Farm-

gate prices have been held below the import price of wheat; moreover, the price of wheat relative to other major crops (rice, cotton, and maize) has fallen consistently for almost three decades.

The burden of Egypt's wheat policy on its public and foreign sector accounts would be eased by reductions in the quantity of wheat imported. This would require increases in domestic output, but, perhaps more important, a reduction in domestic demand. Allowing producers to respond to the import price of wheat and restricting the access to subsidized bread to a somewhat narrower segment of consumers would reduce the growth in wheat imports.

Steps were taken in 1980 to reduce the number of families eligible for rationed foods (tea, sugar, rice, vegetable oil, beans, lentils, poultry, beef, mutton, and fish). An upper ceiling was placed on family income, and those owning or renting more than 10 feddans of land or having a foreign employer were removed from the ration lists. It is estimated that 3 million ration books were eliminated. However, bread continues to be available in unlimited quantities at one piastre for a loaf of local (balady) bread weighing 169 grams, a price equivalent to about eight U.S. cents per kilogram. Wheat and flour subsidies represent over half the total cost to the national budget of the food subsidies, which themselves claim about 20 percent of government revenues. Imports of subsidized foods currently comprise almost one quarter of Egypt's total import bill. Any extension of the new regulations to include bread would therefore have a demonstrable impact on the foreign and public accounts.

At the same time, such a shift in emphasis in domestic food policy would lessen the destabilizing influence on the import of other goods and stimulate growth and employment in the nonfarm sector. Steps to reduce domestic demand would seem to be consistent with the spirit of the open-door economic policies initiated in the mid-1970s and the current moves to strengthen them.

2

INTRODUCTION

> Hussein: For 20 years I have been studying this, and now I know that every town had its own wheatery, a kind of silo built like a giant clay jar buried in the desert. . . .
>
> Basyuni: You mean if we dig there, the wheat will come up?
>
> Ali Salem
> *The Well of Wheat*

Changes in wheat trade typify the changing patterns in world food trade. Prior to World War II almost three quarters of the world wheat trade was accounted for by the imports of Europe, the U.S.S.R., and Japan. During the period 1978-79 the imports of Latin America, Asia (excluding Japan), and Africa accounted for the same proportion, as seen in the table below.[1]

Period	Europe, the U.S.S.R., and Japan	Latin America, Asia (excluding Japan), and Africa
	(percent)	
1934-38	73	27
1959-63	52	48
1969-71	32	68
1978-79	31	69

As a group, LDCs are net importers of cereals (Table 1), but it would be an oversimplification to infer that low-income countries are becoming generally more dependent on trade for food. During the last two decades imported food has become a smaller share of the total imports of LDCs, dropping from almost 20 percent in 1960 (excluding fuels) to 10 percent by 1980. Of 132 LDCs, the share of food in total imports fell in more than 50 percent but rose in 25 percent (see Table 2). Most of the latter were among the poorest LDCs.

The mean ratio of the food import bill to total export revenues for a country normally varies 5-10 percent from year to year. However, because of variations in world prices or domestic output, the ratio may be three to four times the average in some years.[2]

Much of the growth in food trade (and especially in cereals) has been accounted for by middle-income countries, including Eastern Europe and the U.S.S.R. The predominant feature has been the rise in their imports of livestock feed and livestock

Table 1—World trade in cereals by country group, 1977-79

Country Group	Net Imports 1977	1978	1979
	(million metric tons)		
Developed market economies	−57	−85	−89
Developing market economies			
Africa	+9	+11	+11
Latin America	−5	+4	+4
Middle East	+12	+14	+15
Far East	+7	+8	+9
Centrally planned economies	+25	+44	+52
All developed economies	−43	−54	−53
All developing economies	+35	+49	+53

Source: Food and Agriculture Organization of the United Nations, *FAO Trade Yearbook 1979* (Rome: FAO, 1980), p. 111.

[1] These figures are derived from Food and Agriculture Organization of the United Nations, *FAO Trade Yearbook*, various issues (Rome: FAO, various years).

[2] See Alberto Valdés and Panos Konandreas, "Assessing Food Insecurity Based on National Aggregates in Developing Countries," in Alberto Valdés, ed., *Food Security for Developing Countries* (Boulder, Colo.: Westview Press, 1981), pp. 25-52.

Table 2—Trend in share of food in total imports in 132 developing countries, by income group, 1961-78

Annual Income Per Capita	Number of Countries in Which the Share of Food: Decreased	Remained Unchanged	Increased	Total
Less than U.S. $400	17	11	19	47
U.S. $400–800	30	4	7	41
More than U.S. $800	26	10	8	44
Total	73	25	34	132

Source: Food and Agriculture Organization of the United Nations, "FAO Trade Yearbook Tape, 1978," Rome, 1979.
Note: Food includes beverages, cereals, sugar, meats and meat products, fruits and vegetables, and oils and oilseeds.

products as incomes have grown. Since the 1950s international trade in grain has grown at more than twice the rate of global output. More than 40 percent is used as feed for animals today compared with less than 2 percent in the early 1950s. A large part of the recent increases in wheat imports is due to rising incomes, urbanization, and the increased demand by oil-exporting countries.

The growth in import demand reflects both internal and external factors. Higher growth rates of incomes and population than of domestic supplies put upward pressure on internal prices, especially if agricultural productivity is lagging. On the other hand, food imports can be expected to increase if the real prices facing importing countries fall, regardless of the progress of their own agriculture. Expanding foreign exchange earnings have facilitated increased food imports in some cases, particularly in Nigeria, Indonesia, Mexico, Venezuela, and to some extent Egypt.

Real world prices of principal foodstuffs have trended downward most of the last three decades. This is indicated in the following tabulation, which shows a simple average of the real price indexes of 10 commodities[3] using five-year averages and 1965-69 as 100:

1950-54	127
1955-59	104
1960-64	101
1965-69	100
1970-74	116 (103 excluding 1974)
1975-79	84

The opportunity cost to LDCs of acquiring imported food compared to manufactured exports has been declining for three decades.

The fact that some countries have found it advantageous to rely increasingly on imported food is not necessarily an indictment of their agricultural performance. If the long-run trend in real food prices continues,[4] some countries are likely to import an increasing share of their total food supplies.

There are a number of salient features of food imports that are frequently encountered among lower-income LDCs. This study of Egyptian wheat imports encompasses five of them.

First, because food imports represent a significant share of total import expenditures in many LDCs, decisions concerning the allocation of foreign exchange to food imports must take into account spending on other imported goods and changes in foreign

[3] The commodities are rice, maize, wheat, sorghum, sugar, beef, bananas, copra and coconut oil, palm oil, and soybean oil. The data refer to unit export prices in constant 1979 dollars. See International Bank for Reconstruction and Development, *Commodity Trade and Price Trends* (Washington, D.C.: IBRD, August 1980).

[4] In the latter half of the 1970s, the real prices of wheat and maize were as low as at any time since the last century. As Johnson notes, this is "another measure of the supplies of food available to the low-income countries." See D. Gale Johnson, "The World Food Situation: Developments during the 1970s and Prospects for the 1980s," in *Contemporary Economic Problems*, ed. W. Fellner (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1980), p. 311.

exchange reserves. In addition, when food imports constitute a significant share of total import expenditures, variations in the food import bill arising from changes in world prices[5] or in domestic food output are likely to have important consequences.

For example, consider the case of an unexpected rise in world market prices due to a shortfall in output in the rest of the world. If the supplies of foreign currencies are inelastic in the short run, there will be excess demand for foreign exchange. This can only be eliminated at the existing exchange rate by reducing either imports or holdings of reserve assets. If the excess demand exceeds that which can be met from reserves, either food or nonfood imports will decline and domestic consumption will be reduced. On the other hand, postponing or eliminating the importation of raw materials, fuels, or capital goods will affect the performance of perhaps both the agricultural and nonfarm sectors of the economy. Where food imports are relatively unresponsive to changes in the available level of foreign exchange, then instability in either world prices or domestic output may be transmitted to the rest of the economy and affect incomes and growth.

Second, Egyptian food imports are the sole responsibility of a government agency, as is characteristic of many other LDCs. Private international grain trade is forbidden. Under such circumstances, government policies must be considered in any explanation of the level of grain imports.[6] Furthermore, these policies are unlikely to be independent of other economic forces, which suggests that it may well be appropriate to make the policies themselves endogenous.

Third, imports also reflect domestic policies that affect consumption and production.

Fourth, imports of grain under concessionary terms, such as food aid, represent a significant share of Egyptian cereal imports, as is the case in many low-income countries. In 34 LDCs (classified as most seriously affected by rising oil prices) food aid represents one quarter to one third of total cereal imports.[7]

Finally, domestic production and consumption policies adopted in an LDC for a crop such as wheat may well have important indirect effects on wheat imports through substitution effects in both consumption and production. In setting producer prices for wheat, for example, the government must take into account the impact on crops that compete with wheat for resources. In Egypt this is particularly true for cotton, which is an important source of foreign exchange receipts.

These five features form the core of this study. Its principal objective is to develop a set of structural relations that describe how Egyptian wheat imports are determined.[8] Particular attention is given to the role of foreign exchange—an emphasis in part justified by the oft-encountered argument that some LDCs face a foreign exchange constraint on the import of food. By examining the nature and importance of such a constraint, a better understanding may develop of the underlying response of food imports to changes in a country's foreign exchange position, which might prove useful in the debate over international policies to alleviate balance-of-payments constraints to food imports. The food financial facility recently created by the IMF is a case in point.

In Egypt, however, foreign exchange earnings have improved remarkably in recent years (Table 3). Predominant among the factors underlying this change has been the

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[5] Throughout this study Egypt will be assumed to be a "small country," whose own actions do not influence world prices.

[6] Hathaway has chastised the economics profession for its "grossly inadequate . . . recognition of the political realities of the world in which commodity trade occurs. . . . There has been little or no work done on the economics of commodity trade in a world where state trading organizations play an increasing role, especially on the buying side." Dale E. Hathaway, "Changing Patterns of World Trade," *American Journal of Agricultural Economics* 61 (December 1979): 1021.

[7] In embarking on such efforts, one must remain cognizant of Schultz's warning that "the dialogue between economic theory and observable foreign aid is not one of the cogent parts of economics." T. W. Schultz, "Effects of the International Donor Community on Farm People," *American Journal of Agricultural Economics* 62 (December 1980): 874.

[8] In the last five years, Egypt has been the world's fourth largest individual importer of wheat, following China, the U.S.S.R., and Japan. See U.S. Department of Agriculture, Foreign Agricultural Service, *World Grain Situation Outlook for 1980-1981*, Foreign Agriculture Circular FG-35-80 (Washington, D.C., USDA, 1980), p. 12.

Table 3—Balance of payments in goods and services, selected years, 1952-80

Item	1952-58[a]	1959-66[a]	1967-72[a]	1973	1975	1978	1980
			(U.S. $ million)				
Exports (f.o.b.)							
Cotton[b]	+345	+362	+464	+688	+813	+558	+620
Petroleum[c]	. . .	. . .	. . .	+113	+132	+688	+2,730
Other	+98	+152	+281	+323	+455	+886	+1,342
Total	+423	+514	+745	+1,124	+1,400	+2,132	+4,692
Services							
Suez Canal	+88	+164	+15	0	+85	+541	+650
Remittances[d]	. . .	. . .	. . .	+86	+367	+1,760	+2,545
Other net	−26	−56	−55	+79	+82	+1,145	+1,480
Total (net)	+62	+108	−40	+7	+449	+3,446	+4,675
Imports (c.i.f.)							
Food[e]	−52	−201	−130	−208	−982	−1,355	−2,590
Other	−506	−703	−950	−1,456	−3,515	−5,496	−7,457
Total	−558	−824	−1,080	−1,664	−4,497	−6,851	−10,047
Net balance on goods and services	−73	−202	−375	−654	−2,480	−1,273	−608
Debt payment	−8	−56	−240	−407	−476	−899	−1,313
Foreign exchange deficit	−81	−258	−615	−1,061	−2,956	−2,172	−1,921
Supply of funds[f]	+11	+203	+585	+945	+2,980	+2,113	+1,397
Change in reserves	−70	−53	−30	−116	+24	−59	−524

Sources: The figures for 1952-72 are from K. Ikram, *Egypt: Economic Management in a Period of Transition* (Baltimore, Md.: Johns Hopkins University Press, 1981), pp. 343-349. The later years are from Egypt, Central Bank of Egypt, *Economic Bulletin*, various issues; and data from the U.S. Agency for International Development Mission, Cairo.

[a] Averages for the periods given.

[b] Includes raw cotton, yarn, cotton waste, and textiles.

[c] Included in "Other" until 1973.

[d] Included in "Other net" until 1973.

[e] Only includes cereals until 1973.

[f] Including grants, loans, transfer payments, and suppliers' credits.

growth in petroleum exports, which rose almost fourfold in real terms between 1978 and 1980 and now comprise 50 percent of export revenues. With over 10 percent of the country's labor force working in the countries of the Persian Gulf, workers' remittances continue to provide significant supplies of foreign exchange. Revenues from oil pipelines, the Suez Canal, and tourism have also grown (see Table 3). However, as Bruton suggests, these developments are largely independent of the main Egyptian economy and are clouded by political uncertainties.[9] The country's external balance has fluctuated significantly in the past three decades. With demand for imported foods increasing, one may well hesitate to project a continued favorable external position. Even if a strong long-run external position were assured, imports of wheat claim resources that could be utilized for imports of capital goods and raw materials to enhance industrial growth and employment.

A Cautionary Note

The study emphasizes the historical record. There are no projections or attempts

[9] Henry J. Bruton, *The Promise of Peace: Economic Cooperation between Egypt and Israel*, A Staff Paper (Washington, D.C.: Brookings Institution, 1981), pp. 6-7.

to simulate the impacts of alternative policies.

Placing such heavy reliance on gaining insights from the past contrasts with the approach of some other economists.[10] But different approaches have their comparative advantages in addressing different questions. A simulation study may seek to estimate the impact of different policies on foreign exchange, imports, or consumer well-being. In the process it will require estimates of how various economic factors respond to changes induced by the policies. The concerns of this study are to use the past to distill knowledge of these responses rather than to quarry new faces, and to seek an understanding of what particular policy instruments were employed in certain ways at certain times.

Clearly the approach taken has its limitations. It is a captive of the historical period chosen for examination. If the future brings circumstances and policies not included in the range of past experience, then whatever understanding is gleaned has limited value. For that reason, the study endeavors to establish that, at least for this problem, past experience is rich and varied and can perhaps shed some light on how food policies are formed, implemented, and molded by changing circumstance. However, placing total reliance on sometimes questionable data is clearly a discomfort with which the approach must live.[11]

[10] See Lance Taylor, *Macro Models for Developing Countries* (New York: McGraw-Hill, 1979), pp. 58-66; F. D. McCarthy and Lance Taylor, "Macro Food Policy Planning: A General Equilibrium Model for Pakistan," *Review of Economics and Statistics* 62 (February 1980): 107-121; Bent Hansen, "Simulation of Fiscal, Monetary and Exchange Policy in a Primitive Economy: Afghanistan," in *Economic Structure and Development: Essays in Honor of Jan Tinbergen*, ed. H. C. Bos, Hans Linneman, and P. de Waff (Amsterdam: North Holland Publishing Co., 1973), pp. 215-237; David Bigman and Shlomo Reutlinger, "Food Price and Supply Stabilization: National Buffer Stocks and Trade Policy," *American Journal of Agricultural Economics* 61 (November 1979): 657-667; and Shlomo Reutlinger and David Bigman, "Feasibility, Effectiveness, and Costs of Food Security Alternatives in Developing Countries," in Alberto Valdés, ed., *Food Security for Developing Countries* (Boulder, Colo.: Westview Press, 1981), pp. 185-212.

[11] Difficulties with the extent, validity, and consistency of Egyptian data have confronted most researchers. Not atypical of the caveats that these difficulties spawn is the following statement: "One cannot help express grave concern about the permanent damage done to the import data as officially reported by Egyptian authorities. A researcher who may be interested in this type of economic activity will have to check the official data against the world's commodity exports to Egypt, particularly from 1967 on. A high percentage of the discrepancy is attributed to wheat imports" (M. Girgis, *Industrialization and Trade Patterns in Egypt*, Kieler Studien No. 143, Institut für Weltwirtschaft an der Universitat Kiel [Tubingen: J. C. B. Mohr, 1977], p. 139). To enable the reader to verify the sources and to employ his own analytical apparatus, an extensive series of supplementary tables containing all the data used in this study is presented in Appendix 4.

3

BACKGROUND TO EGYPTIAN WHEAT POLICY

> For the land whither thou goest in to possess it, is not as the land of Egypt, from whence ye came out, where thou sowedst thy seed and waterdst it with thy foot, as a garden of herbs.
>
> *Deuteronomy*, 11:10

Considering the vast history of Egypt, students might flinch at limiting an historical perspective on wheat policy in Egypt to the period since 1800 A.D. There is, however, ample material in this period to provide insights into the objectives and instruments of wheat policy. This historical review, which provides a wealth of detail that cannot be captured in a model, is intended as a complement to the quantitative model. A list of the commonly used Egyptian weights and measures follows.

Weights and Measures

1 Egyptian pound (LE)	= 100 piastres
1 hectare	= 2.379 feddans
1 feddan	= 1.038 acres
1 square kilometer	= 238 feddans
1 keila	= 16.5 liters
1 ardeb	= 198 liters = 150 kilograms of wheat
1 cantar	= 44.928 kilograms

There are other reasons for undertaking a brief review of past policies. First, it provides some guidance for identifying the central aspects to be recognized in the formal model, such as the importance of the country's external balance in determining wheat policy, the influence of domestic policy on the volume of trade in wheat, the competition between wheat and cotton production for domestic resources, and attempts to use wheat trade to influence domestic price levels and, through them, income distribution. All of these have been dominant themes of Egyptian wheat policy for nearly two centuries despite massive changes in political organization.

Second, the review of past policies supports the argument that there are only a limited number of forces affecting the wheat sector, objectives that wheat policy can hope to achieve, and policy instruments that can be used. These forces include disturbances in output, changes in world prices of wheat and cotton, and wars. Governments formulate policies to alter the domestic or foreign accounts and to change the distribution of income. And, in most cases, an attempt to shift relative prices has been the chosen policy instrument.

In the late eighteenth century the agrarian structure under the last of the Mamluk rulers was essentially feudal. After British and Ottoman troops ended the short-lived era of French domination, Mohammed Ali came to power. He and his descendants ruled until the demise of the monarchy in 1953. From 1805 to 1849, during his rule, the government was totalitarian in nature. This was followed by what many consider as Egypt's capitalist era, which lasted until about 1930. The period covered by the Great Depression and World War II was characterized by a greater incursion of the state in both the wheat sector and general economic activity. The problems and responses were typical of those of many Western nations. The most recent change in the political course came with the takeover by the Organization of Free Officers under Nasser in 1952, which ushered in an era of modern Arab socialism. Despite these upheavals, there have been striking similarities in both the problems and the solutions of Egyptian wheat policy under the various regimes.

The Eighteenth and Nineteenth Centuries

Agricultural trade has always been important to Egypt. Prior to the tenth century it

was a major supplier of papyrus to Europe.[12] From ancient times into the Middle Ages, Egypt played an important role in the trading and commerce of both the Orient and Mediterranean and was a grain exporter and trader in spices.

In the first half of the nineteenth century, Mohammed Ali imposed compulsory wheat procurement as a means of provisioning the military. He also sought to raise output of the agricultural sector by public investment in irrigation works and improved agricultural practices. Much of this investment was undertaken to permit the expansion of cotton and other export crops (including rice, sugar, and indigo). Investment in domestic agriculture for food and cotton production, as well as in food processing, textiles, glass, iron, and military equipment, also was motivated by the need to reduce import expenditures and achieve independence from foreign suppliers.

Traditional agricultural methods were based on the sowing of winter crops in basins along the Nile that were inundated during the flood season (July-October). When the water receded, crops such as wheat and barley were sown in November for harvest in April. River silt deposited in the basins replenished the fertile topsoil annually. However, winter crop production fluctuated sharply as the result of insufficient soil moisture or excessive flooding. Production of summer crops (cotton and rice) depended on the residual soil moisture in March or April. Under Mohammed Ali large-scale investment was undertaken to control the floodwaters through barrages and irrigation canals and to develop a system of perennial irrigation. This effort culminated over a century later witih the completion of the Aswan High Dam. Much of the investment in irrigation was stimulated by the desire to expand cotton production, especially after the introduction of the high-quality, extra-long staple varieties.

During the first half of the nineteenth century, cotton became an important export crop. Export prices fell from $35 per cantar in 1835 to $10 in 1837 and to $7 in 1848. Throughout the period, an export tax was levied on cotton as the government purchased the crop at prices well below those it received in the export market. Between 1820 and 1834 cotton was typically purchased at LE 0.12 and sold at LE 0.60.[13]

Cereals were an important export crop during the period, and the country benefited from sales to Britain, especially during the Napoleonic wars.[14] The following table shows the production and export of wheat during 1816-44.[15]

Year	Wheat Production	Wheat Exports
	(1,000 ardebs)	
1816	n.a.	134
1821	1,200	n.a.
1829	n.a.	150
1830	1,025	n.a.
1832	2,021	n.a.
1834	950	n.a.
1835	1,347	n.a.
1836	n.a.	19
1840	n.a.	455
1841	n.a.	590
1842	n.a.	410
1843	n.a.	447
1844	2,534	287

In 1824 and 1825 harvests of wheat were poor due to floods. To hold down internal prices, exports were forbidden and the government imported additional supplies. Intervention in the foreign trade of wheat to alter domestic prices has been a recurring theme of Egyptian wheat policy. Variations in quality as an instrument of wheat policy also appear repeatedly. When floods reduced wheat output in 1829, the government not only supplemented supplies by drawing on stocks and importing grain and flour but also mixed beans and barley with the wheat

[12] S. Labib, "Egyptian Commercial Policy in the Middle Ages," in M. A. Cook, ed., *Studies in the History of the Middle East from the Rise of Islam to the Present Day* (London: Oxford University Press, 1970), pp. 63-77.

[13] H. A. B. Rivlin, *The Agricultural Policy of Muhammed Ali in Egypt* (Cambridge, Mass.: Harvard University Press, 1961), p. 151.

[14] Z. Y. Hershlag, *Introduction to the Modern Economic History of the Middle East* (Leiden: E. J. Brill, 1964), p. 84.

[15] Rivlin, *Agricultural Policy*, Tables 8, 9, and 37. Where n.a. appears the figure was not available.

that was supplied to millers. The modern counterpart is changes in the milling ratio.[16]

There followed a period of relaxation in the compulsory procurement and government price fixing. Producers were allowed to sell directly to merchants. But in 1831 high prices forced the government to intervene to protect consumers, and in 1832 government ration shops for wheat were opened in Cairo and Alexandria.

In 1837 the country again needed to import wheat. There was a 3 percent duty on imported wheat, although the government levied a higher import tax on wheat imported by merchants who were non-British; such are the ways of commercial policy! But to encourage imports all duties were suspended in November of 1837. By 1840 a policy of government stockholding had been implemented. In part these were speculative stocks awaiting an increase in demand for Egyptian wheat from poor harvests or trade disruptions in Europe and Russia. The Russian embargo on wheat exports in 1828 during the war with Turkey is an example of what has been currently rediscovered as "food politics."

Cotton production started to rise during the second half of the nineteenth century, increasing from around 1 million cantars during the period 1860-64 to over 6 million cantars by 1900.[17] By the turn of the century cotton was generating 80-90 percent of Egypt's export receipts. The total population grew rapidly following widespread death from disease in 1853 and reached 10 million in 1900. The cultivated area rose only 20 percent, although the increase in perennial irrigation allowed the cropped area to grow 60 percent. The U.S. Civil War disrupted supplies of cotton to Europe and increased demand for Egyptian cotton. Egypt ceased to be an exporter of wheat, and imports of flour and cereals rose from an average of LE 0.8 million in 1885-89 to LE 4.2 million by 1913.[18] Since the late nineteenth century, increasing world supplies from the United States, Canada, Australia, and the Argentine have made wheat exporting less attractive. Egypt continues to depend to an increasing extent on imported wheat to supplement domestic supplies.

Rapid population growth has increased the total population to more than 40 million, about half of whom live in the urban sector. The area of agricultural land has remained constant at about 6 million feddans. The cropped area per capita today is only 0.27 feddans compared with about 0.75 feddans at the turn of the century. The drop in the man/land ratio has had important consequences for agricultural production as well as for agricultural income per capita.[19] Cropland has always been a principal limiting factor for Egyptian agriculture, which depends almost entirely on the Nile strip and delta. The scarcity of land has encouraged land-saving technology and has stimulated major public investment in land-augmenting irrigation works. High-yielding varieties and the extensive use of chemical fertilizers have long been characteristic of Egyptian agriculture. In the 1930s, for example, Egypt used 60 kilograms of nitrogen per feddan compared with 38 kilograms in Holland and 15 in Denmark.[20]

The rapid and widespread adoption of chemical fertilizers is partly explained by the change from basin to canal irrigation.[21] The soil fertility was not replenished under the new system, and it was further taxed by the double (and triple) cropping that perennial irrigation allowed. Hence there was a need for artificial fertilizer to exploit the potential productivity of the new system. In addition, considerable investment in drainage was required, together with the introduction of restorative crops such as berseem (Egyptian clover) into rotations with cotton, which has a large demand for nutrients.

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[16] This is discussed by S. Buchanan, "Egypt: Government Consumption Planning Schemes for Wheat and Other Primary Foods" (M.S. thesis, Cornell University, 1981), Chapter 6.

[17] P. K. O'Brien, *The Revolution in Egypt's Economic System* (London: Oxford University Press, 1960), p. 5.

[18] A. E. Crouchley, *The Economic Development of Modern Egypt* (London: Oxford University Press, 1938), p. 172.

[19] Bent Hansen and G. A. Marzouk, *Development and Economic Policy in the U.A.R. (Egypt)* (Amsterdam: North Holland Publishing Co., 1965).

[20] Hershlag, *Introduction to the Modern History of the Middle East*, p. 108.

[21] Crouchley, *The Economic Development of Modern Egypt*, p. 241.

World War I and the Depression

The Great War of 1914-1918 and its aftermath was a major shock to the Egyptian economy and to the wheat sector in particular. After an initial depression, the war stimulated world demand for cotton and export prices rose strongly. This combined with British military expenditures gave Egypt a strong external position. This favorable balance of trade was further enhanced by the difficulty of purchasing imports. However, greater plantings of cotton and the consequent reduction in domestic wheat production, the disruption of wheat and flour imports, and the increased demand for food by the military created a shortage of wheat. In September 1917 the government restricted plantings of the 1918 crop of cotton to one third of the land. The area fell from 1.8 million to 1.3 million feddans, although, given the profitability of cotton, farmers probably evaded the controls to some extent.

At the outbreak of the war, all export of foodstuffs was banned. Cereal prices were depressed as a result of the ban and ample harvests. However, at the insistence of the farmers who faced a low cotton price in 1914 and wanted to shift land to wheat, the export ban was lifted in April 1915. It was reimposed in 1917 in an attempt to hold down domestic wheat prices. A Supplies Control Board took over the marketing of wheat, controlling its distribution and setting maximum prices at every stage from the farmer to retail.[22] But the price ceilings merely exacerbated the shortages, as wheat was withheld from official channels and sold on the black market. Domestic wheat prices doubled between 1914 and 1918. Again cotton areas were restricted in an effort to increase wheat production, and import duties on wheat were suspended.

