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UTILIZATION OF U.S. FARM SURPLUSES
FOR WELFARE AND DEVELOPMENT PROGRAMS
AT HOME AND ABROAD

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Prepared for:

Agency for International Development

June 1972

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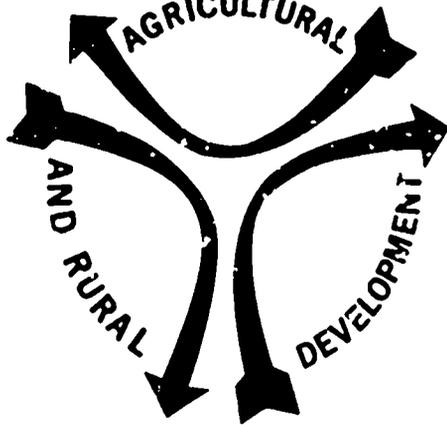
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CARD REPORT

**UTILIZATION OF
U.S. FARM SURPLUSES
FOR WELFARE AND
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AT HOME AND ABROAD**

41

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UTILIZATION OF U.S. FARM SURPLUSES
FOR WELFARE AND DEVELOPMENT PROGRAMS
AT HOME AND ABROAD

by

Keith D. Rogers, Leo V. Mayer and Earl O. Heady

Center for Agricultural and Rural Development

Iowa State University

in cooperation with

Agency for International Development

Washington, D.C.

CARD Report No. 41

June 1972

Ames, Iowa



PUBLICATION DATA SUSPENSE	1. Report No. 338.19-R727a	2.	3. Recipient's Accession No. 18-219720
4. Title and Subtitle "Utilization of U.S. Farm Surpluses for Welfare and Development Programs at Home and Abroad"			5. Report Date June 1972
7. Author(s) Keith D. Rogers, ^{and} Leo V. Mayer, and Earl O. Heady			8. Performing Organization's Name and Address
9. Performing Organization Name and Address Iowa State University, Center for Agricultural & Rural Development Ames, Iowa 50010			10. Project/Task/Work Unit No. Proj. 931-17-146-491
12. Sponsoring Organization Name and Address Department of State Agency for International Development Washington, D.C. 20523			11. Contract/Grant No. Contract AID/csd-2163, Proj. 931-17-146-491
5. Supplementary Notes			13. Type of Report & Period Covered Research Report 7/70 - 6/72

6. Abstracts

This report examines the potential impact, both at home and abroad, of distributing surplus food commodities at concessional prices to provide direct benefits to low-income consumers in the short run, and to promote economic development and raise real income levels in the long run.

Modifications currently under consideration for U.S. welfare programs raise possibilities for using surplus food to finance work projects and to improve nutritional levels of low-income consumers in developed countries as well as developing countries. The basic economic considerations are examined in this report.

Primary emphasis of this study was on gathering and analyzing data regarding P.L. 480 food aid programming, developing conceptual and analytical models for evaluating inter-relationships between food aid and economic development, and providing guidelines for programming food aid shipments and associated self help assistance.

8. Identifiers/Operational Terms

*Food aid programs, *Public Law 480, *Social welfare

338

19. Security Classification UNCLASSIFIED	20. Security Classification UNCLASSIFIED	21. Date of Review 89 90
22. Security Classification UNCLASSIFIED	23. Security Classification UNCLASSIFIED	24. Date of Review 850/40.95

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the agricultural sector at home as well as the agricultural sectors of our neighbors abroad. Nations must constantly seek to adjust their activities to improve the lot of mankind in less fortunate areas of the world. Food aid is one tool which can assist in that process. This report refines the use of food aid to eliminate negative side effects.

Ames, Iowa
June 21, 1972

K.D.R.
L.V.M.
E.O.H.

Preface

This report examines the potential impact, both at home and abroad, of distributing surplus food commodities at concessional prices to provide direct benefits to low-income consumers in the short run, and to promote economic development and raise real income levels in the long run. The problems of low-income consumers in the ghetto of New York or Los Angeles are the same as those of low income consumers in Bombay, India, or Seoul, Korea; only the degree of seriousness is different.

Many proposals have been made for using surplus food from developed countries to satisfy food needs in developing countries. Much less has been said about low-income consumers in developed countries. Modifications currently under consideration for U.S. welfare programs raise possibilities for using surplus food to finance work projects and to improve nutritional levels of low-income consumers in developed countries as well as developing countries. The basic economic considerations involved in such proposals are examined in this report.