Inflation in basic food prices continued unabated after the war. The government, acting under its wartime powers, imported large quantities of wheat and flour from Australia and sold it in government shops at a loss throughout 1919 and 1920. This was made possible by the strong reserve position that evolved during the war and by the postwar boom in cotton export receipts, which jumped to LE 105 million in 1920 from about LE 40 million annually between 1916 and 1919.

Three fundamental aspects of Egyptian wheat policy emerge from the experience of the war. First, because wheat and cotton compete for domestic resources, there is an inevitable tendency to control the areas sown to each through direct acreage control or by relative prices. Second, imported wheat was used to hold down domestic prices. And third, the ability to subsidize wheat imports depended, at least in part, on export earnings and foreign exchange reserves.[23]

A slump in cotton occurred after the war and again in 1926. Each time the government intervened with acreage controls or direct purchases. After an ill-fated attempt to keep up spot prices in 1925, the government purchased futures contracts in cotton to offset the effect of speculation, which was believed to be depressing prices. Perhaps fortuitously, market prices rose, allowing the government to close its positions and not take delivery.

A calamitous fall in cotton export receipts with the onset of the depression in 1931 ushered in another round of government reactions in the cotton and wheat markets. Export receipts fell from LE 48 million in 1928-29 to an average of LE 20 million in 1931-33. Unit prices were below those prevailing before World War I. The area sown to cotton fell from 2.1 million feddans to 1.1 million feddans in just two years. The government reacted to the drop in prices and farm incomes by again entering the market and accumulating stocks of cotton.

A further policy change was the introduction of a tariff on wheat imports. Since the mid-nineteenth century, when Egypt was a part of the Ottoman area, it had been bound by a treaty that virtually guaranteed free trade in the Turkish Empire.[24] The maximum rate of duty on imported goods was set at 8 percent. The last of these treaties expired in 1930, ending 90 years of free trade.[25]

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[22] Ibid., p. 196.

[23] C. Issawi, *Egypt: An Economic and Social Analysis* (London: Oxford University Press, 1947), p. 33.

[24] Crouchley, *The Economic Development of Modern Egypt*, p. 233.

[25] Bent Hansen and K. Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt*, a special conference series on foreign trade regimes and economic development 4 (New York: National Bureau of Economic Research, 1975), pp. 3-4.

Issawi has argued that the tariff on wheat was introduced at the insistence of the cotton producers.[26] It was one of the few occasions when a policy involving an explicit transfer from consumers to producers was implemented. Previous and subsequent interventions either taxed producers or attempted to maintain farm incomes and hold down consumer prices.

It was relatively easy for the cotton producers to build a case for the wheat tariff. In the first place, changing the price of wheat relative to cotton would shift resources to wheat and reduce the country's dependence on a single export crop. Since the introduction of long staple cotton, and especially since the turn of the century, the economy had been buffeted by a series of reversals in the world cotton market. The internal instability that resulted from such dependence was obviously undesirable. Lord Cromer, a British administrator of Egypt, urged in 1905 "that people should be encouraged to grow . . . cereals . . . to lessen the country's dependence on cotton."[27]

Second, as Egypt was a major supplier of long staple cotton, reducing output would presumably lead to higher export prices, at least in the short run. However, the expansion of cotton output in the Sudan and the development of synthetics has largely eliminated this argument.

Third, increased domestic wheat output would reduce dependence on foreign supplies.

All the elements of the traditional defense of protectionism could be used to justify the tariff on wheat: national security, self-sufficiency, and a more diversified economy better able to withstand the vagaries of world markets. In addition, the tariff would not involve government outlay but would raise revenue and relieve the government from pressures to make costly forays into the cotton market. A wheat tariff was introduced, wheat and flour imports fell drastically (Table 4), and imports of all foodstuffs fell from 18 percent of total imports in 1928 to 11 percent by 1935. Further boosts to domestic wheat prices came in two years of the late 1930s when wheat exports were subsidized. Issawi notes that "the result of all these measures was to raise the local price of wheat and maize to more than double that of imported grain."[28]

In 1938 domestic wheat prices rose 25 percent and serious civil disorders broke out. Egypt's "Corn Laws" were not abolished until 1950. Further aid to the wheat industry came through reduced duties on imported fertilizer.

Despite protection, wheat output did not increase enough to offset the decline in imports. In addition, fluctuations in the harvest had a more pronounced effect on domestic availability. Issawi states that wheat supplies were cut 40 percent below 1931.[29] Annual grain and pulse consumption fell from 309 kilograms per capita between 1927 and 1929 to 245 kilograms per capita between 1936 and 1938,[30] even though average wheat yields for 1935-39 were higher than for any five-year period until 1953-59. The stimulus to fertilizer use from favorable prices for wheat contributed to higher yields.

World War II and the 1950s

The reaction of the government to the outbreak of World War II was similar to its reaction to the Great War.[31] Shipping was seriously disrupted so that the normal flow of exports and imports could not be maintained. Acreage controls on cotton were introduced again to limit government stockpiling. Despite some evasion, wartime measures were sufficiently stringent to reduce the cotton area from 1.98 million feddans in 1938 to 0.71 million by 1942.

Following a poor wheat harvest in 1941 and strikes by workers protesting rising

[26] Issawi, *Egypt: An Economic and Social Analysis*, p. 69.

[27] E. R. J. Owen, "Attitudes of British Officials to the Development of the Egyptian Economy, 1882-1922," in M. A. Cook, ed., *Studies in the History of the Middle East from the Rise of Islam to the Present Day* (London: Oxford University Press, 1970), p. 283.

[28] Issawi, *Egypt: An Economic and Social Analysis*, p. 69.

[29] Ibid.

[30] C. Issawi, *Egypt at Mid-Century: An Economic Survey* (London: Oxford University Press, 1954), p. 85.

[31] For an extensive review of wheat production, trade, and marketing during World War II, see E. M. H. Lloyd, *Food and Inflation in the Middle East*, Food Research Institute: Studies in Food, Agriculture and World War II (Stanford, Cal.: Stanford University Press, 1956).

Table 4—Cereal imports and exports, 1931-40

Year	Imports		Exports	
	Wheat	Flour	Cereals (Excluding Rice)	Flour
			(LE 1,000)	
1931	545	1,167	2	...
1932	515	516	31	...
1933	5	57	127	1
1934	123	40	7	...
1935	281	33	8	...
1936	5	34	70	1
1937	0	34	441	28
1938	103	47	112	2
1939	22	23	8	...
1940	4	44	492	12

Source: D. C. Mead, *Growth and Structural Change in the Egyptian Economy* (Homewood, Ill.: R. D. Irwin, Inc., 1967), pp. 349-350.

wheat prices, the government in 1942 ordered that at least one third of each farm be devoted to wheat. Retail price controls were also instituted. These measures also reflected the need to provide food for the allied forces in Egypt, the growth in population, and the lack of imports.

The controls over production, marketing, and distribution of wheat were only partially dismantled after the war. In 1950 import duties on wheat were abolished, but the acreage controls were retained. In addition, between one and three ardebs of wheat per feddan had to be surrendered to the government at a fixed price. Domestic wheat harvests in the immediate postwar years were poor. Soil fertility had been depleted during the war when fertilizer was very scarce. In contrast to the restrictions of the 1930s, government interventions were again directed at encouraging wheat production and holding down consumer prices. Imported wheat was sold at a loss from 1949 to 1951.[32] In the latter year, subsidized imports were about 1 million tons and government trading losses on wheat amounted to LE 18 million. These imports required the use of convertible (nonsterling) foreign exchange reserves. Despite abnormally high sterling reserves following World War II, there was a dollar shortage and licensing of trade with countries outside the sterling bloc was introduced in 1948.[33]

The rapid rise in cotton prices and export earnings during the Korean War stimulated plantings, which rose again to almost 2 million feddans. Trade controls were relaxed. The boom was short-lived however, and the government was again faced with a sharp decline in cotton prices. It responded by buying all outstanding futures contracts on the Alexandria cotton futures exchange in addition to purchases on the spot market. The results were disastrous. The fall in cotton prices was only the beginning of a long-term decline.[34] The government turned to raising the producer prices of wheat in an attempt to maintain agricultural incomes.

The controls and interventions, many of which originated during the depression of the 1930s and World War II, were continued after the Nasser revolution of 1952. Therefore, the socialist period did not signal an automatic increase in government intervention in the wheat market. The most important and immediate action taken by the revolutionary government was a major land reform.[35]

[32] Issawi, *Egypt at Mid-Century*, p. 85.

[33] Hansen and Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt*, p. 30.

[34] Ibid., p. 39.

[35] M. Abdel-Fadil, *Development, Income Distribution and Social Change in Rural Egypt: 1953-1970: A Study in the Political Economy of Agrarian Transition*, Occasional Paper No. 45 (Cambridge: Cambridge University Press, 1975).

4

RECENT DEVELOPMENTS IN THE WHEAT SECTOR

> . . . and so much corn was produced in this fertile country that after sufficing for the consumption of a very extensive population it offered a great surplus for the foreign market . . . and the quantity on hand enabling the peasant to sell it at a low rate afforded a considerable profit to the government being exported to other countries.
>
> Sir Gardner Wilkinson
> *Manners and Customs of the Ancient Egyptians*

Postwar Egyptian wheat policy reflects two basic objectives. The first is maintenance of the wartime controls on retail prices. Egypt operates an extensive system of consumer subsidies on foods, fuels, clothing, and transport. Whereas some goods and services are rationed or subject to a means test, bread has been made available in apparently unlimited quantities at the subsidized price. This is done by supplying wheat to the predominantly state-owned mills at a low price, which is termed the consumer price.

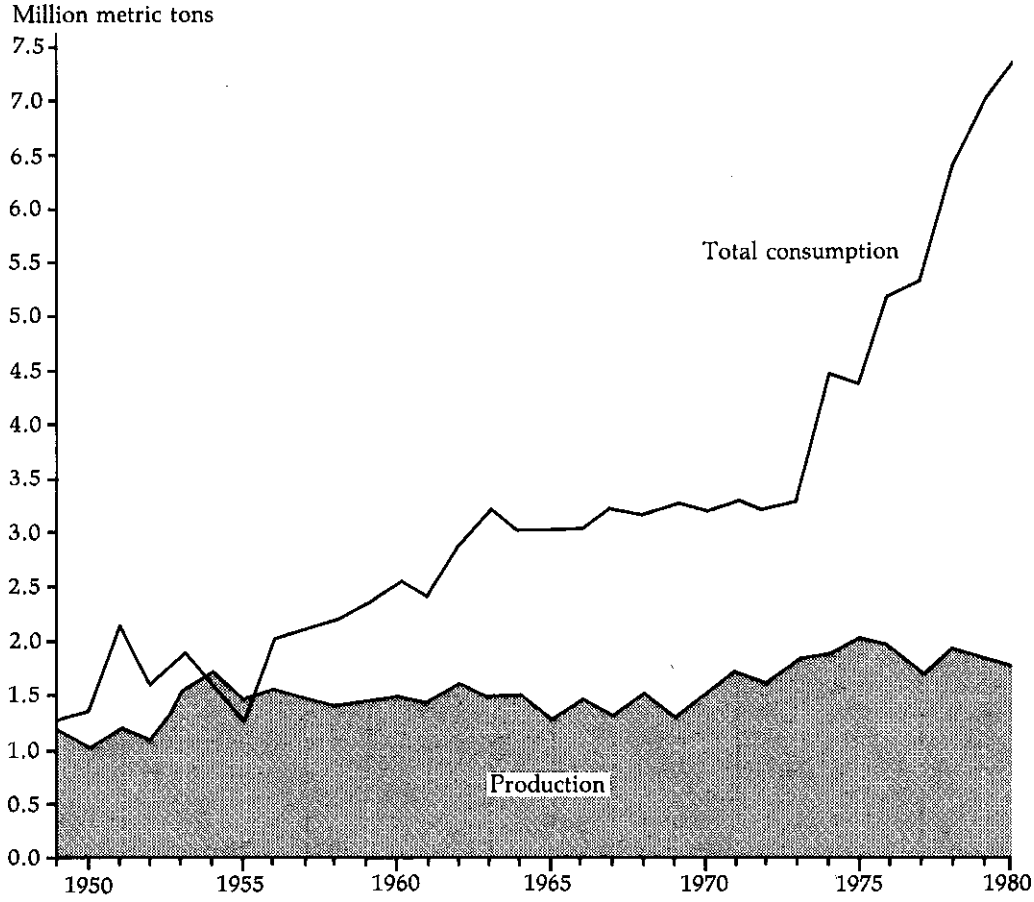
To hold down consumer prices in the face of rapid population growth, urbanization, and increased real incomes, the government has relied on increasing imports of wheat (Figure 1). Even though at times an appreciable part of this has been provided on concessionary terms (Figure 2), the wheat imports have been a major claimant on foreign exchange reserves and receipts. Since 1961, when all foreign trade was nationalized, wheat and flour imports have been totally under the control of the government. Throughout the postwar period there has been concern with the foreign exchange implications of Egypt's agricultural policies. "There is a considerable opportunity cost involved in population increase when foreign exchange that could be used to build up Egypt's productive capacity is used instead to finance food imports. Long-term growth prospects suffer because of immediate consumption needs."[36] At times, however, the foreign exchange constraint has been reflected in domestic consumption. Between 1967 and 1973, when appreciable resources were devoted to the military, per capita wheat consumption was apparently cut back (Appendix 4, Table 14).

The second government objective has been to encourage import substitution. The ratios of domestic to world prices (the nominal protection coefficients) are shown in Figure 3. Wheat and maize have been favored relative to the export crops of cotton and rice. In part this reflects the desire to economize on the use of foreign exchange, although policymakers have been acutely aware of the potential reduction in foreign exchange receipts that can result from the expansion of wheat relative to cotton.

The policy of encouraging cereal output relative to cotton and rice originated from the effect of war on the availability of imported grain and from the desire to reduce the country's economic dependence on cotton. These concerns have partly offset the tendency to move away from cereal production. Land-augmenting investment (irrigation, drainage, and reclamation) and increased use of high-yielding varieties, multiple cropping, and agricultural chemicals have been logical consequences of the scarcity of land and rapid population growth. This has encouraged changes in the product mix toward higher value products, such as milk, fruits and vegetables, and ornamentals, all of which have an export potential to Europe and other Arab countries. The product mix has in fact swung toward these high-value products, with fruit and vegetable production growing rapidly.

[36] R. Wilson, *The Economics of the Middle East* (New York: Holmes and Meier, Inc., 1979), p. 25.

Figure 1 - Production and consumption of wheat, 1949-80

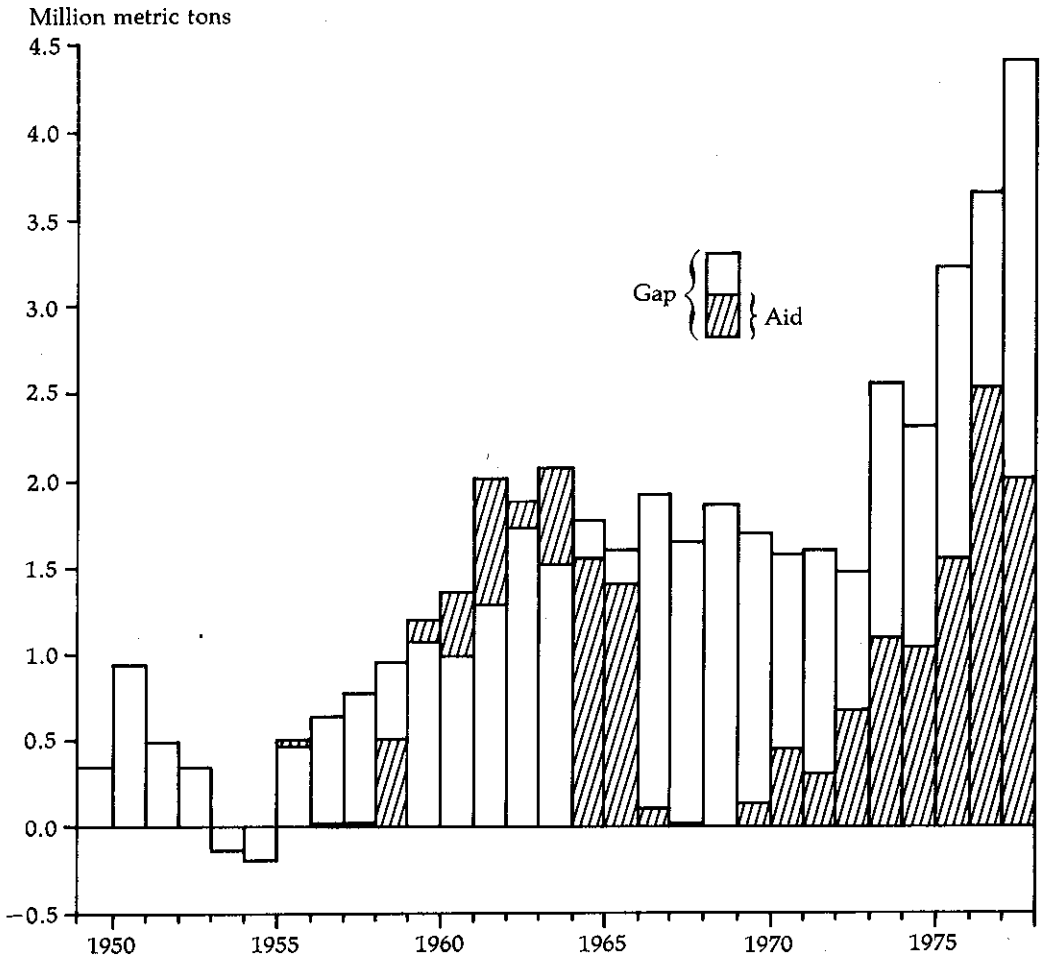


In part this reflects evasion of acreage controls and compulsory wheat procurement. During the period 1965-70 the average delivery quota was 2 ardebs per feddan, whereas the average yield was about 7.25 ardebs per feddan.[37] The amounts varied by district according to soil fertility. These deliveries were made at prices below those prevailing for wheat sold on local markets. The official procurement policies were pursued with varying degrees of vigor. Farmers failing to deliver their quota became liable to a fine. At times, however, relative prices were such that farmers sowed the more profitable, unregulated crops (vegetables and berseem) and paid the penalty for not delivering their quota of wheat.

Both the level and mix of Egyptian agricultural output depend not only on the specific policies adopted for individual crops but on overall economic policies. For example, because Egyptian agriculture is a wholly

[37] M. Abdel-Fadil, *Development, Income Distribution and Social Change in Rural Egypt*, p. 89. Between 1970/71 and 1975/76 an average of 1.57 ardebs per feddan were delivered under the quota scheme; this fell to 0.65 ardebs per feddan in 1976/77 when the compulsory delivery was made optional. See also F. Shalaby, "A Report on Wheat Consumption in Egypt," Program Economist's Office, U.S. Agency for International Development, Cairo, December 1978. (Mimeographed.)

Figure 2 - Aid and the gap between production and consumption of wheat, 1949-78



traded goods sector, exchange rate policies have an important bearing on agricultural prices.[38] The study by Hansen and Nashashibi on the foreign exchange regimes of Egypt since World War II emphasizes the effect of protection and controls on agriculture.[39]

Producer and Consumer Prices

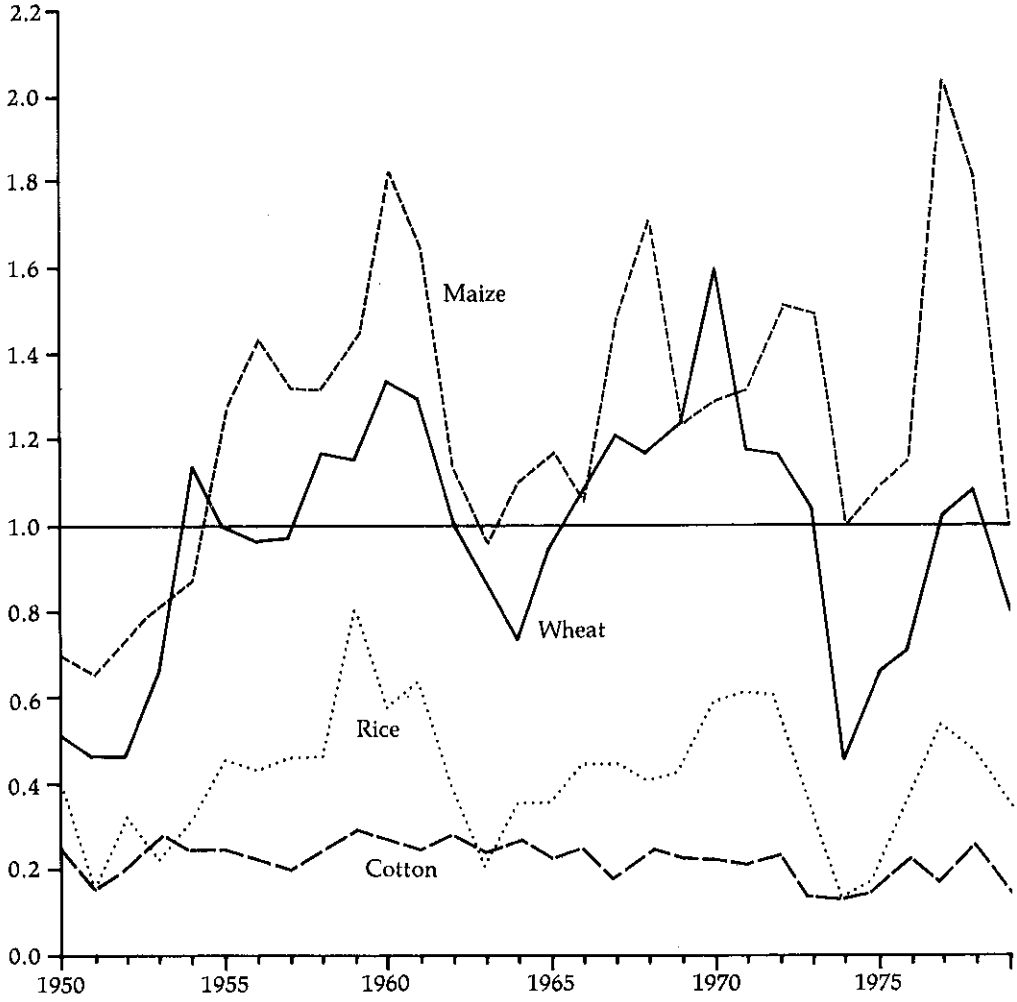
Both producer and consumer prices for wheat are largely determined by the government.[40] Since 1949 the cost of imported wheat has fallen appreciably, with sharp,

[38] For a recent study of these issues, see Jorge García García, *The Effects of Exchange Rates and Commercial Policy on Agricultural Incentives in Colombia: 1953-1978*, Research Report 24 (Washington, D.C.: International Food Policy Research Institute, 1981).

[39] Hansen and Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt.*

[40] The Egyptian wheat marketing system is described by Ahmed A. Goueli, "Food Security Program in Egypt," in A. Valdés, ed., *Food Security for Developing Countries* (Boulder, Colo.: Westview Press, 1981), p. 152.

Figure 3 - Nominal protection coefficients for major crops, 1950-79



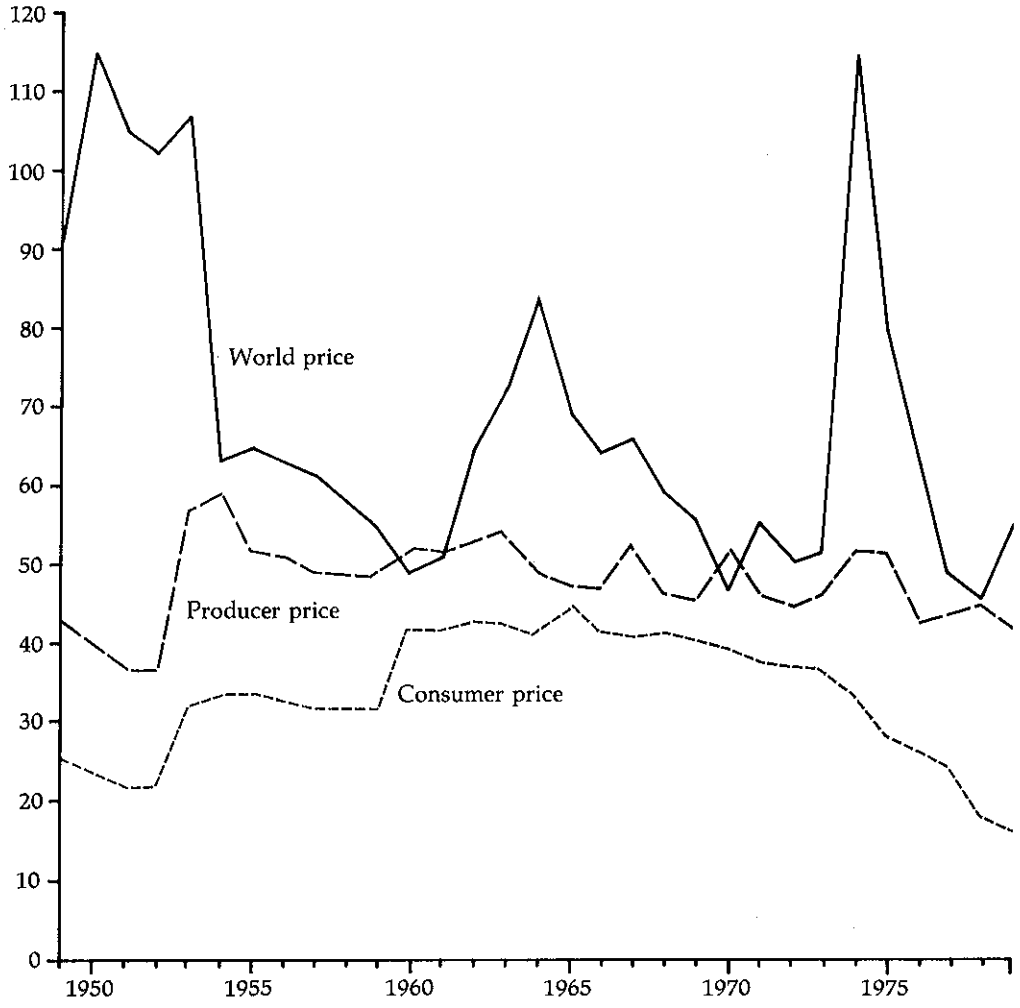
brief rises during the Korean War boom and in 1974 (Figure 4). The slight downward trend in the average price received by producers contrasts sharply with changes in prices to consumers. The latter doubled between 1950 and 1965, but have declined almost every year since. During the latter half of the 1970s the real price of wheat to consumers was cut in half.

The price received by farmers for wheat has declined relative to prices of competing crops (Figure 5). Relative prices alone, however, are not an adequate measure of incentives to producers. Different rates of growth of crop yields and the subsidies on input prices should also be considered, but Figure 5 at least indicates the broad pattern of incentives.[41]

[41] For further details, including an analysis of the domestic resource costs for major Egyptian crops, see W. Cuddihy, *Agricultural Price Management in Egypt,* World Bank Staff Working Paper No. 388 (Washington, D.C.: International Bank for Reconstruction and Development, April 1980); and Egypt, Ministry of Economy, Foreign Trade, and Economic Cooperation, Economic Studies Unit, *Policy Study on Pricing and Taxation of Major Alternative Agricultural Crops* (Cairo: Ministry of Economy, Foreign Trade, and Economic Cooperation, 1980).

Figure 4 - Real wheat prices, 1949-79

LE 1975 per ton

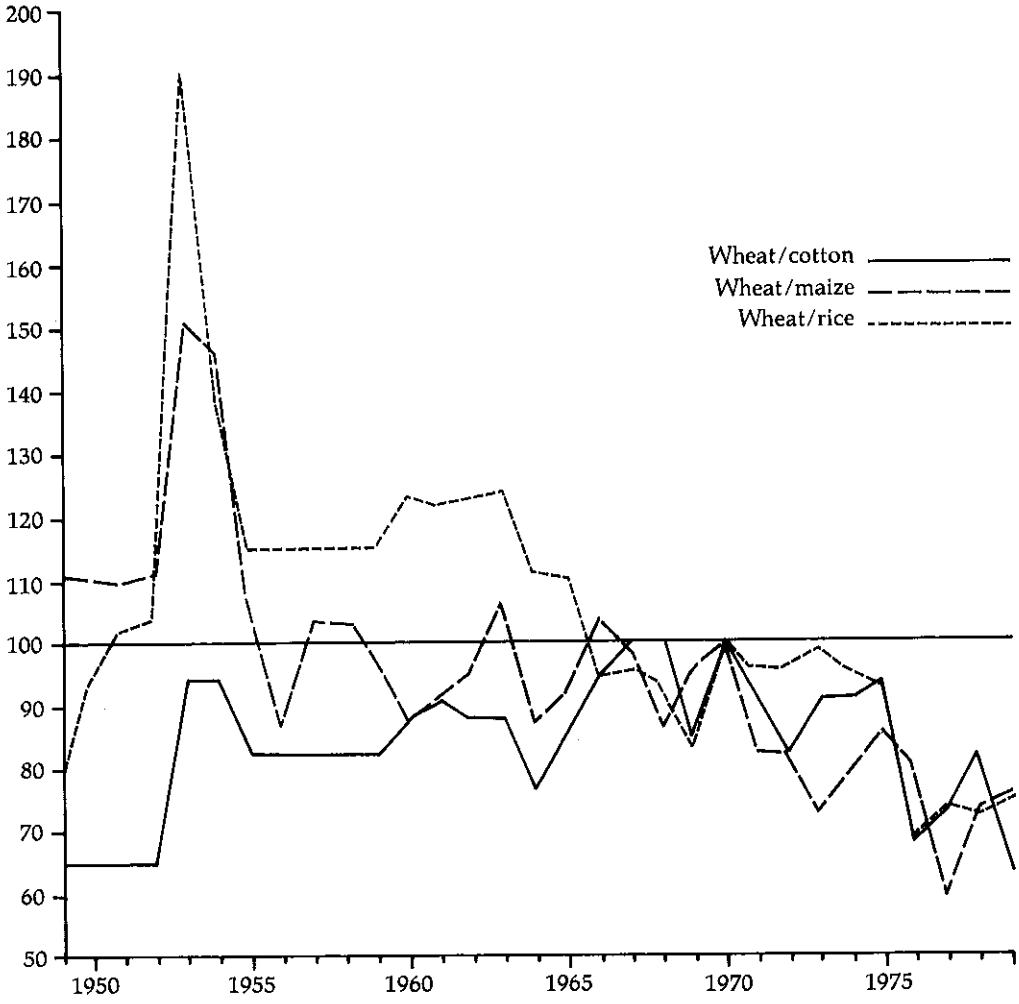


A substantial part of the rapid rise in wheat consumption during the 1970s reflects the marked fall in the real price to consumers as well as the growth in population and income. At the same time, the producer price of wheat also fell relative to livestock products and fruits and vegetables. In short, government pricing policies for wheat encouraged consumption and discouraged production. That Egyptian wheat imports rose rapidly should come as no surprise.

An alternative way to measure the domestic pricing policy is to express internal prices as deviations from the border price. These prices (converted to domestic currency at the official exchange rate) represent the opportunity cost of a tradable good such as wheat to Egypt. The deviations, expressed as either a subsidy or tax,[42] have varied substantially over the three decades (Figure 6). Examination of these subsidy and taxing patterns suggests that changes reflect choices

[42] The construction of the subsidies shown in Figure 6 is given in Table 16.

Figure 5 - Producer price of wheat relative to other crops, 1949-79

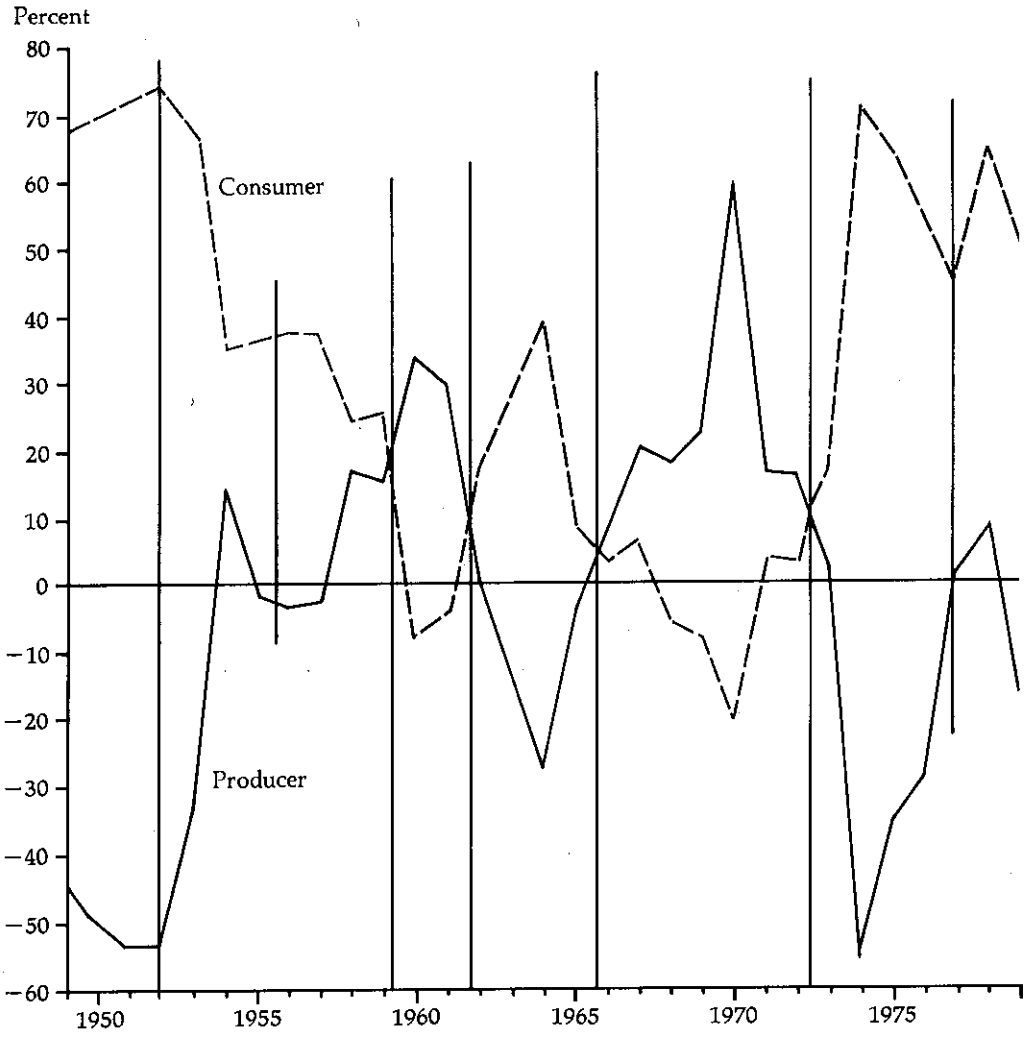


Note: 1970 = 100.

made by the government in response to changing external circumstances.[43] Following World War II, foreign exchange reserves were ample; consumer subsidies, implemented as a wartime measure, were kept high while producer prices were well below world levels. In 1952, after the takeover by the Organization of Free Officers, several policies were instituted to improve rural incomes. While land reform was the principal instrument, it is evident from Figure 6 that the tax on producers was rapidly eliminated.

[43] It should again be stressed that the relationship between internal and border prices is only one dimension of government policy. The calculation of the true net tax or subsidy would include such elements as compulsory delivery quotas, acreage restrictions, input subsidies, public investments in agricultural infrastructure, controls on land rent, expenditures on research and extension, and differential tax rates for rural incomes. Such a computation, if not impossible, lies outside the scope of this study. The following discussion is simply intended to develop some appreciation of the connection between one aspect of internal pricing policies and external events; nothing more is claimed. The reasonably high correlation between the nominal and effective levels of protection of Egyptian wheat production reported by Cuddihy lends some support to the use made here of direct comparisons with border prices. See W. Cuddihy, *Agricultural Price Management*, p. 92.

Figure 6 - Wheat subsidies and taxes, 1949-79



At the same time, with the collapse of the cotton market after the Korean War boom, the consumer subsidy was reduced in the light of the country's reduced capacity to import, especially from outside the sterling bloc. These trends were reinforced by the military incursion in Yemen and the Suez War of 1956, which were followed by strict exchange controls and the shift of trade toward barter with the Eastern bloc.

Following a poor cotton crop in 1962, credits of LE 20 million were received from the IMF and the Egyptian pound was devalued. Consumer subsidies were again raised and producer taxes increased. The effective rate of protection fell from +16 percent in 1961 to −10 percent in 1964.[44] However, as military expenditures rose, increasing pressure on the government and foreign accounts, the pattern of taxes and subsidies was

[44] Hansen and Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt*, p. 160.

reversed. Domestic production was encouraged relative to cotton, and the consumer subsidy was successively reduced. With the outbreak of the Arab-Israeli War in 1967, consumer subsidies were further reduced in an effort to discourage domestic consumption and to reduce the need for imports. This was especially important as foreign aid shipments from the United States had been discontinued. Simultaneously, the producer tax was reduced, a move consistent with the desire to reduce imports.

By the early 1970s conditions had changed again. Consumer subsidies rose as prospects for foreign exchange receipts improved and U.S. aid shipments were resumed, while domestic producers were taxed heavily in comparison to world prices. With the burgeoning subsidies, the fiscal costs became extremely high. The wheat and flour subsidy alone represented 30 percent of government revenues in 1974, the peak year, and was still 10 percent in 1978. Part of the rise in the cost of the subsidy was due to insulating domestic consumers from rises in the world price. It is important to note that the real price of wheat to consumers was consistently lowered during this period.

In addition to the high cost of subsidies, the efficiency losses implied by wide divergences between border and domestic prices of the principal agricultural commodities also caused concern. Under pressure from the IMF, the consumer subsidy was reduced somewhat. Following the food riots of January 1977, the consumer subsidy rose again. The IMF reduced the severity of its terms for additional credits, whereas debt rescheduling and other foreign aid eased the pressure on foreign exchange resources. The producer tax again increased in the late 1970s at a time when foreign exchange receipts grew rapidly, augmenting the capacity to import wheat.

Consumer prices have generally been below world prices except for severe setbacks to the foreign account in 1961 and 1962 and during the years of high military expenditures. As a result the rise in domestic wheat consumption has outstripped the relatively slow growth of domestic production, and imports have become increasingly important. In an economy where foreign exchange has been artificially cheap and rationed administratively, it is possible that the level of imports and hence the extent of the subsidy might reflect the country's capacity to import. A model of wheat imports that explicitly incorporates foreign exchange is developed in the next chapter.

5

TOWARD AN ANALYTICAL FRAMEWORK

> I wanted to tell them [the National Security Council] that we had reached the "zero stage" economically *(marhalat alsifr)* in every sense of the term. . . . I could not have paid a penny toward our debt installments falling due on January 1, 1974; nor could I have bought a grain of wheat in 1974. There would not have been bread for the people.
>
> President Anwar el-Sadat

A framework for the analysis of Egyptian wheat imports should reflect their increasing claim on foreign exchange supplies and hence their role in the balance-of-payments adjustment mechanism; the implicit tax on wheat producers and the explicit subsidy to domestic consumers; and the role of cotton as a competitor for productive resources and as a source of foreign exchange.

Traditionally, the empirical work on the measurement of import demand has been based on single equation models for either aggregate imports or broad categories. The principal arguments are typically relative prices and an activity variable such as output, income, or expenditures. Several other "ad hoc" variables have been used to explain shifts in the import demand function. However, the form of the function that is commonly used cannot generally be derived from any underlying model of economic behavior.

The elasticity of substitution approach draws on the theory of consumer demand to derive estimating equations for the relative quantity of goods from alternative sources as functions of relative prices. This implies, for example, that Canadian and U.S. wheat are imperfect substitutes on the Japanese market, a view formalized by Armington.[45] His approach allows for the demand for the i-th commodity from the j-th source to be one of a total of mn demand functions in which domestic and foreign goods (from various sources) are imperfect substitutes. The mn demand functions can be derived from the maximization of a utility function in the same manner as one derives the reduced-form demand equations from any preference mapping and a given budget constraint.

The Armington approach is the basis of the work by Grennes, Johnson, and Thursby on world wheat trade.[46] Konandreas, Bushnell, and Green[47] take what is essentially one equation from the mn set of wheat demand equations and estimate the demand by each of five regions for U.S. wheat. Their dependent variable is the quantity of wheat imported from the United States by the region. The price of U.S. wheat relative to domestic wheat is significant in only 5 out of 15 estimates reported. These results indicate some of the difficulties in obtaining meaningful price responses in markets for cereals that are essentially dominated by government trading monopolies.[48] In addition to the need to explicitly recognize the role of the government's domestic pricing policy, the importance of cereal imports in the total import expenditures of many countries suggests the need for a complete system of import demand equations.

Since the 1960s there has been increasing

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[45] P. S. Armington, "A Theory of Demand for Products Distinguished by Place of Production," *International Monetary Fund Staff Papers* 16 (March 1969): 159-178.

[46] T. J. Grennes, P. R. Johnson, and M. Thursby, *The Economics of the World Grain Trade* (New York: Praeger Publishers, 1977).

[47] Panos Konandreas, P. Bushnell, and R. Green, "Mixed Estimation of Import Demand Functions for U.S. Wheat," University of California, Davis, May 1977, Table I. (Mimeographed.)

[48] Further evidence of the limited capacity of single equation models to capture the forces determining wheat imports is found in Cathy L. Jabara, "Grain Imports by Middle-Income Countries: Economic and Political Factors Affecting Import Demand," paper presented to a seminar of the USDA-University Trade Research Consortium, Washington, D.C., June 1981.

attention paid to systems of consumer demand equations. A parallel and analogous development is the system of factor cost share equations used to express the reduced form of an input demand model derived from the theory of the firm.[49] Both approaches have been applied to models of import demand.[50] A country can be viewed as a "firm" acquiring imported and domestic inputs for use in generating national output. If it is further assumed that imported factors of production comprise a separable group, then the problem is reduced to selecting levels of imports to minimize the total cost of imported inputs. The reduced form of such a model is a set of import demand functions in prices and total expenditure or imports, the latter constituting the budget constraint.[51]

This study is concerned with the allocation of total import expenditures between wheat and other imports. The notion of a complete system of import demand equations is thus appealing. But to invoke the assumption of weak separability (either in production or utility) between imported and domestic wheats is unappealing. That the marginal rate of substitution between imported wheat and any other imported good might be independent of the quantity of domestic wheat seems implausible. For this reason other grounds must be sought on which to base a complete system of import demand functions. These lie in the administrative allocation of foreign exchange to classes of imports, which is characteristic of many LDCs.

The Foreign Exchange Constraint

The notion that a foreign exchange constraint may be a determinant of imports has been increasingly addressed, especially in the growing literature on food security. Sarris notes that in five major net wheat-importing countries (Brazil, Mexico, Egypt, Pakistan, and India) imports have varied much less than domestic output. "Whether this is due to lack of foreign exchange is not clear."[52] Valdés and Konandreas find that although the average food import bill in 24 LDCs was not a large drain on foreign exchange, it varied markedly and in unfavorable years was "intolerably high for several countries."[53] Siamwalla and Valdés suggest that "foreign exchange availability may be the most crucial factor determining whether or not a country can import enough food to stabilize food consumption."[54] Abbott argues that "importing countries that must allocate limited foreign exchange to payments for

[49] H. Theil, *The System-Wide Approach to Microeconomics* (Chicago, Ill.: University of Chicago Press, 1980).

[50] Among the first to apply these approaches were Barten (using the factor cost minimizing approach) and Gregory (using a CES function in a two-stage utility tree model). See A. P. Barten, "An Import Allocation Model for the Common Market," *Cahiers Economiques de Bruxelles* 50 (Second Trimester 1971): 153-164; and R. G. Gregory, "United States Imports and Internal Pressure of Demand: 1948-1968," *The American Economic Review* 61 (March 1971): 28-47. The cost minimization approach is followed in D. F. Burgess, "A Cost Minimization Approach to Import Demand Equations," *Review of Economics and Statistics* 55 (May 1974): 225-234; and D. F. Burgess, "Production Theory and the Derived Demand for Imports," *Journal of International Economics* 4 (1974): 103-117. A variant using input-output data is given by V. Sundararajan and S. Thakur, "Input-Output Approach to Import Demand Functions: Experiments with Korean Data," *International Monetary Fund Staff Papers* 23 (November 1978): 674-698. See also K. W. Clements and H. Theil, "A Simple Method of Estimating Price Elasticities in International Trade," *Economic Letters* 1 (1978): 133-137. The use of a complete demand system for modeling the import demand of grain is suggested by K. W. Clements, "Grain Import Demand Functions for Japan and the Common Market," University of Chicago, Chicago, Ill., September 1975 (mimeographed); and is further explored in K. W. Clements, "Demand System Models of International Trade in Grain," University of Chicago, Chicago, Ill., December 1975 (mimeographed). An application of a utility maximization to the derivation of import equations for India is found in I. Ali, "A Two-level Utility Function and a Stepped Supply Function in a General Equilibrium Model of Trade," *The Developing Economies* 8 (September 1980): 298-312. An ambitious approach in which five classes of goods from three sources (including domestic supplies) are distinguished for each of six countries in the European Economic Community is presented by R. Berner, "A General Equilibrium Model of International Discrimination" (Ph.D. thesis, University of Pennsylvania, 1976).

[51] The same result would follow if imports are viewed as final goods making up a weakly separable group in the utility function.

[52] Alexander H. Sarris, "Grain Imports and Food Security in an Unstable International Market," *Journal of Development Economics* 7 (November 1980): 490.

[53] Valdés and Konandreas, "Assessing Food Insecurity," p. 31.

[54] Ammar Siamwalla and Alberto Valdés, "Food Insecurity in Developing Countries," *Food Policy* 5 (November 1980): 265.

grain may be influenced by export receipts and foreign capital inflows . . . in making import decisions."[55]

The view that a shortage of foreign exchange constrains the rate of growth of developing economies has received wide attention.[56] In contrast, recent literature stimulated by the rise of oil and commodity prices in the 1970s has posited that current consumption of a particular commodity is constrained by the availability of foreign exchange.

To facilitate discussion of the foreign exchange constraint, suppose that a small, open economy produces tradable goods (importables and exportables) and nontraded goods. The prices of traded goods are determined in world markets. The prices of the nontraded goods are determined by their supply and demand in domestic markets. It is assumed that the sum of the excess demands in all markets is initially zero, so the economy is in both internal and external balance.[57]

Now assume a permanent shift in preferences toward the consumption of a traded good (say an importable). In the first instance, this will create excess demand for importables. Reserves of foreign exchange will fall, which will limit the capacity of the economy to acquire additional imports if the exchange rate is pegged in the short run. But this condition cannot persist. Relative prices must change (for example by a devaluation) until resources are reassigned so that although the consumption of importables has risen (relative to exportables and nontradables), external and internal balance is restored. It is clear that in the long run it is the productive capacity of the economy that limits its consumption of importables (or anything else), and not a foreign exchange constraint.[58]

If the economy is holding foreign exchange reserves, then it can acquire additional foreign goods in the current year. The real income loss due to a rise in world prices is transferred through time but not eliminated. If the price of foreign currency in terms of domestic currency is freely determined, then excess demand for foreign currency will raise its price and ration it between competing uses accordingly. In fact, most developing countries do not allow foreign exchange rates to float in this manner, and there are substantive reasons for such policies.[59] However, it is this adherence to fixed exchange rates that imparts some validity to the concept of a foreign exchange constraint.

Short-term adherence to fixed exchange rates can only be pursued through the use of foreign exchange reserves and access to accommodating flows of foreign capital. Excess demand for foreign exchange implies at least a temporary overvaluation of the domestic currency and the need for some form of nonprice rationing. The additional foreign exchange needed to maintain wheat consumption through expanded imports will not be forthcoming at a fixed exchange rate, as there will be no incentive to expand the export of other goods. If in the short run the price of foreign exchange is pegged and there are limited supplies from reserves and borrowing, then imports are constrained by the availability of foreign exchange. Wheat

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[55] Philip C. Abbott, "Modeling International Grain Trade with Government Controlled Markets," *American Journal of Agricultural Economics* 61 (February 1979): 31.

[56] The concept became a cornerstone of the Latin American structuralist school, and the notion of "two gaps" (foreign exchange and savings) has been incorporated in programming models of economic development. No attempt is made here to engage in this debate. The concept was concerned with economic growth. In contrast, recent literature has posited that current consumption of a particular commodity (food) is constrained by the availability of foreign exchange.

[57] Corden provides a useful statement of this type of "Australian" model. See W. Max Corden, *Inflation, Exchange Rates and the World Economy* (Chicago, Ill.: University of Chicago Press, 1977), Chapter 1.

[58] See in particular Padma Desai and Jagdish N. Bhagwati, "Three Alternative Concepts of Foreign Exchange Difficulties in Centrally Planned Economies," *Oxford Economic Papers* 31 (November 1979): 359-360; and C. Blitzer, P. Dasgupta, and J. Stiglitz, "Project Appraisal and Foreign Exchange Constraints," *Economic Journal* 91 (March 1981): 60.

[59] Theoretical work by Black and Fischer demonstrates the extent to which the variance in domestic consumption is reduced by pegged exchange rates when these are temporary fluctuations in domestic output. See S. W. Black, *Exchange Rate Policies for Less Developed Countries*, Essays in International Finance, No. 119 (Princeton, N.J.: Princeton University, December 1976), and S. Fischer, "Stability and Exchange Rate Systems in a Monetarist Model of the Balance of Payments," in *The Political Economy of Monetary Reform*, ed. R. Z. Aliber (Montclair, N.J.: Allanhead, Asmar and Co., 1977), pp. 61-62.

imports must compete with other imports and with adjustments to reserve holdings for the limited supplies of foreign exchange.

In the longer term any tendency to adhere to overvalued exchange rates will require an administrative mechanism to allocate scarce foreign exchange. A persistent foreign exchange constraint results from continued undervaluing of foreign currency by the central bank.

However, if the central bank is pegging the price of foreign exchange below its market clearing level, then it must either meet the excess demand from reserves or use some nonprice rationing mechanism. If capital inflows or export receipts fall, the bank in the short run must either draw down reserve holdings or tighten import restrictions (for example, through higher tariffs, import quotas, advance deposits) so that the effective demand for foreign exchange at the subsidized price is reduced. Hence, the notion of a foreign exchange constraint leads to a consideration of the balance-of-payments adjustment mechanism and the reserve holding policy of the central bank. Questions such as the following arise. What is the desired level of foreign exchange reserves? How quickly does the central bank act to restore reserve holdings, that is, to close the gap between desired and actual reserves? How do the imports of food and nonfood respond to a change in foreign exchange supplies? What is the importance of maintaining imports at desired levels as contrasted with restoring reserve holdings?

If the central bank subsidizes the sale of foreign currency, it may meet a temporary fall in exchange receipts by drawing down reserves below some desired long-run level. But if it wishes to restore the level of reserves later, exchange receipts will have to be allocated to reserves as well as imports. Consequently, while exchange receipts correspond to a budget constraint facing imports, fluctuations in the level of reserves make total import expenditures an endogenous variable. There is no direct and immediate relation between the flow of export receipts and the level of imports. The length and stability of the lags between them depend on the kind of policies used to achieve external balance. The relation between imports and foreign exchange is in fact part of the balance-of-payments adjustment. In many LDCs, restrictions on imports are used as principal tools to achieve external balance, given a persistently overvalued domestic currency. This certainly has been a characteristic of Egyptian economic policy.[60] The allocation of the foreign exchange budget between classes of imports and reserve holdings is a central pillar of the econometric model developed in Chapter 6.