The report evolves from an Agency for International Development contract (AID/cds-2163) with Iowa State University, which sought to define and examine the essential relationships among food aid, agricultural development, and economic growth. Primary emphasis of the project was on gathering and analyzing data regarding P.L. 480 food aid programming, developing conceptual and analytical models for evaluating interrelationships between food aid and economic development, and providing guidelines for programming food aid shipments and associated self-help assistance.

This report is only one of several which have examined various aspects of food aid programs. Other reports have examined questions of payment terms, pricing policies, developmental effects, future needs, and possibilities for using agricultural abundance from the United States for humanitarian purposes around the world. The major purpose of this report is to improve national policy decisions on a topic which affects

Executive Summary*

The utilization and effectiveness of food aid in promoting economic development is closely associated with and a function of (a) the manner and terms by which food aid is supplied, (b) the program objectives of donor countries, (c) the income level of recipient consumers, (d) the distributional methods used to allocate food aid among consumers, (e) the magnitude of unemployment in the recipient economy, (f) the size of food deficits, if any, and (g) the responsiveness of food producers in recipient countries to food price changes. The manner and terms by which donors provide food aid are closely linked to their own objectives, which may include surplus disposal, emergency relief, expansion of commercial exports, or economic development of recipient countries. The relative weights on each objective influence the contractual terms, varying from grants and loans with lenient conditions for payments to short-term, hard-currency sales and strict conditions for payments.

Unless food aid is provided to recipient countries as a grant or donation, there is some positive cost associated with its procurement. Extended credit terms reduce the immediate obligation, but increase the future obligation by the amount of an interest factor. Continuous contracting of food aid not only obligates the recipient country to a future liability, but also can actually move the country into a position of greater annual debt obligation than the annual amount of aid received. When a constant value of aid is given annually and repayment is over a 20-year period at 4 percent annual interest, payments will equal the value of aid received annually after about 13.5 years. Afterwards, the annual net value of aid is negative; payments exceed new aid received.

The present trend toward concessional sales contracts, with long-term credit provisions which result in eventual net negative additions to government resources, emphasizes the importance of recipient countries investing an amount equivalent to the food aid so that increases

*For the benefit of readers, the authors wish to briefly summarize the major issues that have been examined in the ongoing food aid research program at Iowa State University and that form the basis for this report.

in productivity occur. At minimum, increases in productivity must exceed the interest cost on the aid contract if food aid is to increase the long-run production potential of the recipient economy. The necessary conditions under which food aid can be used as an investment depend on numerous interrelated aspects of income levels, consumer behavior, distribution methods, and response of producers to price changes.

Food aid can effectively serve to bolster lagging agricultural supply in most developing economies where a large portion of consumer income is spent on food. By investing through the use of food aid in activities that expand food production, developing countries can promote food production to help satisfy excess food demand. At the same time, expanding labor-intensive production activities will lead to an expanded demand for labor, increased employment, and consequently increased levels of personal income. The mechanism for promoting increased food production can vary from underwriting research and development activities to providing resources and overhead investment in new institutions such as credit, transportation, and marketing. The economy in most developing countries is dominated by the agricultural sector because that sector has the largest proportion of the population. Thus, development within agriculture can make a major contribution toward meeting minimum food requirements for the society. A developing agriculture can release labor and provide raw materials for use in industrial development. Also, because of its relative size, agriculture in early stages of development will provide a major proportion of the demand for industrial output.

Because a large share of total consumer expenditures in developing countries is for food and the growth of supply tends to lag growth of demand in these countries, the food market can be a major source of inflation. In these circumstances, food aid offers a major means of restraining prices. If food aid is distributed in return for services or revenue, it can finance development investments that will increase domestic food production and combat inflation on a permanent basis.

Food aid also can be used to expand other domestic production and provide import substitutes that result in foreign exchange earnings. The increased availability of foreign exchange can further aid economic development by allowing for importation of critical material and equipment to augment domestic investments.

The impact of food aid on an economy depends most importantly on consumer response. The two major variables that influence consumer response are income and price levels. Engel's Law specifies that, as income increases, the percentage of income spent on food declines, resulting in an increased proportion being spent on nonfood items. Stratifying countries for which P.L. 480 contracts were authorized in 1960 by income level, three annual per-capita income levels were selected: low (\$75), medium (\$250), and high (\$450) income.