The implications of foreign exchange budgeting for import demand functions are summarized by Behrman and Hanson:

> Quantitative restrictions are frequently used to maintain a disequilibrium system with overvalued exchange rates and excess demand for foreign exchange. Disequilibrium is allowed to persist because of the perceived negative distribution, inflationary, and political effects of devaluation, and widespread convictions about the inadequacy of allocation by prices. The existence of strong vested interests in the disequilibrium system (e.g., owners of factors in import substitution subsections, the recipients of import licenses or the government bureaucracy) also helps to perpetuate these systems. To satisfy what appears to be substantial excess demand perpetuated in part by the restrictions themselves, controls are generally relaxed when foreign exchange becomes available from export booms or increased capital inflows. The import functions need to be modified, therefore, not only to include the above mentioned policy tools and foreign prices but also the availability of foreign exchange in a system of disequilibrium exchange control.[61]

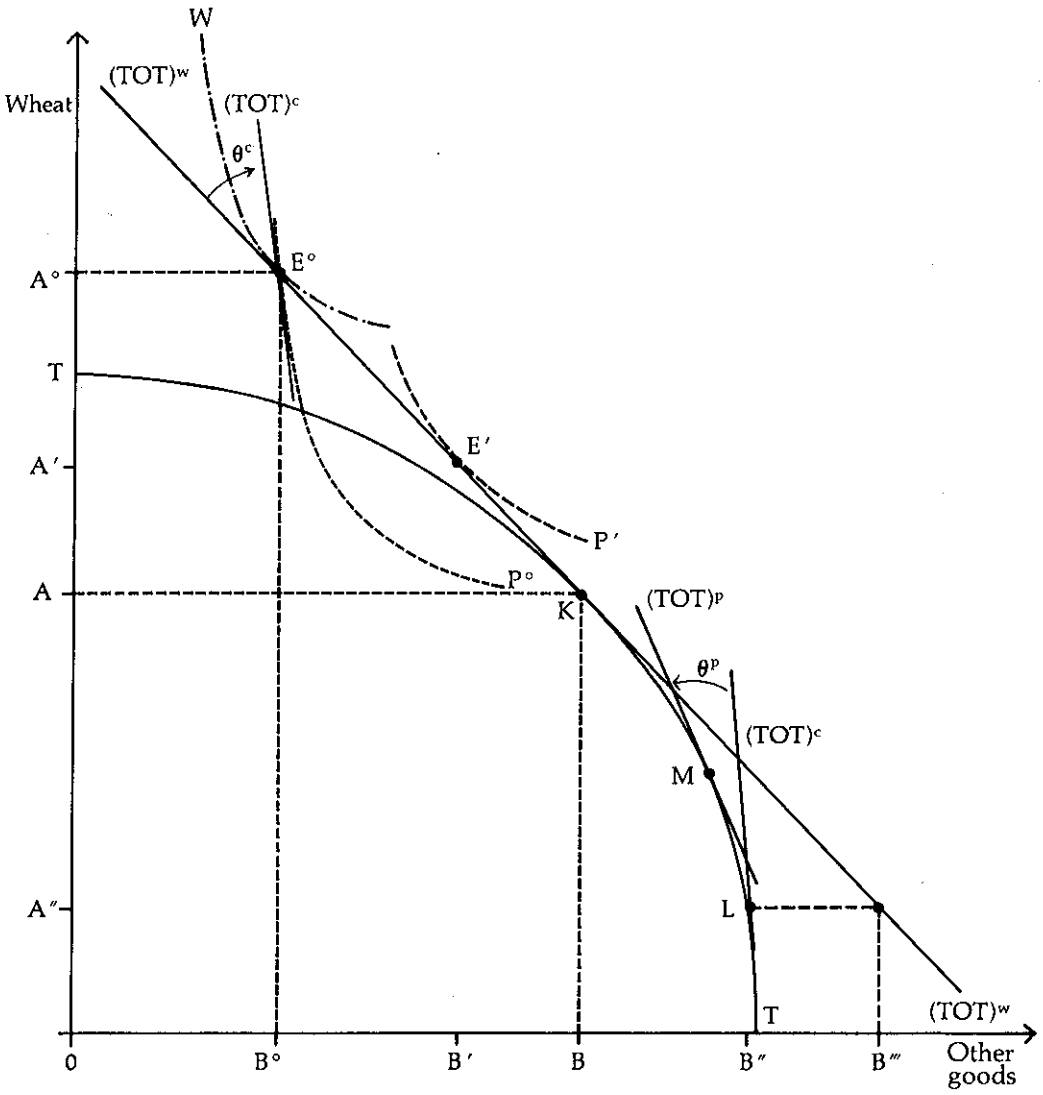
Egyptian Wheat Policy

Figure 7 illustrates the principal elements of Egyptian wheat policy. Wheat and other

[60] See Hansen and Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt*, especially Chapter 5; and the appendix by K. Nashashibi, "Foreign Trade and Economic Development in the UAR: A Case Study," to *Trade Patterns in the Middle East*, by L. Preston (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1970), pp. 73-93.

[61] J. Behrman and J. A. Hanson, "The Use of Econometric Models in Developing Countries," in *Short-Term Macroeconomic Policy in Latin America*, the National Bureau of Economic Research Other Conference Series No. 14, ed. J. Behrman and J. A. Hanson (Cambridge, Mass: Ballinger Publishing Co., 1979), p. 20.

Figure 7 - Production and trade of wheat and other goods with government intervention



traded goods are assumed to constitute the importable and exportable goods for the economy. It is legitimate to treat all other traded goods as an aggregate provided their relative prices are fixed. This is consistent with the small-country assumption made throughout this study. In an unfettered world, domestic output and consumption would be guided by the world price ratio $(TOT)^W$, resulting in production at point K of OB of other goods and OA of wheat. Point K is located on the production possibility frontier, TT. Given the opportunity to trade, individuals would choose combination E', on the private indifference curve P'. Wheat imports (AA') would be acquired at $(TOT)^W$ by the export of other goods (BB'). Total wheat consumption would be OA', comprised of OA units of domestic production plus AA' units of imported wheat.

Now consider the social preference function W, which is distinct from the private or

market demand curve for wheat (see Appendix 1).[62] Assuming for the moment that domestic resource allocation is unchanged, wheat imports will rise from AA′ to AA^0, purchased at $(TOT)^W$ by releasing a quantity B^0B' of the other good. The government is constrained by $(TOT)^W$; but it is also constrained by the private demand curves as reflected in the private preference structure P^0, P′. So to augment wheat consumption to the socially desirable level of OA^0 will involve a change in the price of wheat relative to the other good. In fact, the consumption point E^0 will be attainable only if the domestic terms of trade facing consumers are altered to $(TOT)^C$ by a subsidy to wheat, thereby lowering its relative price to consumers. The extent of the government intervention is conveniently captured by the angle θ^C, which can be viewed as a wedge driven between the world and the consumer prices. The level of wheat imports will be determined in part by the size of that intervention.

Figure 7 allows us to explore further the implications of this change in the relative prices of wheat and other goods. At $(TOT)^W$ domestic resources are allocated so as to produce at point K on the production frontier. But if domestic producers are to face the relative prices given by $(TOT)^C$, then resources will be shifted out of wheat production and into the production of other goods. The sale of subsidized imported wheat by the government will tend to depress the relative price facing domestic producers and output will fall to OA″ (point L on the production frontier). But with the levels of output of wheat and other goods given by point L, consumption at E^0 is no longer feasible. Additional exports of B″B‴ will be needed. There will be an excess demand for foreign exchange, which is typically met by a combination of food aid, a decline in net foreign assets, and, importantly, in the administrative allocation of the scarce foreign exchange to various classes of imports. In addition, some of the adjustment comes through the use of a dual price system. The government drives a further wedge in the domestic pricing by offering producers the price implied by $(TOT)^P$. Production now moves to point M, alleviating but not eliminating the external imbalance caused by the subsidy to domestic consumers.

In reviewing government price policies, Amin provides some justification for the view that the producer wedge is an offset to the consumer price wedge. "Government control of prices which started during the war for most important foodstuffs: wheat, maize, rice and sugar, and more recently for practically all other foodstuffs, and strict control measures are now practiced by the police. The fixing of prices by the government has been done mainly in the interest of consumers and only occasionally were the prices of wheat and rice raised to encourage greater production."[63]

In summary, Egyptian wheat policy involves two key interventions by the government. From Figure 7[64] these are:

Consumer Subsidy: $$\theta^C = (TOT)^W - (TOT)^C, \quad (1)$$

Domestic Wheat Wedge: $$\theta^P = (TOT)^C - (TOT)^P. \quad (2)$$

The magnitude of the wedges will determine the level of wheat imports. It is through them that the effect of the government's domestic consumer and producer policies are captured (Appendix 2).[65] As a consequence of these wedges, there is an excess demand for foreign exchange at a fixed exchange rate. To the extent that the government then implements an import quota scheme through foreign exchange budgeting it is to be expected that the size of the wedges will themselves be partly determined by the country's external balance.

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[62] The relation between the private and social demand for wheat is discussed in Appendix 1.

[63] G. A. Amin, *Food Supply and Economic Development with Special Reference to Egypt* (London: Frank Cass and Co., Ltd., 1966), p. 117.

[64] Although the discussion of Figure 7 did not explicitly refer to the pricing of cotton, the setting of the relative prices facing producers $(TOT)^P$ clearly involved both the wheat and cotton prices. Further, no explicit attention was paid to input subsidies. Imports of wheat and cotton can be incorporated by viewing the terms of trade facing producers as the net of all government interventions.

[65] The manner in which government policies are incorporated in existing models of import demand is reviewed in Appendix 2.

Consider a decline in the command over foreign goods and services brought about by an exogenous fall in foreign exchange receipts. A number of mechanisms may operate to restore external balance. These include devaluation, the use of multiple exchange rates, short-term borrowings, declines in reserve holdings, and cuts in imports. Changes in the level of domestic prices (that is, the two wheat price wedges) will alter the level of wheat imports. In short, the government's intervention in the wheat market is both a determinant of, and is influenced by, the external account.

6

AN ECONOMETRIC MODEL

> There is a wealth of statistical material on the Egyptian economy, but little is usable without much processing and elaboration.
>
> Robert Mabro
> *The Egyptian Economy: 1952-1972*

The econometric model of wheat imports for Egypt explicitly recognizes three features: first, decisions about the level of wheat and other imports are part of the balance-of-payments adjustment mechanism; second, wheat imports reflect domestic pricing policies, which are influenced by the external account; and finally, cotton pricing policy is an integral element because cotton both competes for domestic resources and is a source of foreign exchange.

Consider the fundamental accounting identity,

$$F \equiv M + \Delta R, \qquad (3)$$

which states that the total sources of foreign exchange (F) are identical to its uses: import expenditures (M) and changes in reserve holdings (ΔR). This identity is the basis of the model.[66] Imports will be separated into wheat and "other," both imported at given world prices. Thus,

$$F \equiv P_w M_w + P_n M_n + \Delta R. \qquad (4)$$

Foreign exchange receipts are taken as exogenously determined. However, it is not uncommon for importables and exportables to compete in production (and possibly consumption).[67] This raises the possibility that some part of the foreign exchange earnings may be responsive to domestic policies concerning the production and consumption of the importable. Such is the case with cotton in Egypt.[68]

In Egypt wheat is grown in competition with cotton in a relatively complex crop rotation. This arises because continuous cropping is possible, but the use of a nitrogen-fixing legume (berseem) is required before growing cotton. The extent to which this berseem-cotton rotation is "required" would depend on the relative prices of cotton, artificial nitrogen, and animal fodder. In both lower and upper Egypt, the sowing of cotton (a summer crop) precedes the harvest of wheat (a winter crop) by one or two months. In addition, the extensive use of ceilings on cotton area to encourage wheat output (see Chapter 3) is further evidence of the short-run substitution possibilities between wheat and cotton.[69] Wheat is a major item of total import expenditures

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[66] There is a strong analogy with the identity that income is equal to consumption plus saving.

[67] Such settings arise in a number of African countries: cotton and wheat in the Sudan, cotton and maize in Tanzania, and peanuts and cereals in Senegal. For a discussion of the latter see Cathy L. Jabara and Robert L. Thompson, "Agricultural Comparative Advantage Under International Price Uncertainty: The Case of Senegal," *American Journal of Agricultural Economics* 62 (May 1980): 188-198.

[68] The trade-off between generating more foreign exchange through cotton to be used to import the additional wheat needed to compensate for the decline in domestic output has long been a central element of the debate on agricultural price in Egypt. See Bent Hansen, *Cotton versus Grain: On the Optimal Allocation of Agricultural Land,* Memo No. 275 (Cairo: Institute of National Planning, April 1963). A U.S. Senate team reported that "As long as present market conditions prevail it will be advantageous for Egypt to pursue its plan to produce high quality long-staple cotton and premium quality rice for export on the land most suitable for these purposes and use the foreign exchange obtained in this way to import wheat and maize." U.S. Senate, Committee on the Judiciary, Subcommittee on Refugees and Escapees, *World Hunger, Health, and Refugee Problems: Summary of Special Study Mission to Asia and the Middle East: Arab Republic of Egypt* (Washington, D.C.: U.S. Government Printing Office, 1977), pp. 15-16.

[69] More details of Egypt's cropping patterns may be found in U.S. Department of Agriculture, Foreign Agricultural Service, *Egypt: Major Constraints to Increasing Agricultural Productivity,* Foreign Agricultural Economics Report No. 120 (Washington, D.C.: USDA, 1976); Hansen and Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt,* especially in Chapter 6; and H. A. El-Tobgy, *Contemporary Egyptian Agriculture,* 2nd ed. (Cairo: Ford Foundation, 1976).

and cotton an important source of foreign exchange. However, if the Egyptian government were to lower the domestic price of wheat as part of its cereal consumption policy, producers would switch some land to cotton, augmenting exports. In setting internal prices, the government can be expected to consider not only the allocation of foreign exchange to imports and adjustments in reserve holdings, but also the flow of export receipts from cotton. These receipts would then become part of the balance-of-payments adjustment process, which is integrally related to domestic wheat policy. As a consequence, cotton export receipts (E) are taken as an endogenous component of total foreign exchange earnings.

Another part of total exchange receipts is also viewed as endogenous. These are the foreign exchange receipts (registered in the form of a capital inflow) that correspond to the import of wheat under foreign aid agreements. In the absence of detailed information it will be assumed that all wheat imported as aid is accompanied by a corresponding entry for a capital inflow in the balance-of-payments accounts. It is recognized that this will overstate the contribution of aid wheat. Equation (4) is rewritten as:

$$FEA + E + A \equiv P_w M_w + P_n M_n + R_t - R_{t-1}, \quad (5)$$

where earnings other than cotton (E) and the value of aid wheat (A) are denoted by FEA and taken to be exogenously determined together with world prices (P_w and P_n) and opening reserves (R_{t-1}). This leaves five endogenous variables: E, A, M_w, M_n, and R_t. However, because of the adding up implied by equation (5), it is only necessary to have equations for any four. The first four are chosen.

If, instead of estimating M_n, one were to estimate total import expenditures (M) together with M_w (and E and A), then one could still find M_n from the fact that $M = M_w P_w + M_n P_n$. It is this approach that is followed. Total import expenditures (M), the quantity of wheat imports (M_w), the value of wheat aid (A), and cotton exchange earnings (E) are estimated. These constitute three blocks of equations, each of which is now discussed in turn. In addition, the appropriate econometric specification of the foreign exchange constraint is discussed in Appendix 3.

Balance-of-Payments Adjustment Block

As described by Hemphill,[70] the following structural equations are specified. They relate to the allocation of exchange receipts to aggregate imports (M) and changes in reserves (ΔR). The foreign exchange authority is seen to have two generally conflicting goals. The first is to maintain actual imports (M) at their long-run expected level (M^*), so as not to disrupt domestic production through shortages of raw materials or to lessen future productive capacity through reduced imports of capital goods. Second, the authority endeavors to restore reserves to their desired level R^*, implying that $\Delta R_t^* = R_t^* - R_{t-1}$. In general, there is no presumption that the actual level of receipts (F) will not allow both these goals to be achieved simultaneously. Hemphill derives the following allocation function.[71]

$$\Delta R_t/(F_t - M_t^*) = (1 - \lambda_1) + \lambda_1 [(R_t^* - R_{t-1})/(F_t - M_t^*)], \quad (6)$$

where $0 \leq \lambda_1 \leq 1$. This is a linear function relating actual (ΔR_t) to desired changes in reserve holdings ($R_t^* - R_{t-1}$). The reserve holding goal would be satisfied along the locus of points described by a 45 degree line, where $\lambda_1 = 1$. If the central bank places emphasis on maintaining reserves at the desired level while allowing imports to fluctuate, then λ_1 would tend to unity. Along the locus of points where the dependent variable of equation (6) is unity, then actual imports (M_t) are equal to desired imports (M_t^*); hence a value of λ_1 equal to 0 reflects a policy that emphasizes the stability of import

[70] W. H. Hemphill, "The Effects of Foreign Exchange Receipts on Imports of Less Developed Countries," *International Monetary Fund Staff Papers* 21 (November 1974): 637-677.

[71] Ibid., pp. 675-677.

expenditures at the expense of reserves.[72]

To equation (6) must be added additional structural equations for the three expected variables: M^*, F^*, and R^*. These are given by:

$$M_t^* = F_t^*, \quad (7)$$

$$F_t^* = F_t - \lambda_2 (\Delta F_t), \text{ and} \quad (8)$$

$$R_t^* = \lambda_3 + \lambda_4 (F_t^*). \quad (9)$$

Equation (7) simply represents the assumption that in the long term there is no net reserve accumulation. Equation (8) describes expected foreign exchange receipts as being equal to current receipts plus a response to the change over the last year. If this is expected to be a permanent increase, λ_2 would be negative. If it is regarded as a totally transitory phenomenon, λ_2 would be positive. Finally, desired reserves, equation (9), are seen to be a simple linear function of expected receipts. The coefficient λ_4 should be positive under either a simple transactions demand theory, or alternatively (as Hemphill suggests) if the authorities believe that the variance and magnitude of expected receipts are positively correlated.

Because of the changing mix of Egyptian export receipts due to the declining importance of cotton, it was felt that the variability of expected receipts may have actually declined. In this case desired reserve holdings may have been reduced. This corresponds to a "disturbance view" of reserve holdings, in which the demand for reserves depends on the level of deviations of actual from expected receipts.[73]

In order to test this hypothesis, an alternative version of equation (9) was postulated in which an additional term ($\lambda_5 \sigma_{F^*}$) appeared. The variable σ_{F^*} was defined as the standard deviation of the differences between actual and expected receipts. Expected receipts were generated from equation (8) using a first-round estimate of λ_2 after a time series of σ_{F^*} was constructed by using the variability around three-year moving averages. The estimate of λ_5 was not statistically different from 0. Because of the potentially unsatisfactory nature of the proxy variable used for disturbances, it would be premature to infer from this result that Egyptian reserve holdings have not been affected by changes in the perceived variability of receipts. However, the results were such that the simple transactions view implied by equation (9) was maintained.[74]

Hemphill[75] has shown that equation (6) yields a reduced form equation for import expenditures, which is linear in the variables R_{t-1}, F_t, and ΔF_t. It is this equation that is estimated as part of the structure of the present model. The values of the λ_i can be calculated from the estimated coefficients, as this substructure is exactly identified. The equation describing total import expenditures is then:

$$M = M(C, DW2, R\_1, F, \Delta F, \varepsilon_1). \quad (10)$$

The letters C and ε_1 are used throughout to indicate the presence of an intercept and a stochastic term. The notation X_1 is used to indicate the value of any variable, X, lagged by one period. The prefix Δ (delta) indicates the change in the variable; that is, $\Delta X = X_t - X_{t-1}$. F and ΔF refer to total foreign exchange receipts and their change from the previous period. Given the assumption that the desired levels of long-run import expenditures and exchange receipts are equated [equation (7)], it is to be expected that the coefficient of F would not differ significantly from unity. The variables DW

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[72] Ibid., p. 651. Hemphill shows that equation (6) can be derived from the minimization of a quadratic cost function whose arguments are deviations of actual imports and reserves from their desired levels. This function is given as

$$C = \alpha + \beta_1 (M_t - M_t^*)^2 + \beta_2 (R_t - R_t^*)^2,$$

where, $\lambda_1/(1 - \lambda_1) = \beta_2/\beta_1$.

[73] These issues are examined in F. S. Hipple, *The Disturbances Approach to the Demand for International Reserves*, Princeton Studies in International Finance No. 35 (Princeton, N.J.: Princeton University, 1974).

[74] In a single equation model of Egyptian reserve holdings, Otchere finds that greater variability of export receipts induces significantly lower levels of reserves. See D. K. Otchere, "An Adjustment Model of Reserve Holding Behavior: The Developing Countries," *The Developing Economies* 13 (September 1975): 280-301.

[75] Hemphill, "Foreign Exchange Receipts."

(followed by a numeral) refer to dummy variables for the periods of military conflict between Egypt and Israel.[76]

Wheat Import Block

In order to determine wheat imports, a series of estimating equations is used to describe domestic disappearance and production, foreign aid, and the formation of prices. The latter involves equations for the two wheat price wedges, θ^C and θ^P [see equations (1) and (2)].

The second structural equation of the model describes total domestic wheat demand, which is postulated to depend on real per capita income (INCAP) and the real consumer price of wheat (PCC). Thus,

$$QD = QD(C, INCAP, PCC, \varepsilon_2). \quad (11)$$

An equation is included to explain the level of aid shipments of wheat (AIDC):

$$AIDC = AIDC(C, PWC, DQC, DW4, DA1, DS1, \varepsilon_3). \quad (12)$$

The principal explanatory variable is the world wheat price (PWC). Concessionary shipments are expected to be lower when the world price of wheat is higher. In addition, foreign aid may be granted in part to offset shortfalls in domestic output. For this reason, a variable measuring the deviation of current wheat output around its trend value (DQC) is included. The variable DA1 is a dummy used to capture the effect of the early years of the series when no aid flows were observed, while DS1 is intended to capture the effect of the Suez War.

In an attempt to explain the flow of U.S. food aid between 1961 and 1975, Hopkins[77] uses a regression model in which the U.S. wheat prices, total wheat stocks held by the Commodity Credit Corporation, and deviations from trend grain production in recipient countries are the explanatory variables. This equation explained 82 percent of the variance in U.S. food aid shipments and all variables were significant. Higher prices reduced aid shipments ("selfishness") and deviations below trend output in recipient countries raised shipments ("altruism"). However, Hopkins' attempts to apply this model to the specific case of Egypt were not as fruitful, one suspects, because the model does not capture the political volatility of U.S. aid to Egypt.

The importance of political forces as a determinant of food aid to Egypt is discussed by Merriam.[78] He cites a U.S. Senate report: "Since Egypt is heavily dependent on food importations, and the nutritional situation is already a marginal one, any failure in food imports for whatever reason would have disastrous human and political consequences. The survival of Egypt as a stable, independent nation depends on its being able to secure relatively large amounts of grain and other food it needs from foreign sources."[79]

The first of the wedges in the wheat pricing is the consumer price subsidy (θ^C), denoted here as INV and defined as the difference between the world price and the consumer price. The world price is converted at the official exchange rate used for wheat imports expressed in real terms. That is,

$$\theta^C \equiv INV \equiv (PWC \cdot RXRL) - PCC. \quad (13)$$

It is evident that if this equation is divided through by the world price, the intervention or wedge is simply measured as the difference between the nominal exchange rate and the implicit rate for wheat. RXRL, the real exchange rate (in pounds per dollar), is the official rate deflated by the ratio of the domestic price index to an international one;

[76] A dummy variable for a period of military buildup and hostilities is used in a number of equations. The exact specification is given in Table 7.

[77] See R. F. Hopkins, "Food Aid: The Political Economy of International Policy Formulation," Swarthmore College, Swarthmore, Pa., October 1980, pp. 133, 452. (Mimeographed.)

[78] J. G. Merriam, "U.S. Wheat to Egypt: The Use of an Agricultural Commodity as a Foreign Policy Tool" in *The Role of U.S. Agriculture in Foreign Policy*, ed. R. M. Fraenkel, D. F. Hadwiger, and W. P. Browne (New York: Praeger Publishers, 1979), pp. 90-106.

[79] U.S. Senate, Committee on the Judiciary, Subcommittee on Refugees and Escapees, *World Hunger, Health, and Refugee Problems*, cited in Merriam, "U.S. Wheat to Egypt" p. 100.

that is, a purchasing power parity rate. Let the suffix U indicate undeflated (or nominal) prices. Then the real value of the transfer to Egyptian consumers of the import subsidy is:

$$INV \equiv [(PWCU \cdot \pi) - PCCU] \cdot (1/CPI),$$

where π is the nominal price of Egyptian pounds per U.S. dollar and CPI is an index of domestic prices. Let DEF be a deflator of world prices and write:

$$INV \equiv (PWCU/DEF) \cdot \pi(DEF/CPI) - (PCCU/CPI),$$

which is simply equation (13). Alternatively, the wedge can be perceived as a multiple exchange rate system as evidenced by

$$INV/PWCU = [\pi - (PCCU/PWCU)] \cdot (1/CPI).$$

The extent of intervention (INV) is expected to be positively related to the government's capacity to import (IMC), as measured by receipts of foreign exchange (F) plus opening reserves of foreign exchange (R_1).

An alternative view is that the relevant budget constraint on the size of the intervention (and hence the import subsidy) is the government account rather than the foreign account. Linneman et al. limit the size of the price wedge so that the implied subsidy is less than 3 percent of nonagricultural GDP.[80] In the present study this relation is not imposed. In fact, given a government's ability to expand the monetary basis to cover the fiscal deficit and hence pay for the subsidies through an inflationary tax, it seems probable that its capacity to acquire foreign goods, rather than its ability to finance internal deficits, would constrain imports.

The higher the world price of wheat, the greater must be the intervention to maintain a given level of domestic consumption. Hence, to the extent that the government deliberately intervenes to insulate consumers from movement in world prices, it is expected that PWC will be positively related to the level of intervention, where

$$INV = INV(C, PWC, DW6, IMC, \varepsilon_4). \quad (14)$$

The second wedge in wheat pricing (θ^p) defines the difference between the prices facing producers (PPC) and consumers (PCC). It is denoted DOMW and given by

$$\theta^p \equiv DOMW \equiv PPC - PCC. \quad (15)$$

Only if changes in the world price (PWC) were transmitted equally to both domestic prices would this wedge be invariant to PWC. As this is not expected to be the case, PWC is included as an explanatory variable. More rapid domestic food price inflation is expected to stimulate a higher producer price, and so increase the wedge. Conversely, with greater shipments of aid wheat, the producer price is expected to be lower, reducing the wedge. As the country's capacity to import rises, the price to consumers is lowered, thus increasing the size of the domestic price wedge, as shown by:

$$DOMW = DOMW(C, PWC, DFPI\_1, DW6, IMC, AIDC, \varepsilon_5). \quad (16)$$

The area sown to wheat (AC) is assumed to depend on the producer price of wheat (PPC), the lagged cotton price (PPE_1), and the import capacity variable (IMC). The latter is included as a proxy for the multitude of policy instruments (other than producer price) that are used to influence output. With a lower capacity to import, there are likely to be greater subsidies on inputs, more credit, and fewer quantitative restrictions—all aimed at stimulating import substitution in wheat. For simplicity, wheat yields are treated as exogenous.[81] Whereas an index of weather conditions frequently appears as a shifter in agricultural output functions, the universal use of irrigation in Egypt largely insulates production from seasonal conditions, although pest damage does vary by season. Hence,

[80] Hans Linneman, Jerrie De Hoogh, Michiel A. Keyzer, and Henk D. J. Van Heemst, *MOIRA: Model of International Relations in Agriculture* (Amsterdam: North Holland Publishing Co., 1979), p. 184.

[81] For evidence on the own- and cross-price elasticities of wheat yields, see Cuddihy, *Agricultural Price Management*, p. 40.

AC= AC(C, DW6, PPE_1, PPC, IMC, ε_6). (17)

Cotton Export Block

The two endogenous variables that determine foreign exchange earnings from cotton are taken to be the cotton export tax and the area sown. The tax is simply a wedge between the world price (PWE) and the price paid to producers (PPE). This intervention is denoted INVE, and defined as

$$INVE \equiv (PWE \cdot RXRL) - PPE. \quad (18)$$

Again, if this equation is divided by the world price (undeflated), then the intervention is seen as the difference between the nominal exchange rate and the implicit rate for cotton exports. If the transmission of changes in the world price to the producer price is not complete, then this wedge will vary with the world price (PWE). A rise in the world wheat price would be expected to result in a lower price of cotton to producers. This suggests that the implicit value of a unit of foreign exchange saved through import substitution in wheat exceeds the value of a unit earned by cotton exports. Such a conclusion is consistent with the long-standing policy of heavily taxing the export crops (cotton and rice) relative to the import-competing crops (wheat and maize) discussed in Chapter 4.

$$INVE = INVE(C, PWE, PWC, IMC, \varepsilon_7). \quad (19)$$

For a given world cotton price, INVE determines the producer price, which in turn influences (with a lag) the area sown to cotton (AE). This area also depends on the producer price of wheat, the (lagged) import capacity, and a time trend. Therefore,

AE= AE(C, DW6, T, PPE_1,

IMC_1, PPC, ε_8). (20)

In addition to the eight stochastic equations, the structure includes 15 identities. The complete structure is given in Table 5, and the endogenous and exogenous variables are defined in Tables 6 and 7, respectively.

Table 5—Summary of the structural equations

Endogenous Variable	Equation or Identity
Balance-of-payments adjustment block	
Total import expenditures	M = M (C, DW2, R_1, F, ΔF, ε_1) [equation (10)]
Wheat import block	
Total wheat disappearance	QD = QD (C, INCAP, PCC, ε_2) [equation (11)]
Foreign wheat aid	AIDC = AIDC (C, PWC, DQC, DW4, DA1, DS1, ε_3) [equation (12)]
Consumer wheat subsidy (θ^c)	INV = INV (C, PWC, DW6, IMC, ε_4) [equation (14)]
Domestic wheat wedge (θ^p)	DOMW = DOMW (C, PWC, DFPI_1, DW6, IMC, AIDC, ε_5) [equation (16)]
Area of wheat	AC = AC (C, DW6, PPE_1, PPC, IMC, ε_6) [equation (17)]
Cotton export block	
Cotton export tax	INVE = INVE (C, PWC, PWE, IMC, ε_7) [equation (19)]
Area of cotton	AE = AE (C, DW6, T, PPE_1, IMC_1, PPC, ε_8) [equation (20)]
Identities	
Balance of payments	R ≡ R_1 + F − M
Foreign exchange receipts	F ≡ FEA + E + A
Change in foreign exchange receipts	ΔF ≡ F − F_1
Cotton export receipts	E ≡ (XE · PWE)/1,000
Cotton exports	XE ≡ QE − DE
Cotton production	QE ≡ AE · YE
Wheat production	QC ≡ AC · YC
Nonwheat import expenditures	MN ≡ M − (MC · PWC)/1,000
Commercial wheat imports	MCC ≡ MC − AIDC
Foreign exchange value of wheat aid	A ≡ (AIDC · PWC)/1,000
Import capacity	IMC ≡ R_1 + F
Consumer price of wheat	PCC ≡ PWC · RXRL − INV
Total wheat imports	MC ≡ QD − QC
Producer price of wheat	PPC ≡ DOMW + PCC
Producer price of cotton	PPE ≡ PWE · RXRL − INVE

Table 6—Means, standard deviations, and descriptions of the endogenous variables

Name	Unit	Mean	Standard Deviation	Description
M	U.S. $ million	2,220.28	1,056.87	Total import expenditures, deflated.
QD	1,000 metric tons	2,886.55	1,242.49	Total wheat disappearance.
AIDC	1,000 metric tons	504.06	539.15	Foreign aid shipments of wheat.
INV	LE per ton	21.65	23.15	Government intervention as measured by the difference between world and consumer prices of wheat.
DOMW	LE per ton	14.47	6.68	Difference between producer and consumer prices for wheat.
INVE	LE per ton	612.24	182.53	Difference between world and producer prices of cotton.
AC	1,000 hectares	588.23	60.23	Area sown with wheat.
AE	1,000 hectares	690.55	98.48	Area sown with cotton.
R	U.S. $ million	1,031.83	657.15	Foreign exchange reserves, deflated.
F	U.S. $ million	2,198.83	1,079.61	Total foreign exchange receipts, deflated.
DF	U.S. $ million	93.54	345.07	Change in foreign exchange receipts from previous year, deflated.
E	U.S. $ million	668.26	191.80	Export receipts from cotton, deflated.
XE	1,000 metric tons	270.87	64.87	Quantity of cotton exports.
QE	1,000 metric tons	432.26	63.03	Quantity of cotton production.
QC	1,000 metric tons	1,532.68	256.45	Domestic wheat production.
MN	U.S. $ million	2,002.19	926.48	Nonwheat import expenditures, deflated.
MCC	1,000 metric tons	853.65	688.91	Commercial wheat imports (mean such that MCC $\geq$ 0)
A	U.S. $ million	76.17	82.91	Foreign exchange value of wheat aid.
IMC	U.S. $ million	3,186.49	1,178.10	Import capacity, deflated.
PCC	LE per ton	33.30	8.04	Consumer price of wheat, deflated.
MC	1,000 metric tons	1,353.87	1,054.10	Total wheat imports.
PPC	LE per ton	47.77	5.23	Average price received by wheat producers, deflated.
PPE	LE per ton	170.02	13.39	Average price received by cotton producers, deflated.

Table 7—Means, standard deviations, and descriptions of the exogenous variables

Name	Unit	Mean	Standard Deviation	Description
C	1	1	0.00	Constant term.
FEA	LE million	1,453.75	1,154.94	Foreign exchange receipts excluding cotton, deflated.
YC	tons per hectare	2.63	0.50	Yield of wheat.
YE	tons per hectare	0.64	0.13	Yield of cotton.
PWE	U.S. $ per ton	2,479.22	518.39	Export price of cotton (f.o.b.), deflated.
DE	1,000 metric tons	161.38	88.08	Domestic cotton consumption.
INCAP	LE	111.43	24.84	Gross national product, per capita.
RXRL	LE per U.S. $	0.32	0.07	Purchase power parity exchange rate (nominal exchange rate deflated by the ratio of the domestic to the international price index).
PWC	U.S. $ per ton	176.82	66.53	Average import price of wheat (c.i.f.), deflated.
DQC	1,000 metric tons	0.00	172.24	Deviation of current wheat output from trend.
DFPI_1	...	3.89	5.37	Change in the domestic food price index between t-1 and t-2.
DW2	...	...	...	War years' dummy variable equals 1 for 1967-69 and 1973-75, but equals 0 otherwise.
DW4	...	...	...	War years' dummy variable equals 1 for 1967-73, but equals 0 otherwise.
DW6	...	...	...	War years' dummy variable equals 1 for 1966-73, but equals 0 otherwise.
DA1	...	...	...	Dummy variable for foreign aid equals 1 for 1949-58, but equals 0 otherwise.
DS1	...	...	...	Suez war dummy variable equals 1 for 1956-57, but equals 0 otherwise.
T	...	...	...	Time trend; last two digits of calendar years 1949 to 1979.

7

RESULTS AND IMPLICATIONS

One of the most debated economic issues in Egypt is to what extent the food subsidy program should be continued.

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The model developed in Chapter 6 was estimated using data for 1949-79 (Appendix 4). All monetary variables are expressed in real terms. Domestic variables are expressed in constant 1975 Egyptian pounds (LE), using the Consumer Price Index as the deflator (see Appendix 4, Table 12). Foreign variables are expressed in constant 1975 U.S. dollars, using the deflator of unit values of exports from developed to developing countries (also given in Table 12).

To generate the data for the variables FEA, M, and ΔR of equation (5), the balance-of-payments accounts are analyzed. The problem is to assign the various components to two of these three terms, because from the identity,

$$FEA + E + A \equiv M + \Delta R, \qquad (21)$$

the remaining one follows as the residual. E is cotton export receipts, A the value of aid wheat, and M the total expenditures on the import of goods and services. There is now a choice of measuring FEA or ΔR. In general it is simpler to focus on ΔR. However, the change in the reserve position adopted here is slightly broader than the normal concept of foreign exchange reserves.

The separation of the balance of payments into exogenous (or autonomous) and endogenous (or accommodating) components is based on some arbitrary judgments. The net balance of unrequited transfers and short-term government capital movements are seen as accommodating flows. In addition, it appears reasonable that long-term capital flows are not a consequence of current policy decisions. Consequently, the term ΔR would ideally be defined to include official gold and foreign currency holdings, plus official unrequited transfers, plus net short-term government capital flows, plus the country's position at the IMF, less the use of IMF credit. The term F would then include export of goods and services, private unrequited transfers, and the balance on the long-term capital account. These are essentially the definitions followed in constructing the variables.

To construct the variables, a consistent detailed breakdown of the balance of payments for 1949-79 is required. As this is not available, net short-term government capital flows are not separated from exogenous receipts, although it may be legitimately argued that they are accommodating flows. The alternative would be to exclude all net capital flows from FE, but clearly this is the other extreme, as long-term capital commitments (such as capital inflows from the U.S.S.R. for the construction of the Aswan High Dam) do not principally represent accommodating flows. In constructing the value of foreign exchange reserves, gold holdings have been valued at the London market price (see Table 21). While it is recognized that the gold holdings are often viewed as sacrosanct and not part of the usable reserves, it is felt that this procedure more accurately reflects the long run opportunity cost of those reserves to the country.[82]

The formal econometric structure of the model can be written as:

[82] For a discussion of the valuation of gold holdings as foreign reserves, see D. A. Brodsky and G. P. Sampson, "The Value of Gold as a Reserve Asset," *World Development* 8 (March 1980): 175-192.

$$\underset{(23\times 23)}{\beta}\underset{(23\times 1)}{Y} + \underset{(23\times 23)}{\Delta}\underset{(23\times 1)}{Y\_1} + \underset{(23\times 17)}{\Gamma}\underset{(17\times 1)}{X} = \underset{(23\times 1)}{\varepsilon} \quad (22)$$

where β, Δ, and Γ are the structural coefficient matrices of the endogenous (Y), lagged endogenous (Y_1), and exogenous (X) variables respectively; ε is a vector of normally distributed random error terms, each with mean zero and constant variance.

Inspection of Table 5 reveals that the first eight rows of the structural coefficient matrix form an upper triangular submatrix. This occurs because these equations are recursive. In such a model there is a simultaneous dependency among some of the endogenous variables, but causation is in only one direction. For example, starting with predetermined variables, the first endogenous variable is determined. This, with other predetermined variables, determines the next endogenous variable, which does not influence the first. As a consequence, the eight recursive structural equations can be estimated using OLS, provided it is further assumed that the errors across equations are uncorrelated. In all cases except the cotton export tax the structural equations displayed sufficient evidence of autocorrelation among the residuals to warrant the use of a first-order autoregressive correlation.

The reduced form of the model can be estimated directly or derived. In order to use the important additional structural information contained in the identities, the reduced form is derived.[83] Multiplying equation (22) by β^{-1} and rearranging gives

$$\underset{(23\times 1)}{Y} = \underset{(23\times 23)}{\pi_1}\underset{(23\times 1)}{Y\_1} + \underset{(23\times 17)}{\pi_2}\underset{(17\times 1)}{X} + \underset{(23\times 1)}{v}, \quad (23)$$

so that $\hat{\pi}_1 = -(\hat{\beta}^{-1}\hat{\Delta})$; $\hat{\pi}_2 = -(\hat{\beta}^{-1}\hat{\Gamma})$; and $v = \beta^{-1}\varepsilon$. The matrices $\hat{\pi}_1$ and $\hat{\pi}_2$ are the estimated reduced-form coefficients or impact multipliers. The elements of $\hat{\pi}_2$ show the immediate effect of a change in an exogenous variable (X) on the current value of an endogenous variable (Y). If interest is centered on the value of the endogenous variables after, say, k periods, then it is necessary to allow for the induced changes in the Y's to themselves affect the future determination of the endogenous variables. This involves capturing the elements of $\hat{\pi}_1$; these interim multipliers are given by $\hat{\pi}_1^k\hat{\pi}_2$.[84]

Structural Estimates

Estimates of the structural coefficients are given in Table 8 together with the relevant elasticities evaluated at the sample means. The historical tracking ability of the structural equations is given in Figure 8.

Balance-of-Payments Adjustment Block

The variation in total real import expenditures is explained in large measure by equation (10). As expected, the elasticity of import expenditures with respect to foreign exchange receipts does not differ significantly from 1. Although equation (10) is treated as a structural equation, it has its own structural subsystem [equations (6) to (9)] whose parameters can be exactly identified from the coefficients of (10). These are:

λ_1: the foreign exchange allocation parameter (6) = 0.17;

λ_2: the coefficient of adjustment for expected foreign exchange receipts (8) = −0.32;

λ_3, λ_4: the parameters of the desired reserve holding equation (9) = 664.41, −0.29.

The value of λ_1 lies between 0 and 1 as required. Its low value indicates that in the formulation of the foreign exchange budget, Egyptian policymakers have given greater attention to achieving desired levels of imports at the expense of destabilizing reserve holdings. In fact, the implied cost of not achieving desired imports is found to be five

[83] There are a number of nonlinear identities in the structure. These were converted to linear approximations following the techniques presented by A. W. Womack and J. L. Matthews, "Linear Approximations of Nonlinear Relationships by the Taylor's Series Expansion Revisited," *Agricultural Economics Research* 24 (October 1972): 93-101.

[84] An accessible discussion of the nature and derivation of impact and interim multipliers can be found in D. S. Huang, *Regression and Econometric Methods* (New York: John Wiley and Sons, 1970), pp. 244-268.

Table 8—Estimates of the structural coefficients

Equation Used for Estimate	Dependent Variable	Independent Variables, Coefficients, and Elasticities[a]	R^{2}[b]	$\hat{\rho}$[c]	n[d]
Balance-of-Payments Adjustment Block					
10	M	$= -109.55 - 301.20DW2 + 0.17R\_1 + 1.05F - 0.28DF$ $(-1.12)\ (-3.76)\ (3.04)\ (31.21)\ (-2.81)$ $\{0.36\}\ \{1.06\}$	0.98	−0.16	31
Wheat Import Block					
11	QD	$= -780.29 + 39.22INCAP - 21.70PPC$ $(-0.85)\ (7.46)\ (-1.33)$ $\{1.58\}\ \{-0.25\}$	0.72	−0.29	31
12	AIDC	$= 1{,}187.72 - 1.86PWC - 0.06DQC - 704.91DW4 - 621.54DA1 - 449.89DS1$ $(5.25)\ (-1.74)\ (-0.20)\ (-3.80)\ (-3.08)\ (-2.34)$ $\{-0.65\}$	0.55	−0.61	31
14	INV	$= -43.28 + 0.23PWC - 11.57DW6 + 0.008IMC$ $(-7.97)\ (11.24)\ (-3.85)\ (7.66)$ $\{1.88\}\ \{1.88\}$	0.92	−0.06	30
16	DOMW	$= 12.93 - 0.023PWC + 0.42DFPI\_1 - 11.04DW6 + 0.0036IMC - 0.0077AIDC$ $(3.42)\ (-1.55)\ (1.91)\ (-5.44)\ (3.64)\ (-3.37)$ $\{-0.29\}\ \{0.79\}\ \{-0.27\}$	0.72	−0.30	29
17	AC	$= 569.06 - 68.40DW6 - 0.79PPE\_1 + 4.34PPC - 0.01IMC$ $(3.25)\ (-2.54)\ (-1.00)\ (2.49)\ (-0.98)$ $\{-0.16\}\ \{0.35\}\ \{-0.51\}$	0.38	−0.47	30
Cotton Export Block					
19	INVE	$= -113.73 - 0.60PWC + 0.22PWE + 0.09IMC$ $(-1.16)\ (-1.62)\ (4.67)\ (5.54)$ $\{-0.17\}\ \{0.90\}\ \{0.47\}$	0.72	...[e]	30
20	AE	$= 1{,}268.18 + 39.96DW6 - 6.03T + 1.59PPE\_1 - 0.036IMC\_1 - 7.44PPC$ $(4.14)\ (1.07)\ (-2.68)\ (1.35)\ (-1.99)\ (-2.72)$ $\{0.39\}\ \{-0.16\}\ \{-0.51\}$	0.66	−0.19	29

Note: Domestic variables were deflated using the Egyptian Consumer Price Index. Foreign variables were deflated using the World Bank's International Price Index. Both indexes are given in Appendix 4, Table 12.

[a] For definitions of the variables, see Tables 8 and 9. The values of the Student t statistic appear in parentheses below the estimates of the coefficients. The elasticities (where relevant) appear in brackets. They were evaluated at the sample means.

[b] The coefficient of multiple determination.

[c] The estimates of the first order autocorrelation coefficient.

[d] The number of observations in each equation.

[e] The correction for autocorrelation was not required in this equation.

times as high as the cost attached to not adjusting reserve holdings to their desired level. The negative value of λ_2 suggests that changes in foreign exchange receipts are incorporated into expectations concerning future receipts. The level of desired reserves is apparently inversely related to expected foreign receipts ($\lambda_4 = -0.29$), but this estimate does not differ significantly from 0.

Wheat Import Block

Seventy-two percent of the variation in total wheat disappearance is explained by equation (11). Income per capita shifts the demand function significantly. The elasticity of wheat demand to per capita income is estimated to be 1.58. This equation reflects the demand for wheat derived from the demand for the final products. In addition to bread, wheat is consumed in pastas, cakes and pastries, and by livestock. For this reason, the income elasticity of demand for wheat is likely to exceed that for bread. In fact, if two thirds of total wheat were used for bread with an income elasticity of 0.5, and the remainder for livestock and other bakery products with an income elasticity of say 2.0, then the weighted average income elasticity of demand for wheat might be at least 1. The actual estimate of 1.58 may overstate the true value if the price of wheat

Figure 8 - Continued

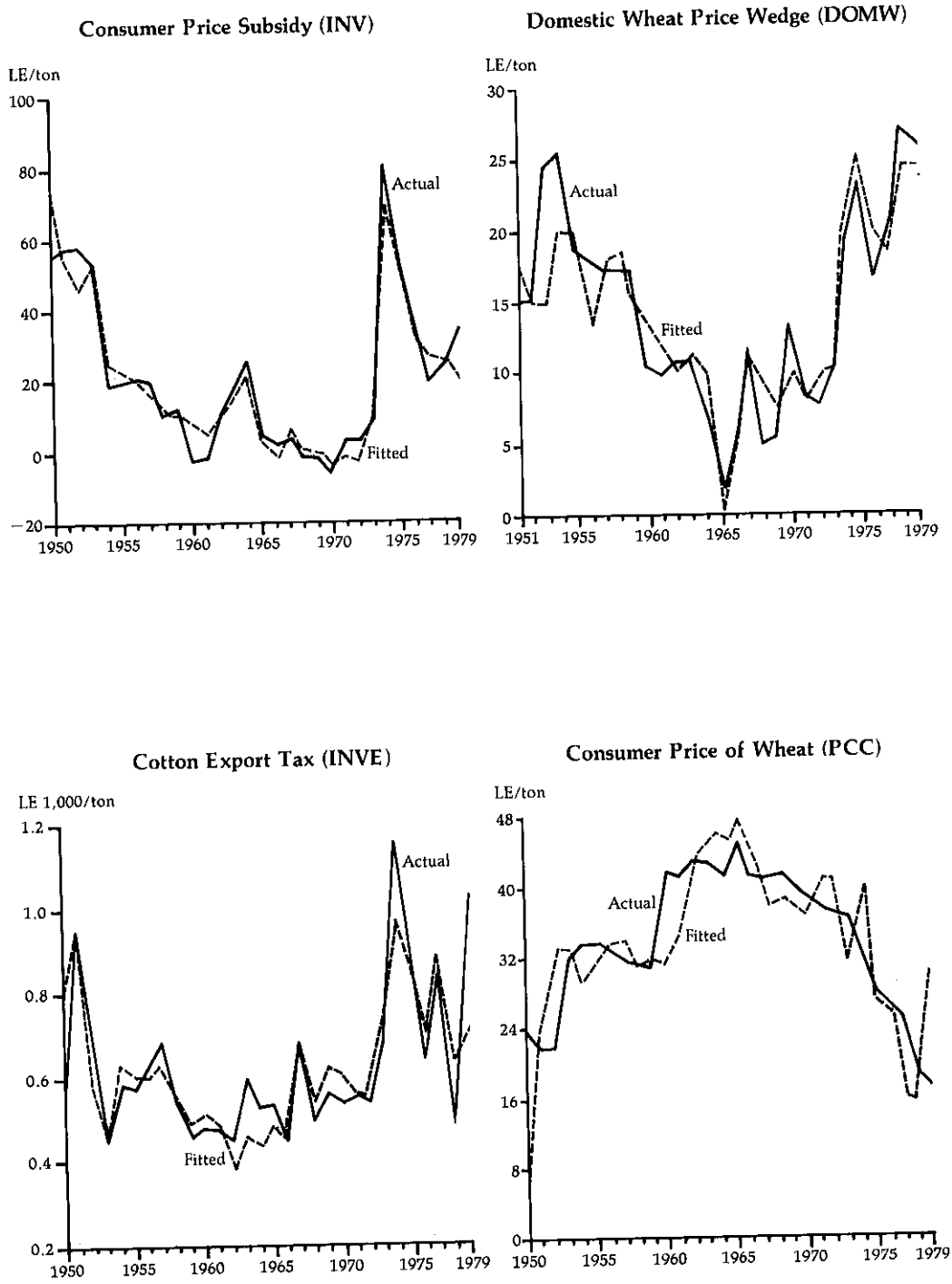
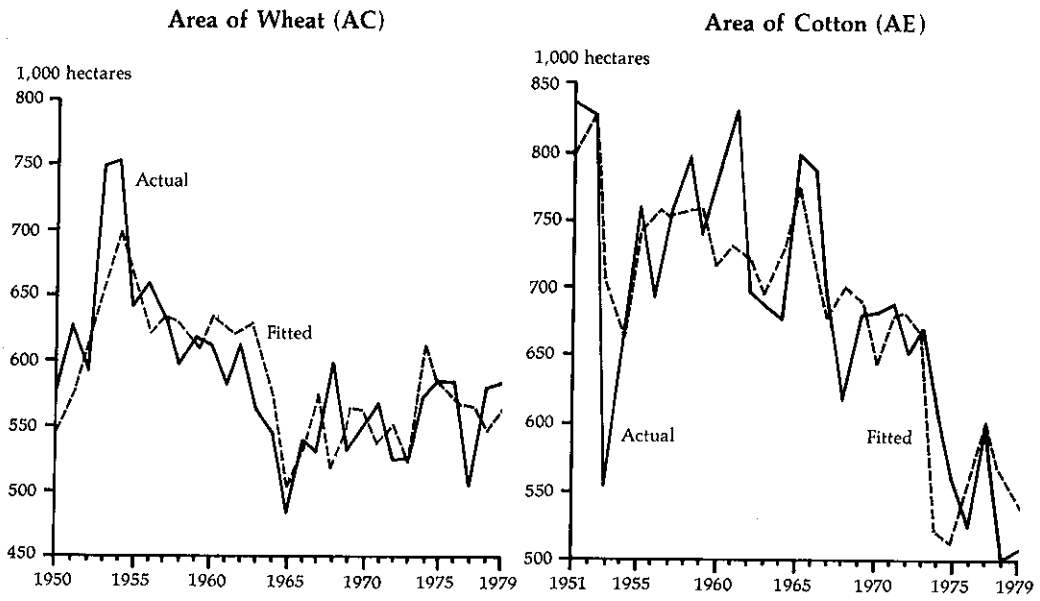


Figure 8 - Continued



has fallen relative to substitutes. Lack of data precluded their inclusion in the equation.

Total wheat disappearance is negatively related to the consumer price as expected. The implied price elasticity of demand for wheat is −0.25 when evaluated at the sample means. It is likely that the elasticity has declined over time with the growing absolute subsidy; the estimated price elasticity of demand for wheat in 1979 is −0.06. All domestic monetary variables are expressed in real terms, deflated by the Egyptian Consumer Price Index. As there is a wide range of retail price controls, it is possible that this official price index understates the actual rate of inflation. To the extent this is true, the estimate of the demand elasticity will be overstated.

The flow of aid wheat [equation (12)] has been substantially affected by political events. This is confirmed by the significant coefficients for DW4 and DS1. Donors do not appear to have responded to deviations in domestic wheat output from trend levels (DQC) in supplying wheat to Egypt. This result was largely expected given the lack of any marked variability in Egyptian yields. On the other hand, a 10 percent rise in the world price of wheat is found to reduce aid shipments by 6.5 percent, confirming that donors respond predictably to an increase in the cost of philanthropy.

A question often raised is whether aid makes any net addition to total supplies, or is simply converted to income by an offsetting reduction in commercial wheat imports. This study maintains the hypothesis that receipts of aid wheat are fully offset by reduced imports [see equation (17) in Table 5]. Direct support is provided by Abbott and Sarris, both of whom reject the hypothesis that wheat aid to Egypt has made any net contribution.[85]

The first of the two equations for the

[85] Alexander H. Sarris, "Grain Imports and Food Security in an Unstable International Market," *Journal of Development Economics* 7 (November 1980): 489-504; and Philip C. Abbott, "Developing Countries and International Grain Trade" (Ph.D. thesis, Massachusetts Institute of Technology, 1976), p. 183.

wedges in domestic wheat prices is given by equation (14). As expected, a rise in the capacity to import allows the government to offer a higher real subsidy to domestic consumers. A 10 percent rise in import capacity is reflected in about a 20 percent rise in the real subsidy to domestic consumers. This subsidy also increases with a rise in the world price, reflecting the policy of insulating consumers.

The second structural equation that describes the domestic pricing policy is equation (15). The dependent variable (DOMW) measures the extent to which the subsidized consumer price is modified for producers. Again, the country's external position is found to have a significant influence on domestic wheat pricing policy. As the capacity to import rises, the subsidy to consumers rises and the producer price falls, thus reducing the incentive for import-substituting production. But because the decline in the consumer prices is the larger of the two, the wedge between them widens. Conversely, a rise in the world wheat price induces a rise in both domestic prices, but the producer price rises less and the size of the wedge declines.

An increase in the rate of inflation of food prices is associated with a greater wedge between the two prices (because an effort to expand food supplies causes the real price to producers to rise). The size of the wedge is inversely related to the volume of aid wheat shipments. Higher aid reduces the domestic price wedge, indicating that the producer price of wheat falls relative to the consumer price. This is consistent with the claims that "large P.L. 480-type aid to Egypt has the effect of underwriting the bad internal agricultural policies of that government."[86]

Finally, in the wheat import block, equation (17) depicts the area sown to wheat. It responds to changes in both the real wheat and cotton prices facing producers. The estimate of the short-run supply elasticity of wheat with respect to its own price is 0.35.[87]

Cotton Export Block

Seventy-two percent of the variation in the cotton export tax is explained by equation (18). Rents to producers of higher world cotton prices are almost fully extracted by the government's cotton trading agency. A 10 percent rise in the world price is accompanied by a 9 percent rise in the cotton export tax. An increase in the import capacity is found to increase the cotton export tax by lowering the real price paid to producers. In contrast, a fall in the import capacity leads to greater plantings of both wheat and cotton.

The import capacity variable in the equations for crop area is intended as a proxy for the net impact of the many policy instruments (other than real producer prices) that stimulate or discourage wheat and cotton production. These include credit rationing, input prices and availability, compulsory quotas, floors and ceilings on area sown, the structure of fines for failing to comply, and the vigor of enforcement of regulation. To measure their separate effects would be an impossible task. Lower import capacity stimulates wheat plantings through nonprice instruments as predicted. In the case of cotton, it might have been predicted that lower import capacity would discourage cotton plantings, as resources were shifted to domestic wheat production to substitute for wheat imports. In that event, the import capacity variable would have opposite signs in the wheat and cotton area equations. Consider, however, the use of an instrument such as subsidized input prices. Credit, water, fertilizer, fuels, pesticides, and seeds have all received substantial subsidies of up to 80 percent.[88] To the extent that the government is unable to control the allocation of subsidized inputs to particular crops, the attempt to stimulate one crop through cheap inputs may well result in implicit subsidies to other crops. For that reason, the import capacity variable is found to have the same sign in the area equations for both wheat and cotton.

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[86] Theodore W. Schultz, "Effects of the International Donor Community on Farm People," *American Journal of Agricultural Economics* 62 (December 1980): 873-878.

[87] Cuddihy, *Agricultural Price Management*, p. 40, reports a value of 0.44.