Through a combination of economic principles, price and income elasticity estimates from various empirical studies, and international data relating to average consumption estimates, consumer response patterns were established for developing countries. According to the results, a strong preference for food by low-income consumers (\$75) gives an average propensity to consume food of 0.69, a marginal propensity to consume food of 0.55, and a corresponding income elasticity of demand for food of 0.80. Thus, the initial impact of supplying food aid to low-income consumers directly as food or indirectly as wages is an increase in the level of real income, resulting in 55 percent being spent to increase food consumption and 45 percent being spent to increase consumption of other items. Also, when food is distributed directly, roughly one-half will be traded away in the market system to obtain non-food commodities. Assuming that, previous to receiving food aid, all the food supply was produced domestically or that previous levels of imports are maintained, 45 percent of the commodity aid will compete directly with domestic food production with a depressing effect on prices.

For consumers at the medium income level (\$250), the average propensity to consume food was estimated at 0.47, marginal propensity to

consume at 0.34, and the corresponding elasticity of food demand at 0.73. The incremental real income resulting from food aid generates additional demand equal to 34 percent of the value of food while demand for other items increases by 66 percent of food aid value. As in the low-income case, the 66 percent traded or substituted for nonfood commodities creates direct competition for domestic production. The portion of food aid for which demand is not created increases by about 50 percent from the low-income level to the medium income level and, thus, represents a greater price-depressing force.

At the high income level (\$450), 39 percent of the budget is allocated to food on the average, but only 26 percent of marginal income is spent on food for a corresponding income elasticity of 0.66. Each dollar of food aid at the high income level generates demand for 26 cents of food and 74 cents of nonfood items. Consequently, 74 percent reflects on the market as competition for domestic production.

At each income level, some portion of the food aid replaces consumption of domestically produced food and consequently has a depressing effect on domestic prices. Lower prices cause lower gross incomes for food producers and can reduce domestic food supply if producers are responsive to market prices and incomes. Food aid increases consumer welfare and the demand for nonfood items, but does so, however, at the expense of the domestic agricultural producers unless an offsetting decrease occurs in commercial imports.

The response of consumers to increased real income also affects the substitutability of food aid for other forms of capital to finance development investments. Essentially, food aid can substitute for capital on a dollar-for-dollar basis up to the amount of additional demand for food which will be generated by development investments. Beyond this point, supplying additional food aid will create a market surplus with a depressing effect on prices, lowering the value of the food aid directly as well as indirectly through the negative impact on producer welfare.

Theoretically, food aid should be a near-perfect substitute for capital on a project that is composed entirely of labor inputs and employing previously unemployed personnel. On a practical basis, development projects do not consist only of labor inputs and labor will not be supplied totally by employees previously without any income; thus, wages will represent only a portion of the total investment and food purchases will only be a portion of total consumer expenditure. The limit on the amount of food that can substitute directly for capital in financing development is set by the proportion of the total investment that derived food demand represents. Because of the inverse relationship between income level and marginal propensity to consume food, projects which draw labor from low-income groups can utilize a higher proportion of food as investment without a negative impact on domestic prices than can projects which draw labor from higher income groups, ceteris paribus. If a broader concept of commodity aid than just food is considered, the differences among income groups are not as distinct because the marginal propensity to consume all goods varies less among income groups than the marginal propensity to consume food. Consequently, the lower the per-capita real income, the larger is the development effort that can be financed with food or commodity aid per unit of supporting capital.

With the exception of disaster or other emergency situations, an effective demand for food aid commodities will exist in a recipient country only if the food aid (a) displaces commercial imports from donor countries or third-country competitors, (b) displaces domestic production, or (c) expands demand. Various international organizations have developed policy guidelines emphasizing the importance of protecting third-country trade when making concessional sales. P.L. 480 guidelines require that concessional sales be made only as an addition to commercial exports. Protection and expansion of domestic agricultural supply is a primary objective of many developing countries. If the interests of all three groups are considered, only one alternative remains, and that is to expand demand for food in the recipient country.

One means of expanding demand is through direct income and price subsidies in the form of direct distribution of commodities and food stamp programs. India has used fair-price shops with lower prices charged for P.L. 480 imports than for similar domestic commodities on the open market. An analysis of 12 years of data from India indicates that the fair-price shop system has been sufficiently effective in expanding demand so that the negative impact on domestic prices and production has been minimal. It appears that distribution of P.L. 480 commodities to restricted groups at prices below domestically produced commodities has been an effective way to expand food demand in India. Similarly, although it is not possible to measure the aggregate impact of food distribution programs in the U.S. because their magnitude is relatively small, the same general conclusion likely holds.