[88] Ibid., Chapter V.

Finally, the area of cotton sown [equation (20)] responds to the real producer price of cotton and wheat. The own-price supply elasticity of cotton is estimated as 0.39 and the cross-price elasticity with respect to wheat as –0.51.[89] This latter result is consistent with the long-standing concern for the response of wheat and cotton production to relative prices.

Alternative Estimates of the Structural Parameters

It was noted that a simultaneous recursive model may be estimated by OLS provided that the disturbance terms are not correlated across equations.[90] As a check on this possibility, the model is estimated using two- and three-stage least squares. The results, shown in Appendix 4, Table 11, vary little from the OLS estimates that are used to derive the reduced-form parameters.

Policy Implications

This section presents estimates of the reduced-form parameters of the model on which discussion of the policy implications is based. Of principal concern is the effect of a change in exogenous foreign exchange receipts (FEA) on both total imports and the composition of imports. This question can be addressed by calculating the marginal propensity to import out of foreign exchange. These estimates are presented in Table 9. Of each additional dollar of foreign exchange, $0.81 is spent in the current year and $0.11 in the following year. In the initial year, reserve holdings rise by $0.25, which is spent in subsequent years. Of the additional total import expenditures, the marginal propensity to spend on imported wheat is only $0.05 in the current year. This finding implies that wheat imports are highly unresponsive to changes in the level of foreign exchange earnings. A fall in foreign exchange receipts of, say, U.S. $1 million will reduce commercial wheat imports by only 277.5 tons, which when valued at the average price of $176.82 per ton (in constant 1975 U.S. dollars) represents a marginal propensity to spend on wheat of $0.049 per $1.00.[91] Most of the adjustment is made in nonwheat imports.

This result is consistent with the stated objectives of Egyptian food policy. Goueli summarizes the short-run food security policy of Egypt, stating that "first priority is given to food imports in foreign currency allocation, food requirements are projected and the deficit is determined and is procured from the international market through medium and short term agreements and spot market, regardless of price."[92] The priority given to food imports in the foreign exchange budget is highlighted by Sagi who notes that "total exports together with exogenous foreign currency resources determine the import capacity. After allowing the necessary foreign exchange for importing food . . . the leftover foreign exchange is administratively allocated to imports of intermediate goods, capital goods, and consumption goods."[93]

Although a country may have a very low marginal propensity to import food, this does not necessarily imply a shortage of foreign exchange. Leaving aside the problem of how one would measure such a shortage, a country faced with a shortage of exchange may choose to maintain its food imports and destabilize its nonfood imports. Such is the case for Egypt. The reverse could be true of another country.

With a low marginal propensity to import food, nonfood import expenditures (and foreign exchange reserves) must act as the buffer for changes in foreign exchange receipts. Access to a special fund of foreign

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[89] Ibid., p. 40. Cuddihy reports –0.14 as the short-run estimate of the elasticity of cotton area to the wheat price. Sadeq reports an own-price elasticity of wheat area of 0.399 and a cross-price elasticity of cotton area to the wheat price of –0.37. See S. Sadeq, "Modified Nerlovian Dynamic Supply Response Functions for Five Major Egyptian Crops," October 1978. (Mimeographed.)

[90] J. L. Murphy, *Introductory Econometrics* (Homewood, Ill.: R. D. Irwin, Inc., 1973), p. 436.

[91] Jabara uses pooled cross-section and time-series data (1976-79) for 10 wheat-producing LDCs (including Egypt) to fit a wheat import demand function by OLS. The point estimate of the marginal propensity to import wheat out of foreign exchange is 0.1. See Jabara, "Grain Imports by Middle-Income Countries."

[92] Goueli, "Food Security in Africa with Special Reference to Egypt," pp. 27-28.

[93] E. Sagi, "An Econometric Study of Some Issues in the Economic Development of Egypt: Agricultural Supply, Industrial Growth and the Burden of Defense Expenditures" (Ph.D. thesis, University of Pennsylvania, 1980), p. 134.

Table 9—Effects of a unit increase in foreign exchange receipts on the level and composition of import expenditures

Variable	Units	Lag					
		No Lag[a]	1 Year[a]	2 Years	3 Years	4 Years	5 Years
Total imports (M)	Cents per U.S. $	80.86 (0.56)	10.85 (0.07)	-10.72	2.72	0.66	-0.10
Commercial wheat imports (MCC)	Cents per U.S. $	4.91 (0.50)	-3.74 (-0.38)	-0.54	0.49	-0.13	-0.06
Other import expenditures (MN)	Cents per U.S. $	75.95 (0.56)	14.59 (0.11)	-10.18	2.22	-0.76	-0.22
Total reserves (R)	Cents per U.S. $	25.05 (0.37)	-16.09 (-0.24)	-4.75	-3.11	-3.83	-3.01
Import capacity (IMC)	Cents per U.S. $	105.91 (0.51)	-5.24 (-0.03)	-15.47	-0.39	-3.17	-3.11
Total wheat disappearance (QD)	Tons per U.S. $	191.52 (0.10)	-9.48 (-0.01)	-27.98	-0.70	-5.74	-5.62
Domestic wheat production (QC)	Tons per U.S. $	-86.02 (-0.09)	201.83 (0.20)	2.79	-28.55	1.85	-3.39

Note: Domestic variables were deflated using the Egyptian Consumer Price Index. Foreign variables were deflated using the World Bank's International Price Index. Both indexes are given in Appendix 4, Table 12.

[a] Elasticities appear in parentheses below the estimates of the reduced form parameters. They were evaluated at the sample means.

reserves such as the newly created IMF food facility would lead to few additional food imports.[94] Rather, it would contribute to stabilizing nonfood import expenditures. Such a result could still be desirable to avoid disruption to the import of raw materials and capital goods. However, the present findings emphasize that the essential problem of compensatory finance is one of providing a cushion against any unexpected shock to real income, rather than addressing shortfalls due to changes in world prices for particular commodities such as food or fuel.

A rise in foreign exchange receipts induces a rise in wheat disappearance and a fall in domestic output. Simultaneously, the real cotton price to producers is allowed to decline, reflecting the stronger perceived external position. However, a second round of reactions is set in motion. With a lower cotton price, producers respond by reducing plantings in the next season so that export earnings in the second year actually fall, reducing the capacity to import. Domestic resources move into wheat production so that domestic output rises, reducing the need for imported wheat.

A second external disturbance of particular interest is a change in the world wheat price. It is seen to have major implications for many variables in this model. Table 10 gives the reduced-form multipliers for a unit rise in the world price (PWC).

In the first instance, both the consumer price and the subsidy on wheat are increased. A 10 percent increase in the import price of wheat leads to a 4.9 percent increase in the consumer price, and an 18.5 percent rise in the subsidy (all evaluated at the sample mean). The percentage rise in the consumer price following a rise in the world price is often referred to as the transmission elasticity, and generally varies from 0 to 1. When it is 0, domestic consumers are completely insulated against changes in the world price, whereas a value of 1 indicates that changes in world prices are fully transmitted to the domestic economy.

It is important to distinguish between the degree of protection and the degree of insulation. For example, the Common Agricultural Policy of the European Economic Community heavily subsidizes certain producers by maintaining domestic farm prices

[94] For a discussion of the possible extension of the present compensatory financing facility of the IMF to include cereal imports, see Louis M. Goreux, "Compensatory Financing for Fluctuations in the Cost of Cereal Imports," in Alberto Valdés, ed., *Food Security in Developing Countries* (Boulder, Colo.: Westview Press, 1981), pp. 307-332.

Table 10—Effects of a unit increase in the world wheat price

Variables	Units	Lag		
		No Lag[a]	1 Year	2 Years
Commercial wheat imports (MCC)	1,000 metric tons	−1.060 (−0.22)	1.826	−0.298
Other import expenditures (MN)	U.S. $ million	−1.422 (−0.13)	0.824	0.295
Volume of aid wheat (AIDC)	1,000 metric tons	−1.858 (−0.44)	0.000	0.000
Producer price of wheat (PPC)	LE per ton	0.080 (0.30)	−0.008	0.000
Domestic output (QC)	1,000 metric tons	0.931 (0.11)	−1.529	0.304
Consumer price (PCC)	LE per ton	0.092 (0.49)	−0.014	0.000
Domestic disappearance (QD)	1,000 metric tons	−1.987 (−0.12)	0.297	0.006
Import capacity (IMC)	U.S. $ million	−0.765 (−0.04)	1.643	0.032
Consumer wheat subsidy (INV)	LE per ton	0.228 (1.85)	0.014	0.000

Note: This table was derived using the structural coefficients given in Table 8.

[a] Elasticities appear in parentheses below the estimates of the reduced form parameters. They were evaluated at the sample means.

above world prices, implying high protection. At the same time, the domestic consumers are insulated by a variable levy that makes the transmission elasticity 0. In the case of Egypt, wheat consumption is heavily subsidized, but the government policy has not totally insulated consumers from changes in world prices. This result is consistent with Abbott's findings. He reports that for Egypt, unlike most other developed and developing countries, "the hypothesis that domestic and world wheat prices are unrelated is rejected."[95]

A transmission elasticity of 0.5 for the consumer price of wheat in Egypt is possibly higher than might have been anticipated. It is widely understood that bread prices at least have remained constant for long periods.[96] Certainly, the nominal price has been held constant, but the real price has altered (see Figure 4). In fact in the 1970s the real price fell by more than half, which coincided in part with a fall in the real cost of imported wheat (1973 and 1974 excepted). These long-term movements are reflected in the coefficients of variation of 38 percent for the world price and 24 percent for the consumer price. However, if the variability around the trend prices between 1965 and 1979 is examined, it is clear that the year-to-year variability of the consumer price is less than one quarter that of the world price. The coefficient of variation about the trend value of the world price was 35 percent and, of the consumer price, 8 percent for 1965-79. It should be noted that much of this difference can be attributed to the years 1973 and 1974.

A rise in the world wheat price causes further reactions in Egypt. The shipments of foreign aid are reduced. A 10 percent rise in the wheat price reduces receipts of concessionary wheat by 4.4 percent. Less foreign aid then encourages the government to raise the producer price of wheat to expand domestic output. The elasticity of transmis-

[95] Abbott, "Modeling International Grain Trade," p. 29.

[96] "The price of the standard loaf of bread has remained unchanged since the 1930s" (Cuddihy, *Agricultural Price Management*, p. 90).

sion to the producer price is 0.30. As a consequence of the rise in consumer and producer prices for wheat, domestic consumption declines, output increases, and commercial imports are reduced. When combined with a fall in aid shipments and offset only by a modest rise in domestic output, total consumption falls. A 10 percent rise in the world price has a net effect of reducing domestic consumption by 1.2 percent.

The elasticity of commercial wheat imports to the world price is −0.22. As a consequence, a rise in the world price results in an increase in expenditures for commercial wheat imports. Some of these additional expenditures are met by a decline in foreign exchange reserves. A rise of U.S. $1.00 per ton in the world price leads to an increase of U.S. $665,161 in expenditures on wheat imports. Reserves are reduced by U.S. $180,966 and the balance is met by a reduction in the import expenditures on other goods, equivalent to a fall of U.S. $1.4 million. A 10 percent rise in the world wheat price results in a fall in the real quantity of other imports of 1.3 percent.

Egypt's food policies affect the economy through the foreign trade account in a number of ways. First, additional quantities were imported to maintain domestic prices at an average of 47 percent of the world price during 1949-79. Imports also increased because the producer price averaged only 67 percent of the world price. Had Egyptian consumers and producers faced the average world price, commercial wheat imports would not have been needed (assuming aid shipments were unchanged). However, commercial wheat imports averaged 0.85 million tons per year at a cost of $150 million, which diverted this amount of foreign exchange from other import expenditures. Second, a rise in the world price leads to higher real expenditures for imported wheat, as the import demand for wheat is inelastic. Hence the quantity of other imports must adjust when the world wheat price changes. Non-wheat import expenditures are destabilized to accommodate the food pricing policies. Finally, the additional commercial imports required to keep domestic prices lower than world prices creates an excess demand for foreign exchange. The foreign currency price of Egyptian pounds must rise through administrative allocation in the foreign exchange budget. This has implications for the allocation of domestic resources between the traded and nontraded foods sectors. But these implications lie beyond the scope of the present study.

Repercussions of a rise in the world wheat price are felt in both the current and subsequent years. As current stocks of foreign exchange reserves are reduced to partially cover the added wheat import expenditures, the country's capacity to import (IMC) is reduced. The higher price of wheat encourages policymakers to stimulate cotton output (by raising the producer price) and thus encourages export earnings. Import capacity is enhanced in the following year, which discourages domestic wheat production and permits higher wheat imports.

It is instructive to examine the 1974-79 decline in the real price of imported wheat from U.S. $294 to U.S. $78 per metric ton (in constant 1975 dollars). In the same period the real domestic price of wheat to consumers fell from LE 36 to LE 16 per ton, reflecting the relatively high elasticity of transmission. Much of the rapid rise in Egyptian wheat consumption in the latter half of the 1970s reflected the fall in the real cost of additional imports, which was passed on to consumers through steadily declining real prices. At the same time, higher levels of foreign exchange receipts facilitated additional imports.

Although the movement in domestic consumer prices partly reflects world price movements, the real level of consumer price remains far below the cost of imported wheat. Furthermore, this difference has been widening, and by 1979 the real absolute subsidy per ton was greater than at any time since World War II. Imported wheat now supplies 70 percent of total consumption.

Farm-gate prices for wheat have been insulated from movements in border prices but have been held consistently below them. The producer price of wheat has been allowed to fall relative to other controlled crops (maize, rice, and cotton).

Whereas the present flow of exchange receipts permits increased wheat imports, it is probable that the continued trends in consumer subsidies and producer taxes will eventually be reevaluated. The historical evidence supports the view that Egypt's domestic wheat policies have not been implemented in isolation from the foreign sector. A closer alignment of producer and consumer prices with the cost of imported wheat would relieve the budgetary pressure of the subsidy scheme and lessen its desta-

bilizing impact on the importation of other goods. Directing wheat subsidies to the poorest Egyptians and using the compensatory cereal facility of the IMF would alleviate the social and economic effects of a wheat policy more aligned to the true costs of consuming additional wheat. Moreover, such a strategy would appear to be in keeping with the open-door economic policies that the country has been fostering since the mid-1970s.

APPENDIX 1

PRIVATE AND SOCIAL DEMAND FOR WHEAT

The use of a social welfare function (W) in Figure 7 of Chapter 5 underlies the derivation of private and social demand curves.[97] The relation can be conveniently established with familiar tools of economic analysis; it is illustrated in Figure 9.

In the upper half of the figure, P represents the private (aggregate) preferences for wheat (w) and other goods (o). At relative prices P_w^1, P_w^2, and P_w^3, private demand for wheat would be Q_w^1, Q_w^2, and Q_w^3. In this manner the private (or market) demand curve for wheat can be traced (DD in the lower half of the figure). Now let the social welfare function be represented by W. The essential difference between P and W is that the marginal rate of substitution between wheat and other goods along W differs from that implied by P at all relative prices above P_w^3. For example, at the relative demand price P_w^2, social demand is $Q_w^2(W)$, so that the curve D'D represents the social demand for cereals.

This kinked social demand curve reflects the desire by society for some (or all) members to consume more wheat than implied by P. Below relative price P_w^3, the two demand curves become identical, indicating that at these prices private consumption decisions generate a level of wheat intake considered to be adequate.

In the case of Egypt, one might argue that except among the very lowest income groups, expanded consumption of wheat cannot be justified on nutritional grounds.[98] Rather, it may be that the heavy subsidy simply reflects a politically feasible technique for transferring income. Even if this were the case, the assumption that society is acting as if to expand wheat consumption provides a convenient basis for the analysis.

To achieve the expanded consumption level of $Q_w^2(W)$ dictated by the social preference function, the consumer price of wheat would be below P_w^2. If P_w^2 represents the domestic equivalent of the world price, then the government would subsidize domestic consumption. Furthermore, for a given level of domestic supply, imports would expand. In summary, society may prefer wheat consumption levels that differ from those of private individuals.[99] These preferences and the associated price wedge necessary to achieve the desired consumption level would be reflected in the volume of wheat imports in the same way that private preferences would determine the demand for wheat imports in an unfettered system.

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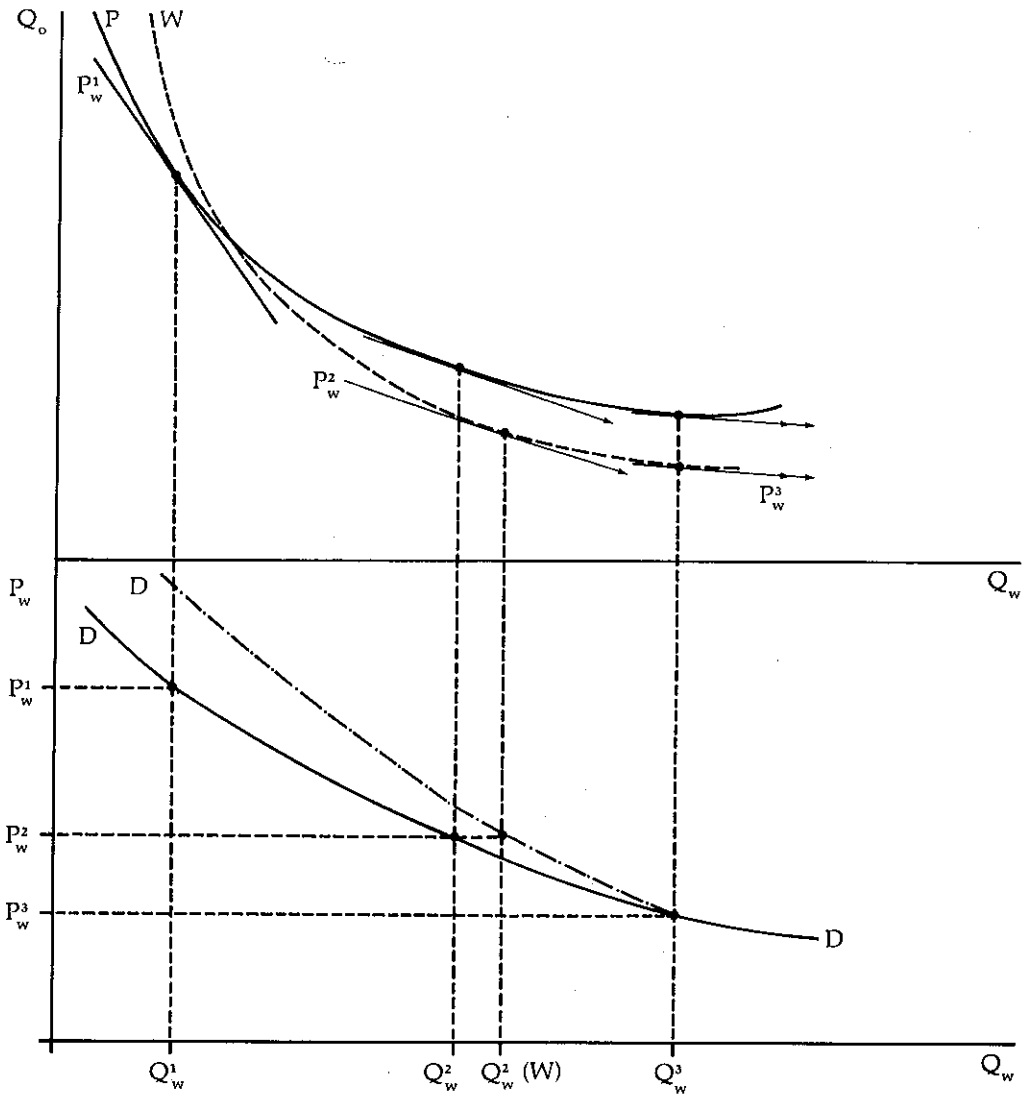
[97] For an application of private and social demand curves to food policies, see Pasquale L. Scandizzo and O. Knudsen, "The Evaluation of the Benefits of Basic Needs Policies," *American Journal of Agricultural Economics* 62 (February 1980): 46-57. Their work is built on A. C. Harberger, "Basic Needs versus Distributional Weights in Cost-Benefit Analysis," International Bank for Reconstruction and Development, Washington, D.C., 1978. (Mimeographed.)

[98] Of course, the incidence of inadequate nutrition observed with the subsidy is probably less than what it would have been if there were no subsidy.

[99] For an example of a study of food imports in which the competing interests of producers and consumers are analyzed, see G. C. Rausser and J. W. Freebairn, "Estimation of Policy Preference Functions: An Application to U.S. Beef Import Quotas," *Review of Economics and Statistics* 56 (1974): 437-449.

Figure 9 - The private and social demand for wheat



APPENDIX 2

IMPORT DEMAND MODELS INCORPORATING GOVERNMENT POLICY MEASURES

A principal theme of this study is the explicit incorporation of government policies in a model of import demand for food. It is pertinent, therefore, to review the manner in which other researchers have addressed this issue.

Typically, the only recognition of government intervention has come through the addition of an exogenous variable to the relative price and activity measure in a single equation model of import demand.

In its simplest form this has been achieved by the use of a dummy variable that allows for subperiods in which the import demand function is systematically displaced due to government intervention. Periods of quantitative import controls imposed to allocate scarce foreign exchange are sometimes represented in this form.[100] To the extent that a shortage of either foreign exchange receipts or international reserves leads to import restrictions, some measure of the capacity to import will often appear as a shifter of the import demand function.

The model of economic growth attributed to Chenery and Strout,[101] in which the savings and foreign exchange gaps constitute limits to growth, is one basis for explicitly including measures of import capacity. Chenery and Eckstein[102] estimate aggregate import functions for 16 countries in which both the current level of foreign exchange earnings from the export of goods and services and the reserve stocks of gold and foreign currency enter as explanatory variables.

Use of an import capacity variable (variously defined) has been widespread.[103] In addition, studies of cereal import demand have followed a similar path. Foreign exchange (either as a flow or a stock) enters the wheat import demand function for India[104] and for Brazil,[105] for Indian cereals,[106] Asian rice,[107] and wheat in various countries.[108]

[100] Examples of the use of this procedure can be found in R. Weisskoff, "Trade, Protection and Import Elasticities for Brazil," *Review of Economics and Statistics* 61 (February 1979): 58-66; J. C. Leith, *Foreign Trade Regimes and Economic Development: Ghana*, a special conference series on foreign trade regimes and economic development 2 (New York: National Bureau of Economic Research, 1974), p. 135; and Garcia, *The Effect of Exchange Rates*. An Egyptian example is found in E. E. Montasser, "Egypt's Pattern of Trade and Development: A Model of Import Substitution Growth" (Ph.D. thesis, Princeton University, 1972), p. 177.

[101] H. B. Chenery and A. Strout, "Foreign Assistance and Economic Development," *The American Economic Review* 56 (September 1966): 679-733.

[102] H. B. Chenery and P. Eckstein, "Development Alternatives for Latin America," *Journal of Political Economy* 78 (July-August 1970): 966-1006.

[103] Examples include the use of international reserves, export earnings, or net overseas assets. See Nurul Islam, "Experiments in Econometric Analysis of an Import Demand Function," *Pakistan Economic Journal* 11 (September 1961): 21-38; (December 1961): 1-19; M. Dutta, "A Prototype Model of India's Foreign Sector," *International Economic Review* 5 (January 1964): 82-103; and Stephen J. Turnovsky, "International Trading Relations for a Small Country: The Case of New Zealand," *Canadian Journal of Economics* 1 (November 1968): 772-790.

[104] Raj Krishna and A. Chhibber, *Policy Modeling of a Dual Grain Market: The Case of Wheat in India*, Washington, D.C.: International Food Policy Research Institute, forthcoming.

[105] L. L. Hall, *The Effects of PL 480 Wheat Imports on Latin American Countries*, Cornell International Agriculture Monograph 76 (Ithaca, N.Y.: Cornell University, April 1980); and L. L. Hall, "Evaluating the Effects of PL 480 Wheat Imports in Brazil's Grain Sector," *American Journal of Agricultural Economics* 62 (February 1980): 19-28.

[106] D. Blandford and J. A. Von Plocki, *Evaluating the Disincentive Effect of P.L. 480 Food Aid: The Indian Case Reconsidered*, Cornell International Agriculture Mimeograph 56 (Ithaca, N.Y.: Cornell University, July 1977).

[107] B. Islam, "Price, Income, and Foreign Exchange Reserve Elasticity for Asian Rice Imports," *American Journal of Agricultural Economics* 60 (August 1978): 532-535.

[108] A. C. Zwart and K. D. Meilke, "The Influence of Domestic Pricing Policies and Buffer Stocks on Price Stability in the World Wheat Industry," *American Journal of Agricultural Economics* 61 (August 1979): 447.

Abbott develops a model for the import demand of both wheat and feedgrains.[109] He treats these as homogenous products where imports are the excess demand over domestic production. As a consequence the import function has as its arguments those of the domestic demand and supply functions. These include the domestic prices facing consumers and producers. For each, an additional equation is specified linking domestic to world prices, forming a price transmission elasticity.[110] As shifters in these domestic price formation equations, Abbott includes domestic output and stocks, foreign aid (in grain), and the foreign exchange position. The degree of price intervention by the government is postulated to depend on these variables. The reduced-form import function then involves P.L. 480 flows, domestic production, foreign exchange, population, income, and a time trend.

The principal results from the reduced form can be summarized as follows: only in 3 of 16 countries was the world price significant, suggesting that the domestic wheat economy is isolated from the world market by government intervention; there was little systematic relation between imports and income or population; shortfalls in domestic production did not lead to a commensurate increase in imports (that is, trade was only partially being used to fill the domestic gap); the level of foreign exchange reserves was one of the most significant variables in explaining wheat imports by LDC importers; and in more than half of the countries the hypothesis that P.L. 480 wheat made no net addition to domestic supplies could not be rejected.

Abbott's reduced-form equation for Egyptian wheat included as explanatory variables the world wheat price (c.i.f.), population, domestic output, P.L. 480 shipments, and a time trend variable.[111] The equation explained almost 90 percent of the variation in wheat imports between 1951 and 1973, but only the population and trend variables were significant. Because the world price entered positively, although with marginal significance, it was deleted. The second version explained 86 percent of the variance, but the time trend and the population variable with its perverse sign had the only significant coefficients. In neither case was the foreign exchange variable included.

Sarris presents similar results for Egyptian wheat imports.[112] In a single equation he regressed imports on the border prices, domestic output, food aid, and a trend. Price was perversely signed, but not significant, and again, the only significant explanatory variable was the time trend.

Krishna and Chhibber[113] present a model of the Indian wheat sector in which imports depend on the excess of government sales over procurements (both endogenously determined), and foreign exchange reserves plus aid. The model includes equations explaining the level of issue and procurement so that the import levels reflect the endogenously determined levels of the government policy instruments. Based on the reported reduced-form coefficient between endogenous wheat imports and exogenous foreign exchange reserves and aid, the marginal propensity to spend foreign exchange on wheat was calculated to be 0.19.[114] The possibility exists

[109] The most complete treatment of his work is in Abbott, "Developing Countries and International Grain Trade." A shorter version is Abbott, "Modeling International Grain Trade," pp. 22-31. A useful statement of the problems of and approaches to incorporating the role of government in trade modeling is given in P. C. Abbott, "The Role of Government Interference in International Commodity Trade Models," *American Journal of Agricultural Economics* 61 (February 1979): 135-140. The model presented in Chapter 6 involves some of the same variables and its formulation was guided by Abbott's work.

[110] For further discussion of this concept, the reader is directed to M. E. Bredhal, W. H. Meyers and K. J. Collins, "The Elasticity of Foreign Demand for U.S. Agricultural Products: The Importance of the Price Transmission Elasticity," *American Journal of Agricultural Economics* 61 (February 1979): 58-63; and to M. R. Cronin, "Export Demand Elasticities with Less than Perfect Markets," *Australian Journal of Agricultural Economics* 23 (April 1979): 69-72.

[111] Abbott, "Developing Countries and International Grain Trade," p. 139.

[112] Sarris, "Grain Imports and Food Security," p. 491. These results are drawn from Alexander H. Sarris, "The Economics of International Grain Reserve Systems" (Ph.D. thesis, Massachusetts Institute of Technology, 1976).

[113] Krishna and Chhibber, "Policy Modeling of a Dual Grain Market."

[114] This calculation was made using the average Egyptian import price of U.S. $176.82 (c.i.f.). This was done partly because Krishna and Chhibber do not report price data and partly to make the estimate comparable with the estimate in this study.

that this estimate is biased upwards if reserve holdings and wheat import expenditures are not determined independently. This matter is explored in Appendix 3.

A similar equation for Indian cereal imports is used by Blandford and Von Plocki.[115] They use an estimate of the shortfall in cereal supplies with respect to a consumption "norm," together with a measure of the capacity to import. The latter is foreign exchange receipts (exports plus net capital inflows) deflated by the ratio of the price index for cereals relative to the price index for all imports. This variable captures both the foreign exchange effect and the effect of changes in the world price of cereals (relative to other import prices); however, it does not allow separate estimates of the two effects. As in the case of the Krishna and Chhibber study, imports are in part explained by the shortfall between requirements and supplies, and this policy variable is explained by the model.

The study by Hall examines the import of wheat in four Latin American countries. She notes that since "the government has had monopoly control . . . of wheat imports the determinants of the quantity of wheat imported would be the determinants of the government's desire to import wheat."[116] The quantity of commercial wheat imports is posited to depend on the price at which imported wheat is sold to consumers. Three shifters are included: the quantity of P.L. 480 shipments, domestic output, and the level of foreign exchange reserves. The relation between imports and the domestic consumer price is found to be positive. This is used to support the argument that a higher price increase allows the government to import more wheat due to the extra revenues. Similarly, additional P.L. 480 imports allow the government to increase the support price to producers.[117] Hall does not report the reduced-form coefficients relating wheat imports to foreign exchange reserves. However, using the structural coefficient she reports for Brazil and Columbia allows estimates of the marginal propensity to spend on imported wheat out of foreign exchange reserves of 0.0178 and 0.0398, respectively.

The determination of the quantity of imports by government action is the basis for the Philippine rice import equation of Apiraksirikul and Barker.[118] This is a single equation model in which the estimated shortfall (forecast output less assumed requirements) of rice, the ratio of domestic to foreign price of rice, and a dummy variable for election years are the arguments of the rice import function. They note "the size of the import is controlled by the government, and hence, our model attempts to identify those factors that influence the government import decisions."[119] However, they treat the government intervention as exogenous.

A more comprehensive approach to Philippine food imports is presented by Bautista.[120] He rejects the use of a traditional import demand function for cases where there is government control. Instead, his model has four equations; the supply and demand of imported food and the supply and demand of domestic (import-competing) food. Although the two categories contain many different commodities, there are common products, for example, rice. Consequently, the model (implicitly) distinguishes products by place of origin; domestic and foreign rice are considered two distinct products. The demand functions for both depend on own and cross prices, and real consumer expenditures. The supply of imports offered by the government depends on the domestic price of foreign food, the price of domestic food, and the capacity to import. The government is seen to be responsive to world prices, and increases imports to protect consumers from inflation in domestic

[115] Blandford and Von Plocki, *Evaluating the Disincentive Effect of P.L. 480 Food Aid*, pp. 14-22.

[116] Hall, *The Effects of PL 480 Wheat Imports on Latin American Countries*, p. 11.

[117] A similar argument is made in Uma Lele and M. Agarwal, "Food Grain Imports," *Ceres* 72 (November-December 1979): 25.

[118] S. Apiraksirikul and Randolph Barker, "Rice Trade Policy as it Relates to National Objectives in the Philippines," Paper No. 77-8 (Los Banos: International Rice Research Institute, June 1977).

[119] Ibid., p. 11.

[120] R. M. Bautista, "Import Demand in a Small Country with Trade Restrictions," *Oxford Economic Papers* 30 (1978): 199-216.

food prices. The capacity to import is represented by the average of current and lagged export receipts. In summary, the government's food import policy depends on the conflicting interests of economizing on foreign exchange expenditures on food and stabilizing domestic food prices.

This is a recurring theme in recent studies of food imports in LDCs. Sarris formulates the grain import policy as "a trade-off between expenditures on imports and domestic cost of not satisfying the requirements."[121] Although he focuses on the development of a normative model, the two crucial elements of the shortfall in meeting domestic requirements and the foreign exchange costs are precisely those that entered the econometric formulations of grain import functions for the studies by Krishna and Chhibber and Blandford and Von Plocki.

This trade-off between competing government objectives also underlies the studies of Brazilian export trade in soybeans, corn, cotton, and beef.[122] Lattimore and Schuh use an exact analogy of Bautista's imports model. They state that "there are two basic forces impinging on the government with respect to beef export policy. One is the desire to hold down the price of beef to domestic consumers. The other is the need for foreign exchange receipts."[123] The importance of beef in household expenditures leads them to include (like Bautista) the rate of domestic inflation as an explanatory variable of the government export policy. Similarly, they use a measure (not specified) of the "overall position in the balance of payments" as a further determinant of the beef export policy.

However, unlike other authors they explicitly estimate a policy intervention equation. The degree of intervention in the beef market is measured by the difference between the domestic beef price and the world price of beef converted to domestic currency at the effective exchange rate facing the beef sector. This measure of intervention is explained by world price, the domestic inflation rate, and the balance-of-payments position (together with a series of dummy variables aimed at capturing shifts in trade policy).

Wong incorporates the Thai government intervention in the rice trade by including the export tax.[124] This affects government revenues, the domestic price, and the foreign exchange earnings from rice. Thailand apparently faces a world demand for rice that is less than perfectly elastic, so that intervention by the government affects both the volume and price of rice exports. However, no attempt is made to explain the level of the export tax.

In a study of Asian rice imports, Islam uses foreign exchange reserves to measure the capacity of a country to import.[125] The government's restrictions on rice imports are seen to vary inversely with the level of foreign exchange reserves. Once again the trade-off between the parsimonious use of scarce reserves and the satisfaction of domestic requirements is incorporated in his model.[126] He estimates a reduced-form import equation for five countries by OLS, and reports the elasticity of imports with respect to foreign exchange. These range from 4.24 for Pakistan to 0.01 for Malaysia, averaging 1.80 for all five countries. Islam argues that the low elasticity for Malaysia (essentially 0) arises because during 1953-72 Malaysia was "the one country that did not experience

[121] Sarris, "Grain Imports and Food Security," p. 490.

[122] Robert L. Thompson, "The Brazilian Soybean Situation and Its Impact on the World Oils Market," *Journal of the American Oil Chemists' Society* 56 (May 1979): 391A-398A; Robert L. Thompson and G. Edward Schuh, "Trade Policy and Exports: The Case of Corn in Brazil," Purdue University, Lafayette, Ind., May 1975 (mimeographed); H. W. Ayer and G. Edward Schuh, "Social Rates of Return and Other Aspects of Agricultural Research: The Case of Cotton Research in Sao Paulo, Brazil," *American Journal of Agricultural Economics* 54 (November 1972): 557-569; and R. G. Latttimore and G. Edward Schuh, "Endogenous Policy Determination: The Case of the Brazilian Beef Sector," *Canadian Journal of Agricultural Economics* 27 (July 1979): 1-16.

[123] Lattimore and Schuh, "Endogenous Policy Determination," p. 6.

[124] C. M. Wong, "A Model for Evaluating the Effects of Thai Government Taxation of Rice Exports on Trade and Welfare," *American Journal of Agricultural Economics* 60 (February 1978): 66-73.

[125] Islam, "Price, Income and Foreign Exchange Reserve Elasticity."

[126] "It is likely that government efforts to preserve foreign exchange will allow only partial satisfaction, through imports, of increases in demands for rice" (Ibid., p. 533).

foreign exchange shortages."[127] As Islam notes, rice trading was not a government monopoly. As a consequence, imports were not directly dependent on an administratively determined allocation of foreign exchange. In such instances it is to be expected that rice imports would not be explained by variations in foreign exchange reserves. The administrative assignment of foreign exchange to import classes typically arises as a nonprice rationing mechanism implemented when central banks can no longer hold down the nominal price of foreign currency by supplying reserves.

The absence of a state trading monopoly does not, however, preclude the possibility that public policy toward the agricultural sector may still reflect concerns about the country's external balance. Such concerns may be reflected in the setting of producer prices or in the level of public investment in research or productive infrastructure. In fact, in the Malaysian case, Goldman argues that the policy of self-sufficiency in rice was originally viewed "as a partial remedy for the balance-of-payments problems that were expected to emerge in the 1960s. Fear of dwindling foreign exchange reserves was an important factor in sustaining continued public investment in paddy production."[128]

From this review of import demand models involving explicit recognition of government intervention three central issues emerge. First, there has been widespread use of some measures of foreign exchange availability as a determinant of imports. The variable has almost always been statistically significant and positive. The estimated coefficient can be used to determine the marginal propensity to import cereals from foreign exchange flows (receipts) or stocks (reserves). However, frequently no clear distinction is made between the flow and stock concepts. None of the studies have embodied a complete system of import demand equations in which recognition is explicitly given to competing uses of foreign exchange. The possibility that the estimated response of cereal import demand to foreign exchange availability may not be biased has not been explored (see Appendix 3).

Second, there has been no explicit attempt to provide an underlying behavioral model of the balance-of-payments adjustments process. For example, the effect on cereal imports of changes in the level of foreign exchange reserves to achieve a desired level of stocks has not been considered.

And finally, it would seem desirable that government intervention should be treated as an endogenous variable responding to, as well as affecting, other variables in the system. This has been stressed by a number of authors. As noted by Bautista, the demand function resulting from the inclusion of an exogenous policy variable "represents a mixture of an import demand function by consumers of the import commodity and an import policy function by public policymakers setting the restrictions on imports. Obviously, a more satisfactory alternative would be to represent separately the underlying structural relations . . ."[129]

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[127] Ibid., p. 534.

[128] R. H. Goldman, "Staple Food Self-Sufficiency and the Distributional Impacts of Malaysian Rice Policy," *Food Research Institute Studies* 14 (1975): 279.

[129] Bautista, "Import Demand in a Small Country," p. 200.

APPENDIX 3

SIMULTANEOUS EQUATION BIAS IN ESTIMATION OF THE MARGINAL PROPENSITY TO IMPORT OUT OF FOREIGN EXCHANGE

In Appendix 2 a number of studies are cited that attempt to measure the response of imports to changes in a country's balance-of-payments position by incorporating a variable to reflect foreign exchange availability. However, without explicit recognition of the simultaneous determination of reserve levels and imports, a potential bias arises. This bias is now briefly explored.

If a country is pegging its exchange rate, then in the short run it will have a given quantity of foreign exchange (F) available, which can either be spent on imports (M) or used to adjust the level of its reserve holding (ΔR), such that

$$F \equiv M + \Delta R. \tag{24}$$

Now suppose there are only two import goods, wheat (w) and other goods (n), whose foreign prices are given as P_w and P_n. It follows that

$$P_w M_w + P_n M_n \equiv M. \tag{25}$$

Let the import function for wheat be simply denoted as

$$M_w = \gamma_0 + \gamma_1 F + \gamma_2 \underline{Z} + \varepsilon_w. \tag{26}$$

The vector $\underline{Z}$ may comprise both exogenous variables (population, income, world price) and endogenous variables (domestic output). The foreign exchange variable is taken as given exogenously. In what follows no violence will be done to the argument if γ_2 is restricted to 0 for simplicity, so that

$$M_w = \gamma_0 + \gamma_1 F + \varepsilon_w, \tag{27}$$

where $\varepsilon_w \sim (0,\sigma_\varepsilon^2)$ and γ_1 is the marginal propensity to import wheat out of foreign exchange.

If we apply OLS to equation (27) then $\hat{\gamma}_1$ will only be an unbiased and consistent estimator of the marginal propensity if F and ε_w are independent. If F is truly exogenous then this condition will hold. However, a typical formulation uses foreign exchange reserves, so the model is in fact:

$$M_w = \alpha_0 + \alpha_1 R_t + \varepsilon_w, \text{ and} \tag{28}$$

$$R_t = R_{t-1} + F + P_w M_w + P_n M_n, \tag{29}$$

where equation (29) is a rearrangement of equations (24) and (25). It is now evident that OLS estimation may lead to biased and inconsistent estimates of the marginal propensity to import out of foreign exchange reserves. Solving equations (28) and (29) for R_t and taking its expectation yields:

$$E(R_t) = (R_{t-1} + F + P_w\alpha_0 + P_n M_n)(1 - \alpha_1 P_w). \tag{30}$$

Now consider the covariance of R_t and ε_w:

$$\text{Cov}\,(\varepsilon_w,R_t) = E\{[\varepsilon_w - E(\varepsilon_w)][R_t - E(R_t)]\}$$

$$= P_w\sigma_\varepsilon^2/(1 - \alpha_1 P_w). \tag{31}$$

Clearly, this covariance is not 0. Further, it can be shown that the OLS estimate of α_1 in equation (28) will be biased upward. The use of foreign exchange reserves in single equation models of grain imports will tend to overstate the responsiveness of imports to changes in foreign exchange where import levels and reserves are simultaneously determined as part of a policy to eliminate the excess demand for foreign currency at the existing exchange rate. Furthermore, as discussed in Chapter 6, it is often the case that some elements of F are not independent of decisions about import levels. Hence, even the use of equation (27) is likely to involve biased estimates of the marginal propensity to import out of foreign exchange.

APPENDIX 4

SUPPLEMENTARY TABLES

Table 11—Simultaneous equation estimates of the structural parameters: a comparison under three estimation procedures

Equation Used For Estimate	Dependent Variable[a]	Explanatory Variable[a]	Ordinary Least Squares[b]		Two-Stage Least Squares		Three-Stage Least Squares	
			Estimate	Student t Statistic	Estimate	Student t Statistic	Estimate	Student t Statistic
10	M	C	−109.55	−1.12	−98.11	−1.14	−145.84	−1.78
		DW2	−301.20	−3.76	−301.32	−3.99	−301.51	−4.85
		R_1	0.17	3.04	0.15	3.16	0.21	4.84
		$\overline{F}$	1.05	31.21	1.05	35.24	1.04	37.94
		DF	−0.28	−2.81	−0.32	−3.00	−0.27	−3.20
11	QD	C	−780.29	−0.85	−297.59	−0.38	−302.53	−0.40
		INCAP	39.22	7.46	39.33	9.11	38.49	9.15
		PCC	−21.70	−1.33	−34.11	−2.46	−31.18	−2.40
12	AIDC	C	1,187.72	5.25	1,204.52	4.35	1,465.37	5.78
		PWC	−1.86	−1.71	−1.78	−1.10	−3.38	−2.34
		DQC	−0.06	−0.20	0.26	0.59	0.02	0.06
		DW4	−704.91	−3.80	−704.80	−3.76	−815.71	−4.79
		DA1	−621.54	−3.08	−780.49	−3.21	−583.55	−2.72
		DS1	−449.89	−2.34	−922.62	−3.35	−859.99	−3.62
14	INV	C	−43.28	−7.97	−50.95	−11.08	−54.19	−13.24
		PWC	0.23	11.24	0.27	14.74	0.28	16.98
		DW6	−11.57	−3.85	−10.38	−4.49	−8.76	−5.41
		IMC	0.008	7.66	0.009	10.58	0.009	11.01
16	DOMW	C	12.93	3.42	13.87	4.16	14.79	5.15
		IMC	0.004	3.64	0.003	3.71	0.003	3.21
		AIDC	−0.008	−3.37	−0.01	−3.60	−0.01	−3.59
		DW6	−11.04	−5.44	−11.74	−6.84	−11.94	−7.78
		PWC	−0.02	−1.55	−0.02	−1.58	−0.02	−1.71
		DFPI_1	0.42	1.91	0.49	2.09	0.60	3.14
17	INVE	C	−113.73	−1.16	−158.35	−1.82	−234.61	−3.16
		PWE	0.22	4.67	0.20	4.70	0.23	8.13
		PWC	−0.60	−1.62	−0.11	−0.30	−0.07	−0.23
		IMC	0.09	5.54	0.10	6.71	0.10	6.88
19	AC	C	569.06	3.25	607.61	2.54	773.14	4.17
		DW6	−68.40	−2.54	−81.96	−3.19	−101.39	−4.69
		PPE_1	−0.79	−1.00	−0.86	−0.86	−1.22	−1.59
		$\overline{PPC}$	4.34	2.49	3.90	1.69	2.04	1.08
		IMC	−0.01	−0.98	−0.01	−1.22	−0.01	−1.65
20	AE	C	1,268.18	4.14	1,290.54	3.88	1,239.90	4.65
		DW6	39.96	1.07	33.14	0.89	69.69	2.23
		T	−6.03	−2.68	−5.61	−2.75	−7.79	−4.52
		PPE_1	1.59	1.35	1.38	1.16	1.65	1.77
		IMC_1	−0.04	−1.99	−0.04	−2.14	−0.02	−1.39
		$\overline{PPC}$	−7.44	−2.72	−7.42	−2.07	−5.83	−2.09

[a] For definitions of the variables, see Tables 6 and 7.

[b] These figures are from Table 8.

Table 12—Price indexes, population, GNP, and nominal exchange rates, 1949-79

Year	Index of International Inflation (1975=100)	Food Price Index (1975=100)	Consumer Price Index	Population	Gross National Product	Nominal Exchange Rate
				(millions)	(LE million)	(U.S. $/LE)
1949	42	33.0	50.2	19.89	905	2.87
1950	37	35.6	53.2	20.46	978	2.87
1951	44	38.0	57.7	20.94	944	2.87
1952	45	37.2	57.6	21.44	916	2.87
1953	43	34.4	53.6	21.94	950	2.87
1954	42	34.8	51.4	22.56	1,048	2.87
1955	42	35.6	51.2	22.99	1,110	2.87
1956	44	36.0	52.5	23.53	1,129	2.85
1957	45	37.6	54.6	24.09	1,198	2.85
1958	44	38.0	54.7	24.66	1,303	2.85
1959	43	38.4	54.8	25.24	1,437	2.85
1960	44	38.8	55.0	25.92	1,379	2.85
1961	44	39.2	55.4	26.58	1,461	2.85
1962	44	39.2	53.8	27.26	1,513	2.30
1963	45	40.0	54.2	27.95	1,679	2.30
1964	45	42.4	56.1	28.66	1,881	2.30
1965	46	53.2	64.5	29.39	2,199	2.30
1966	47	58.8	70.3	30.14	2,381	2.30
1967	47	58.0	70.8	30.91	2,459	2.30
1968	47	58.4	69.8	31.69	2,497	2.30
1969	48	62.0	72.1	32.50	2,652	2.30
1970	52	66.0	74.9	33.33	2,927	2.30
1971	55	69.6	77.2	34.08	3,080	2.30
1972	60	71.6	78.8	34.84	3,403	2.30
1973	72	76.4	82.2	35.62	3,634	2.56
1974	89	89.2	91.1	36.42	4,085	2.56
1975	100	100.0	100.0	37.23	4,738	2.56
1976	101	114.8	110.3	37.87	6,118	2.56
1977	109	133.2	124.3	38.74	7,139	2.56
1978	124	148.0	138.1	39.64	9,089	2.56
1979	142	162.7	151.8	40.55	11,434	1.43

Sources: The index of international inflation was derived from the export values of industrialized countries in International Monetary Fund (IMF), *International Financial Statistics Yearbook, 1979* (Washington, D.C.: IMF, 1979), pp. 70-71. The value for 1979 is from IMF, *International Financial Statistics* 23 (October 1980), p. 48.

The 1949, 1978, and 1979 figures in the food price index were estimated by linking that index to the consumer price index. The 1950-61 figures are from Food and Agriculture Organization of the United Nations (FAO), *1967 FAO Production Yearbook,* vol. 21 (Rome: FAO, 1968); in this source, 1953 = 100. The 1959-70 figures are from FAO, *1971 FAO Production Yearbook,* vol. 25 (Rome: FAO, 1972); in this source, 1963 = 100. The 1974-77 figures are from International Labour Organisation, *Yearbook of Labour Statistics, 1977* (Geneva: ILO, 1977).

Overlap years are used to convert the 1953 base years to a 1963 base. This was done for all years through 1967. The published index for 1968 has 1966/67 as its base year (the average for 1966 and 1967 is 146). Using that information, the index is rebased for 1968 and all following years. Finally, the entire series is rebased to 1975.

The 1949-78 figures for the consumer price index are from IMF, *International Financial Statistics, 1979,* pp. 168-169. The 1979 figure is from IMF, *International Financial Statistics, 1980,* p. 42.

For population, the 1949-77 figures are from IMF, *International Financial Statistics, 1979,* pp. 170-171. The 1978 population is from IMF, *International Financial Statistics, 1980,* p. 144 and the 1979 population is an estimate using a 2.3 percent growth rate from 1978. See K. Ikram, *Egypt: Economic Management in a Time of Transition* (Baltimore, Md.: Johns Hopkins University Press, 1980), p. 105.

The gross national product (GNP) figures for 1969-77 are from IMF, *International Financial Statistics, 1979,* pp. 170-171. The 1949 and 1950 figures are from Bent Hansen and K. Nashashibi, *Foreign Trade Regimes and Economic Development: Egypt,* a special conference series on foreign trade regimes and economic development 4 (New York: National Bureau of Economic Research, 1975), p. 35; they were converted to current prices from 1954 prices by using the consumer price index in this table. The 1952-59 figures are from United Nations, *Yearbook of National Accounts Statistics,* various issues. The 1978 figure is from Ikram, *Egypt: Economic Management,* p.339, and the 1979 figure is from unpublished data from the World Bank.

(continued)

Table 12—Continued

The nominal exchange rates for 1949-78 are from IMF, *International Financial Statistics, 1979,* pp. 168-169. The 1979 rate is from IMF, *International Financial Statistics, 1980,* p. 142. The rate of U.S. $1.43 per LE 1.00 is known as the parallel rate. The parallel rate was introduced in the early 1970s at U.S. $ 1.70 and was adjusted to its present rate in 1976. The proportion of foreign transactions using this rate has increased since 1976. The official rate (U.S. $2.56 per LE 1.00) was abolished, except for some bilateral transactions, on January 1, 1979. Before then, all wheat imports were paid for at this rate. See Ikram, *Egypt: Economic Management,* pp. 352-353.

Table 13—Production and trade of wheat and wheat flour, 1949-79

Year	Production (QC)	Area (AC)	Yield (YC)	Wheat Imports (MC)	Flour Imports (MF)	Aid Shipments: Wheat (AIDC)	Aid Shipments: Flour (AIDF)
	(1,000 metric tons)	(1,000 hectares)	(tons/hectare)		(1,000 metric tons)		
1949	1,167	595	1.96	283	6	0	0
1950	1,018	576	1.77	443	89	0	0
1951	1,209	629	1.92	1,028	89	0	0
1952	1,089	589	1.85	710	144	0	0
1953	1,547	752	2.06	467	67	0	0
1954	1,729	754	2.29	10	50	0	0
1955	1,451	640	2.27	0	10	3	0
1956	1,547	660	2.34	610	53	481	12
1957	1,467	636	2.31	710	95	9	1
1958	1,412	599	2.36	774	286	8	2
1959	1,443	620	2.33	731	467	200	220
1960	1,499	612	2.45	631	473	523	482
1961	1,436	581	2.47	661	431	431	659
1962	1,593	611	2.61	860	510	810	877
1963	1,493	565	2.64	972	815	725	831
1964	1,500	544	2.76	810	776	926	828
1965	1,272	481	2.64	1,230	610	857	496
1966	1,465	542	2.70	1,428	610	804	430
1967	1,299	530	2.45	1,783	651	14	62
1968	1,526	602	2.53	1,507	560	0	1
1969	1,277	531	2.40	1,200	228	142	142
1970	1,519	551	2.76	851	275	133	133
1971	1,732	570	3.04	1,931	345	439	439
1972	1,618	523	3.09	1,386	216	299	299
1973	1,838	525	3.50	1,490	227	671	1
1974	1,884	576	3.27	2,850	258	963	89
1975	2,033	586	3.47	2,970	521	1,021	10
1976	1,962	586	3.35	2,930	690	1,205	253
1977	1,699	504	3.37	3,346	719	1,814	523
1978	1,933	580	3.33	3,759	980	1,509	360
1979	1,856	585	3.17	3,609	934	1,639	427

Sources: The production figures for 1949-78 are from Food and Agriculture Organization of the United Nations (FAO), *FAO Production Yearbook,* various issues (Rome: FAO, various years). The 1979 figure was supplied by the Egyptian Ministry of Agriculture.

The figures for the area sown with wheat from 1949 to 1977 are also from FAO, *FAO Production Yearbook,* various issues. The 1978 and 1979 figures were supplied by the agricultural attaché in the United States' embassy in Cairo.

The wheat yield figures were derived by dividing the wheat production figures in this table by the wheat area figures.

The 1949-76 figures for wheat imports are from FAO, *FAO Trade Yearbook,* various issues (Rome: FAO, various years). The 1977-79 figures, from the American agricultural attaché in Cairo, were supplied by the General Authority for Supply Commodities of the Egyptian Ministry of Supply.

The sources for the flour import figures are the same as for wheat imports. Careful cross checking of the sources for both these series indicates that the data include both commercial sales and foreign aid (which includes concessional sales). Some misreporting is evident, however. For example, the amount of

(continued)

Table 13—Continued

flour shipped under P. L. 480 in 1960-64 exceeds the amount of imports reported. The same is true for wheat in 1964.

In the absence of data, it is assumed that no wheat was received as foreign aid in 1949-54. The figures for 1955-68, which do not include donations from individual members of the EEC, are from data from a forthcoming IFPRI study on food aid. The 1969-72 figures are from J. Von Braun, "Wirkingen von Nahrungsmittelhilfe in Empfängerlandern—Vergleichende Untersuchung für Agypten und Bangladesch," *Quarterly Journal of International Agriculture* 9 (1980): 364; they include wheat flour. For 1973-77 the data for the United States are from A. A. Goueli, "Food Security in Africa with Special Reference to Egypt," paper presented to Food Security in a Hungry World: An International Food Security Conference, San Francisco, Cal., March 4-6, 1981, p. 151; the data for other countries are from Von Braun, "Wirkingen." Both these sets of data for 1973-77 include wheat flour. For 1978-79 the data for the United States were supplied by the American agricultural attaché in Cairo; data for other countries are from Von Braun, "Wirkingen." These figures, too, include wheat flour.

The sources for the amount of wheat flour received as foreign aid are the same as for the amount of wheat received as foreign aid. But the 1973-79 figures include aid shipments from the United States alone.

Table 14—Availability and consumption of wheat and wheat flour, 1949-78

Year	Production	Commercial Imports	Foreign Aid	Total Imports	Industrial Use	Feed
			(1,000 metric tons)			
1949	1,167	291.3	0.0	291.3	0	0
1950	1,018	566.6	0.0	566.1	0	0
1951	1,209	1,151.6	0.0	1,151.6	0	0
1952	1,087	910.0	0.0	910.0	0	0
1953	1,547	560.1	0.0	560.1	0	0
1954	1,729	79.4	0.0	79.4	0	0
1955	1,451	10.9	3.0	13.9	0	0
1956	1,547	185.9	497.7	683.6	0	0
1957	1,467	831.6	10.4	841.9	0	0
1958	1,412	1,160.4	10.8	1,171.2	0	0
1959	1,443	874.1	505.6	1,379.6	0	0
1960	1,499	95.5	1,192.4	1,287.9	0	0
1961	1,436	0.0	1,346.3	1,259.6	24	0
1962	1,593	0.0	2,028.1	1,568.3	24	0
1963	1,493	224.8	1,879.2	2,103.9	24	0
1964	1,500	0.0	2,076.0	1,887.8	24	0
1965	1,272	531.3	1,545.9	2,077.2	24	0
1966	1,465	874.0	1,401.2	2,275.2	29	0
1967	1,299	2,587.1	100.1	2,687.2	31	0
1968	1,526	2,283.4	1.4	2,284.8	30	0
1969	1,277	1,516.7	142.0	1,658.7	32	0
1970	1,519	1,099.9	133.0	1,232.9	32	0
1971	1,732	1,971.2	439.0	2,410.2	37	0
1972	1,618	1,387.0	299.0	1,686.0	33	0
1973	1,838	1,132.9	672.4	1,805.3	34	0
1974	1,884	2,221.7	1,086.6	3,208.3	41	25
1975	2,033	2,658.7	1,034.9	3,693.6	47	30
1976	1,962	2,331.9	1,556.4	3,888.3	43	35
1977	1,699	1,804.2	2,540.4	4,344.6	43	40
1978	1,933	3,111.1	2,009.0	5,120.1	43	40

(continued)

Table 14—Continued

Year	Seed	Waste	Stock Changes	Total Domestic Consumption	Domestic Consumption Per Capita
		(1,000 metric tons)			(kilograms per capita per year)
1949	112	68	0	1,278	64
1950	112	68	+48	1,357	66
1951	105	74	+37	2,145	102
1952	134	58	+220	1,585	74
1953	129	81	0	1,897	86
1954	124	83	0	1,601	71
1955	119	85	0	1,261	55
1956	114	88	0	2,029	86
1957	109	90	0	2,110	85
1958	109	90	+197	2,187	89
1959	107	130	+197	2,389	95
1960	105	166	−45	2,561	99
1961	105	198	−45	2,414	91
1962	105	198	−45	2,879	106
1963	98	198	+55	3,222	115
1964	98	198	+55	3,013	105
1965	98	203	−21	3,045	104
1966	92	238	+317	3,064	102
1967	94	214	+419	3,228	104
1968	106	248	+244	3,183	100
1969	93	251	−732	3,292	101
1970	98	251	−851	3,222	97
1971	102	294	+400	3,309	97
1972	93	269	−320	3,229	93
1973	95	277	−80	3,317	93
1974	94	232	+250	4,450	122
1975	103	376	+820	4,351	117
1976	105	351	+100	5,216	138
1977	105	349	+140	5,367	139
1978	105	349	+156	6,360	157

Sources: The figures for production, commercial imports, and foreign aid are all from Table 13. Commercial imports were calculated as the sum of wheat imports and wheat flour imports (divided by 0.72 to give the grain equivalent) minus aid shipments of wheat and wheat flour (again, divided by 0.72 to give the grain equivalent). In 1961, 1962, and 1964, reported foreign aid shipments of wheat (in grain equivalents) exceeded total imports reported. In these years, commercial imports have been set at zero. Foreign aid is the sum of aid shipments of wheat flour (divided by 0.72 to give the grain equivalent) and wheat.

The total import figures are the sums of commercial imports and foreign aid.

The industrial use figures for 1949-60 are arbitrarily set at zero because data are lacking. The 1961-65 figures are the averages reported by the Food and Agriculture Organization of the United Nations (FAO) for those years. The 1965-77 figures are from FAO, *FAO Food Balance Sheets*, various issues (Rome: FAO, various years). The 1978 figure is equal to the 1977 figure.

For feed the 1949-73 figures were set at zero. The 1974-77 figures are from FAO, *FAO Food Balance Sheets*, various issues, and the 1978 figure is equal to the 1977 figure.

The seed figure for 1949 is set equal to the 1950 figure. That figure is from FAO, as are the 1951 and 1952 figures. The 1953-56 figures were interpolated. The 1957 and 1958 figures are the average of the 1957/58 and 1958/59 figures from FAO. The 1963 and 1964 figures are an average from FAO. The 1965-77 figures are from FAO, *FAO Food Balance Sheets*, various issues. The 1978 figure is equal to the 1977 figure.

The same procedure was followed to get the waste figures that was used to get the seed figures. Their source was FAO, *FAO Food Balance Sheets*, various issues. Flour waste is included in the 1961-68 figures, using a conversion factor of 0.72.

The figures for stock changes are from FAO, *FAO Food Balance Sheets*, various issues. Zero is used when no data are given. The 1978 figure is from a personal communication from the Ministry of Agriculture in Cairo.

Total domestic consumption is the sum of production and total imports minus the sum of industrial use, feed, seed, waste, and stock changes. Domestic consumption per capita is that total divided by the population figure for that year in Table 12.

Table 15—Analysis of the gap between consumption and production of wheat and wheat flour, 1949-78

Year	Gap	Percent of Gap Closed by:		
		Commercial Imports	Aid	Other
1949	111	262	0	−162
1950	339	167	0	−67
1951	936	123	0	−23
1952	498	183	0	−83
1953	350	160	0	−60
1954	−128	62	0	+38
1955	−190	6	2	+92
1956	482	39	103	−42
1957	643	129	2	−31
1958	775	150	1	−51
1959	946	92	53	−46
1960	1,062	9	112	−21
1961	978	0	138	−38
1962	1,286	0	158	−58
1963	1,729	13	109	−22
1964	1,513	0	137	−37
1965	1,773	30	87	−17
1966	1,599	55	88	−42
1967	1,929	134	5	−39
1968	1,657	138	0	−38
1969	1,873	81	8	+11
1970	1,703	65	8	+28
1971	1,577	125	28	−53
1972	1,611	86	19	− 5
1973	1,479	77	45	−22
1974	2,566	83	42	−25
1975	2,318	115	45	−59
1976	3,254	72	48	−19
1977	3,668	49	69	−18
1978	4,427	70	45	−16

Sources: The gap figures are the differences between the total domestic consumption and production figures in Table 14. The percent of the gap closed by commercial imports is total imports as a percentage of production; the percent of the gap closed by aid is foreign aid as a percentage of production. The percent of the gap closed by "other" represents the net effect of stock changes, feed and seed, waste, and industrial uses. See the appropriate columns in Table 14.

Table 16—Prices of wheat and wheat flour, 1949-79

Year	World Prices		Domestic Wheat Prices	
	Wheat	Flour	Producers	Consumers
	(LE/ton)			
1949	38.5	46.5	21.3	12.6
1950	42.6	51.4	21.3	12.6
1951	46.2	55.8	21.3	12.6
1952	45.9	49.8	21.3	12.6
1953	45.8	48.5	30.3	17.2
1954	26.5	44.4	30.3	17.2
1955	27.0	36.5	26.6	17.2
1956	27.6	28.7	26.6	17.2
1957	27.3	25.4	26.6	17.2
1958	22.7	23.6	26.6	17.2
1959	23.1	25.0	26.6	17.2
1960	21.3	23.8	28.6	23.0
1961	22.0	24.7	28.4	23.0
1962	28.3	33.3	28.6	23.0
1963	32.3	37.0	28.8	23.0
1964	37.6	40.7	27.4	23.0
1965	31.7	37.1	30.2	29.0
1966	30.0	37.1	32.8	29.0
1967	30.9	35.5	37.4	29.0
1968	27.5	31.9	32.2	29.0
1969	26.6	29.2	32.8	29.0
1970	24.2	28.9	38.7	29.0
1971	30.3	31.9	35.4	29.0
1972	30.2	25.1	35.1	29.0
1973	37.0	46.8	38.1	30.0
1974	103.4	112.9	46.9	30.0
1975	79.5	116.0	51.3	28.0
1976	65.1	90.1	47.1	29.0
1977	53.2	80.3	54.1	30.0
1978	56.5	77.9	61.7	24.7
1979	77.4	97.2	64.0	24.7

Year	Subsidy Equivalents		Real Wheat Prices		
	Producers	Consumers	World	Producers	Consumers
	(percent)			(LE/ton)	
1949	−44.7	+67.7	91.6	42.4	25.1
1950	−50.0	+70.4	115.0	40.0	23.7
1951	−53.9	+72.7	104.9	36.9	21.8
1952	−53.6	+73.9	102.1	37.0	21.9
1953	−33.8	+66.2	106.6	56.5	32.1
1954	+14.3	+35.1	63.1	58.9	33.5
1955	−1.5	+36.3	64.5	52.0	33.6
1956	−3.6	+37.7	62.8	50.7	32.8
1957	−2.6	+37.0	60.7	48.7	31.5
1958	+17.2	+24.2	51.6	48.6	31.4
1959	+15.2	+25.5	53.7	48.5	31.4
1960	+34.3	−8.0	48.4	52.0	41.8
1961	+29.1	−4.5	50.2	51.3	41.5
1962	+1.1	+17.7	64.3	53.2	42.8
1963	−10.8	+28.8	71.7	53.1	42.4
1964	−27.1	+38.8	83.5	48.8	41.0
1965	−4.7	+8.5	69.1	46.8	45.0
1966	+9.3	+3.3	63.9	46.7	41.3
1967	+21.0	+6.1	65.7	52.8	41.0
1968	+17.9	−5.5	58.7	46.1	41.5
1969	+23.3	−9.0	55.2	45.5	40.2
1970	+59.9	−19.8	46.5	51.7	38.7
1971	+16.8	+4.3	55.2	45.9	37.8

(continued)

Table 16—Continued

1972	+16.2	+4.0	50.0	44.5	36.8
1973	+3.0	+18.9	51.6	46.3	36.5
1974	−54.0	+71.0	116.0	57.5	32.9
1975	−35.5	+64.8	79.7	51.3	28.0
1976	−27.6	+55.5	64.4	42.7	26.3
1977	+1.7	+43.6	48.4	43.5	24.1
1978	+9.2	+65.5	45.3	44.7	17.9
1979	−17.3	+50.8	54.5	42.2	16.3

Sources: The world price of wheat is the import price (c.i.f.) of wheat in Egyptian pounds (LE) per metric ton. The 1949 figure was estimated by linking to commodity price data in International Monetary Fund, *International Financial Statistics Yearbook, 1979* (Washington, D.C.: IMF, 1979), p. 76. The 1950 and 1951 figures were estimated by linking to the U.S. f.o.b. price (Atlantic ports) in International Bank for Reconstruction and Development, *Commodity Trade and Price Trends* (Washington, D.C.: IBRD, August 1979), p. 48. Egypt, Ministry of Foreign Trade, *Annual Statement of Foreign Trade,* various issues, was the source for the 1952-54 and 1956-59 figures. The 1955 figure was interpolated. The 1960-79 figures are from Egypt, Central Agency for Public Mobilization and Statistics, *Monthly Bulletin of Foreign Trade,* various issues.

The world price of flour is the import price of wheat flour in LE per metric ton. The 1949-51 figures are based on the world prices of wheat and use the average price of wheat relative to flour for 1952-54. The 1952-59 figures are from Egypt, Ministry of Foreign Trade, *Annual Statement on Foreign Trade,* various issues. The 1960-79 figures are from Egypt, Central Agency for Public Mobilization and Statistics, *Monthly Bulletin of Foreign Trade,* various issues.

The domestic wheat prices for producers are in LE per metric ton. They are from the Ministry of Agriculture in Cairo. The 1949 price is assumed to be equal to the 1950 price. The 1950-59 prices are those announced by the government. The 1960-79 prices are the average prices received by farmers.

The domestic wheat prices for consumers are in LE per metric ton. The 1949 price is assumed to be equal to the 1950 price. The 1950-59 prices are the average prices of wheat in Cairo given in Egypt, Ministry of Finance and Economy, *Monthly Bulletin of Agricultural and Economic Statistics,* various issues. The data in this source are in piastres per keila. The prices for 1953-59 are Hindi wheat prices; the prices for 1950-52 are for commercial middling wheat, which is made up of both Hindi and Mawari grades. The 1960-64 prices are interpolations between 1955-59 and 1965-69. The 1965-76 prices are for wheat supplied to mills. They are from W. Cuddihy, *Agricultural Price Management in Egypt,* World Bank Staff Working Paper No. 338 (Washington, D.C.: International Bank for Reconstruction and Development, April 1980), p. 132. The 1977-79 prices are the selling prices of wheat to mills. They are from K. Korayem, "The Impact of the Elimination of Food Subsidy on the Cost of Living of the Urban Population in Egypt," paper presented to the International Labour Organisation, Income Distribution and International Employment Policies Branch, Geneva, May 1980, p. 70.

Subsidy equivalents are the differences between producer and consumer prices and the landed (c.i.f.) import price of wheat expressed as a percentage of the landed import price. Real wheat prices are in LE per metric ton. The world price is deflated by the international price index in Table 12. The producer and consumer prices are deflated by the consumer price index in Table 12.

Table 17—Prices received by farmers for major crops, 1949-79

Year	Wheat	Cotton	Maize	Rice
		(LE/ton)		
1949	22.0	95.5	16.8	21.5
1950	21.3	95.5	16.4	17.5
1951	21.3	95.5	16.4	16.1
1952	21.3	95.5	16.1	15.9
1953	30.3	95.5	16.9	12.3
1954	30.3	95.5	17.7	16.9
1955	26.6	95.5	21.5	18.0
1956	26.6	95.5	26.0	18.0
1957	26.6	95.5	22.0	18.0
1958	26.6	95.5	22.0	18.0
1959	26.6	95.5	23.3	18.0
1960	28.6	95.5	27.9	18.0
1961	28.4	92.6	26.3	18.0
1962	28.6	94.2	25.4	18.0
1963	28.8	96.8	22.9	18.0
1964	27.4	106.9	26.9	19.2
1965	30.2	102.4	27.9	21.3
1966	32.8	101.9	26.8	26.9
1967	37.4	108.9	31.9	30.2
1968	32.2	110.1	36.8	31.6
1969	32.8	114.5	28.9	31.0
1970	38.7	115.5	32.7	30.1
1971	35.4	115.8	33.4	29.1
1972	35.1	126.8	36.8	28.4
1973	38.1	123.9	42.0	29.7
1974	46.9	149.2	50.8	38.1
1975	51.3	161.9	50.8	42.6
1976	47.1	203.2	50.3	52.9
1977	54.1	215.9	76.1	56.2
1978	61.7	221.4	71.4	66.1
1979	64.0	297.1	70.9	65.9

Year	Relative Prices			Indexes of Relative Prices (1970=100)		
	Wheat/ Cotton	Wheat/ Maize	Wheat/ Rice	Wheat/ Cotton	Wheat/ Maize	Wheat/ Rice
			(LE/ton)			
1949	0.22	1.31	1.02	65	111	79
1950	0.22	1.30	1.22	65	110	95
1951	0.22	1.30	1.32	65	110	102
1952	0.22	1.32	1.34	65	112	104
1953	0.32	1.79	2.46	94	152	191
1954	0.32	1.71	1.79	94	145	139
1955	0.28	1.24	1.48	82	105	115
1956	0.28	1.02	1.48	82	86	115
1957	0.28	1.21	1.48	82	103	115
1958	0.28	1.21	1.48	82	103	115
1959	0.28	1.14	1.48	82	97	115
1960	0.30	1.03	1.59	88	87	123
1961	0.31	1.08	1.58	91	92	122
1962	0.30	1.13	1.59	88	96	123
1963	0.30	1.26	1.60	88	107	124
1964	0.26	1.02	1.43	76	86	111
1965	0.29	1.08	1.42	85	92	110
1966	0.32	1.22	1.22	94	103	95
1967	0.34	1.17	1.24	100	99	96
1968	0.34	1.02	1.18	100	86	92
1969	0.29	1.13	1.06	85	96	82
1970	0.34	1.18	1.29	100	100	100
1971	0.31	0.97	1.22	91	82	95
1972	0.28	0.95	1.24	82	81	96

(continued)

Table 17—Continued

1973	0.31	0.85	1.28	91	72	99
1974	0.31	0.92	1.23	91	78	95
1975	0.32	1.02	1.20	94	86	93
1976	0.23	0.93	0.89	68	79	69
1977	0.25	0.70	0.96	73	59	74
1978	0.28	0.86	0.93	82	73	72
1979	0.22	0.90	0.97	65	76	75

Sources: The basic data for 1950-78 are from J. Von Braun, "Agricultural Sector Analysis and Food Supply in Egypt," Joint Project of the Institute of National Planning, Cairo, and the Institute of Agricultural Economics, University of Göttingen, February 1980. (Mimeographed.) Almost identical data (from the Ministry of Agriculture) is given in K. Ikram, *Egypt: Economic Management in a Period of Transition* (Baltimore, Md.: Johns Hopkins University Press, 1980), p. 424. For 1949 the data for wheat, maize, and rice are from D.C. Mead, *Growth and Structural Change in the Egyptian Economy* (Homewood, Ill.: R.D. Irwin, Inc., 1967), Table III-B-1. The cotton value is assumed to be equal to its value in 1950. The 1979 data are from the agricultural attaché at the American Embassy in Cairo.

Table 19—Cotton area, production, and exports, 1949-79

Year	Cotton Area	Cotton Production (Lint)	Cotton Exports
	(1,000 hectares)	(1,000 metric tons)	
1949	711	387	358.5
1950	829	382	386.5
1951	832	363	254.9
1952	826	446	270.4
1953	556	318	346.5
1954	663	348	287.7
1955	763	335	277.4
1956	694	325	234.8
1957	764	405	264.1
1958	800	446	281.4
1959	739	457	317.8
1960	789	478	374.2
1961	834	336	295.3
1962	696	457	250.5
1963	684	442	289.7
1964	677	504	291.1
1965	798	521	329.7
1966	781	462	347.6
1967	683	437	206.4
1968	615	437	264.0
1969	681	541	252.7
1970	683	509	285.3
1971	690	510	323.4
1972	652	514	295.0
1973	672	490	284.8
1974	609	441	232.2
1975	560	382	185.1
1976	525	396	165.2
1977	598	409	143.9
1978	500	438	154.0
1979	503	484	147.0

Sources: The cotton area figures for 1949-60 are from Food and Agriculture Organization of the United Nations (FAO), *World Crop Statistics; Area, Production and Yield: 1948-1964* (Rome: FAO, 1966). The 1961-71 figures are from FAO, *FAO Production Yearbook*, various issues (Rome: FAO, various years). The source of the 1972-75 figures is FAO, *Monthly Bulletin of Agricultural Economics and Statistics*, various issues; for the 1976-78 figures it is K. Ikram, *Egypt: Economic Management in a Period of Transition* (Baltimore, Md.: Johns Hopkins University Press, 1980), p. 419. The 1979 figure was provided by the agricultural attaché at the American Embassy in Cairo.

The 1949-79 figures for cotton production are from FAO, *FAO Production Yearbook*, various issues. The 1979 figure was provided by the agricultural attaché at the American Embassy in Cairo.

The cotton export figures for 1949-77 are from FAO, *FAO Trade Yearbook*, various issues (Rome: FAO, various years). The figures for 1978 and 1979 were provided by the agricultural attaché at the American Embassy in Cairo.

Table 20—Area, production, and average yield of the major crops, 1950-79

Year	Wheat			Maize		
	Area	Production	Yield	Area	Production	Yield
	(1,000 feddan)	(1,000 metric tons)	(kilograms/ feddan)	(1,000 feddan)	(1,000 metric tons)	(kilograms/ feddan)
1950	1,371	1,017	742	1,451	1,306	900
1951	1,496	1,209	808	1,655	1,421	858
1952	1,402	1,089	777	1,679	1,506	882
1953	1,791	1,547	865	2,017	1,853	920
1954	1,795	1,729	961	1,905	1,568	823
1955	1,524	1,451	953	1,833	1,714	932
1956	1,571	1,547	982	1,836	1,652	899
1957	1,514	1,467	978	1,769	1,498	848
1958	1,426	1,412	991	1,955	1,758	899
1959	1,476	1,443	974	1,860	1,500	806
1960	1,456	1,499	1,029	1,821	1,691	929
1961	1,384	1,436	1,037	1,603	1,617	1,009
1962	1,455	1,593	1,095	1,832	2,004	1,094
1963	1,349	1,493	1,110	1,721	1,867	1,085
1964	1,295	1,500	1,158	1,660	1,934	1,165
1965	1,144	1,277	1,111	1,450	2,141	1,476
1966	1,291	1,465	1,135	1,575	2,376	1,509
1967	1,249	1,291	1,036	1,485	2,163	1,456
1968	1,413	1,518	1,074	1,554	2,297	1,478
1969	1,246	1,269	1,018	1,484	2,366	1,594
1970	1,304	1,516	1,163	1,504	2,393	1,592
1971	1,349	1,729	1,282	1,522	2,342	1,539
1972	1,239	1,616	1,304	1,531	2,417	1,579
1973	1,248	1,837	1,472	1,654	2,507	1,515
1974	1,370	1,884	1,375	1,755	2,640	1,505
1975	1,394	2,033	1,459	1,830	2,781	1,520
1976	1,404	1,962	1,397	1,891	3,048	1,612
1977	1,211	1,699	1,403	1,765	2,725	1,544
1978	1,379	1,933	1,402	1,907	3,197	1,676
1979	1,391	1,856	1,334	1,913	2,938	1,536

Year	Rice			Cotton		
	Area	Production	Yield	Area	Production	Yield
	(1,000 feddan)	(1,000 metric tons)	(kilogram/ feddan)	(1,000 feddan)	(1,000 metric tons)	(kilogram/ feddan)
1950	700	1,242	1,776	1,974	1,226	620
1951	488	620	1,275	1,979	1,165	589
1952	374	517	1,381	1,966	1,364	693
1953	424	652	1,541	1,323	920	695
1954	610	1,118	1,835	1,578	1,021	647
1955	600	1,309	2,179	1,816	983	541
1956	690	1,573	2,280	1,652	964	583
1957	731	1,709	2,335	1,819	1,182	649
1958	519	1,082	2,083	1,904	1,298	681
1959	729	1,535	2,108	1,759	1,312	745
1960	706	1,486	2,105	1,873	1,380	737
1961	537	1,142	2,126	1,986	1,004	506
1962	830	2,039	2,456	1,657	1,335	806
1963	959	2,219	2,313	1,627	1,313	806
1964	962	2,036	2,117	1,611	1,426	891
1965	848	1,788	2,109	1,900	1,501	791
1966	844	1,679	1,989	1,859	1,289	693
1967	1,075	2,279	2,121	1,826	1,208	743
1968	1,204	2,586	2,147	1,464	1,210	827
1969	1,191	2,557	2,146	1,622	1,480	912
1970	1,142	2,605	2,280	1,627	1,404	863
1971	1,137	2,534	2,228	1,525	1,418	929
1972	1,146	2,507	2,189	1,552	1,422	917
1973	997	2,274	2,281	1,600	1,368	855

(continued)

Table 20—Continued

1974	1,053	2,247	2,129	1,453	1,204	828
1975	1,053	2,423	2,314	1,346	1,061	788
1976	1,078	2,300	2,134	1,247	1,073	860
1977	1,040	2,275	2,188	1,423	1,089	765
1978	1,030	2,351	2,283	1,209	1,175	972
1979	1,037	2,510	2,420	1,196	1,210	1,012

Sources: The figures for 1950-78 are from K. Ikram, *Egypt: Economic Management in a Period of Transition* (Baltimore, Md.: Johns Hopkins University Press, 1980), pp. 422-423. The 1979 figures are from the agricultural attaché at the American Embassy in Cairo.

Cotton production is for unginned quantities. For 1979 the lint output was converted to unginned output using the average ratio of 1977 and 1978.

Table 21—Foreign exchange, 1949-79

Year	International Reserves Excluding Gold	Imports	Gold Reserves	Use of IMF Credit	Official Unrequited Transfers	London Market Gold Price
	(U.S. $ million)		(million ounces)	(U.S. $ million)		(U.S.$/ounce)
1949	936	512	1.54	0	0	35
1950	896	618	2.80	0	0	35
1951	798	694	4.97	0	0	35
1952	554	653	4.97	0	0	35
1953	528	474	4.97	0	0	35
1954	544	444	4.97	0	0	35
1955	458	572	4.97	0	0	35
1956	354	593	5.37	0	24	35
1957	277	629	5.37	15	10	35
1958	252	619	4.97	15	−1	35
1959	131	694	4.97	12	3	35
1960	90	766	4.97	30	−2	35
1961	29	715	4.97	27	−8	35
1962	49	887	4.97	85	−4	35
1963	42	934	4.97	103	−9	35
1964	84	927	3.98	109	5	35
1965	54	960	3.98	95	10	35
1966	63	954	2.67	70	6	35
1967	102	956	2.67	74	122	35
1968	75	850	2.67	72	251	39
1969	52	963	2.67	51	288	41
1970	74	1,192	2.43	49	304	36
1971	57	1,244	2.43	76	268	51
1972	47	1,287	2.43	26	290	58
1973	260	1,572	2.43	75	635	97
1974	252	3,205	2.43	114	993	157
1975	194	4,305	2.43	80	986	161
1976	240	4,226	2.43	207	623	125
1977	431	4,533	2.43	310	404	148
1978	492	5,309	2.47	386	319	193
1979	529	6,713	2.47	325	49	307

Sources: The figures for international reserves for 1950-79 are from International Monetary Fund (IMF), *International Financial Statistics Yearbook, 1980* (Washington, D.C.: IMF, 1980), line 1 l.d, pp. 166-167. The 1949 figure is from the same source, p. 168.

The 1953-59 import figures are from IMF, *International Financial Statistics, 1980,* line 77 ab d, pp. 168-169. The figures were multiplied by 1.1 to convert them from f.o.b. to c.i.f. The 1949-52 figures are from IMF, *International Financial Statistics Yearbook, 1979* (Washington, D.C.: IMF, 1979), line 71, p. 168. They were converted from LE million using the exchange rates in Table 12.

The figures for gold reserves, use of IMF credit, and official unrequited transfers are from IMF, *International Financial Statistics, 1979,* lines 1ad, 2e.d, and 77afd, pp. 168-171; and IMF, *International Financial Statistics, 1980,* lines 1ad, 2e.d, and 77afd, pp. 166-169.

The prices of gold on the London market are from IMF, *International Financial Statistics, 1979,* line 76kr, p. 75, and IMF, *International Financial Statistics, 1980,* line 76kr, p. 75.

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