Under present P.L. 480 provisions, the U.S. is supplying food commodities under three basic plans: cash or credit sales, donations, and barter agreements. Recipient countries, in turn, are distributing food under three basic plans: grants, wages-in-kind, and market sales. In practice, the method of distribution in a recipient country usually is tied to the alternative plan through which food is made available by the U.S. There is no technical or legal reason, however, that the method of supplying and distributing food must be tied together.

Grants or donations of food have traditionally been used for individuals unable to work, such as children, pregnant women, and handicapped adults. Also, grants and donations have been used extensively to meet food shortages in times of disaster or emergency. Utilized for these purposes, grants and donations represent a temporary increase in domestic supply, which is offset by an increase in demand of similar magnitude since the previously mentioned groups will have a high marginal propensity to consume food. Since grants are independent of any increase in production, the major permanent effect is the long-run investment in human capital. A number of studies have found a positive correlation between nutrition levels and productivity. In

most developing countries, however, the problem of reducing unemployment is more pressing than is increasing labor productivity.

Distribution of food through work projects results in an impact very similar to grants. Food causes a temporary supply shift, and likewise, income causes a temporary demand shift. Work projects related to overhead-investment in agriculture result in an additional supply impact which is permanent. The additional output increases food supply more than with grants distribution so that market-clearing prices are lower. With price elasticities of demand for food less than 1.0, the lower prices imply lower income to agricultural producers even if supply increases. As with the grant distribution, the negative impact on producer welfare is a function of the income level of food aid recipients. Consumers, on the other hand, enjoy an increased level of welfare from the lower food prices.

The impact of food sales is limited to the supply side of the food market. Placing food aid on the market increases supply without affecting demand. This movement alone would result in reduced food prices and a negative impact on domestic food production. The total effect depends on how the government uses the revenue received from the food sales. If the government uses this revenue for capital improvements to increase agricultural production, a positive long-run supply effect could presumably be achieved, as with work projects. The capital investment would result in an additional supply shift without an associated demand shift so that equilibrium food prices would be lower than with work projects. Investment in labor-intensive overhead work projects would produce the same supply and demand shifts as with work projects. Thus, the income and welfare implications also would be the same.

The permanent effect of food aid depends on the investment achieved. With grants of food, the investment is in terms of human capital, but also can be in terms of increased productivity through resource development and refinement. The permanent effect in all three cases is the impact that the investment has on production coefficients and the quality of resources which are available. For investment effects to occur,

food must be distributed to groups with a long-run potential for increased productivity. Distributing food only for emergencies or as welfare measures for the old and economically helpless will not increase long-run productivity, although it can be justified for humanitarian reasons. Programs also should include, in a major way, those groups who will benefit most from improved nutrition. These are the groups on whom long-run expansion and growth in economic output depend.

In conclusion, the impact of food aid is highly dependent upon two main issues. One issue revolves around the type of mechanism used to distribute food aid among potential consumers. The economic impacts of food aid differ considerably if the mechanism used for distribution is work projects, simple grants of food to helpless indigents, or sales through normal marketing channels. A second major issue is the income level of recipients. This issue is intimately a part of the first issue but for a full appreciation of its importance, it must be considered separately. The impact of food aid differs substantially depending on whether it is distributed to low-income consumers or to high income consumers. The differences arise from variation in consumer spending patterns, and these must be accounted for if food aid is to have a positive impact. In general, to avoid negative impacts on domestic production food aid must be distributed in a manner that expands demand for food by an amount nearly equal the additional supply of food. This provision can help maximize the positive impact of future shipments of food aid.

INTRODUCTION

Rapid development and adoption of technology in U.S. agriculture has resulted in an excess capacity to satisfy effective domestic demand for food and fiber.¹ For the last decade annual production has exceeded, on the average, domestic needs for wheat and rye by 20.2 million tons, for feed grains (corn, oats, barley and grain sorghum) by 17.7 million tons, and for rice by 41.4 million hundredweight. With the exception of 1967, cotton production has exceeded domestic disappearance each year between 1960 and 1970, with surplus production ranging as high as 6.7 million bales in 1963.

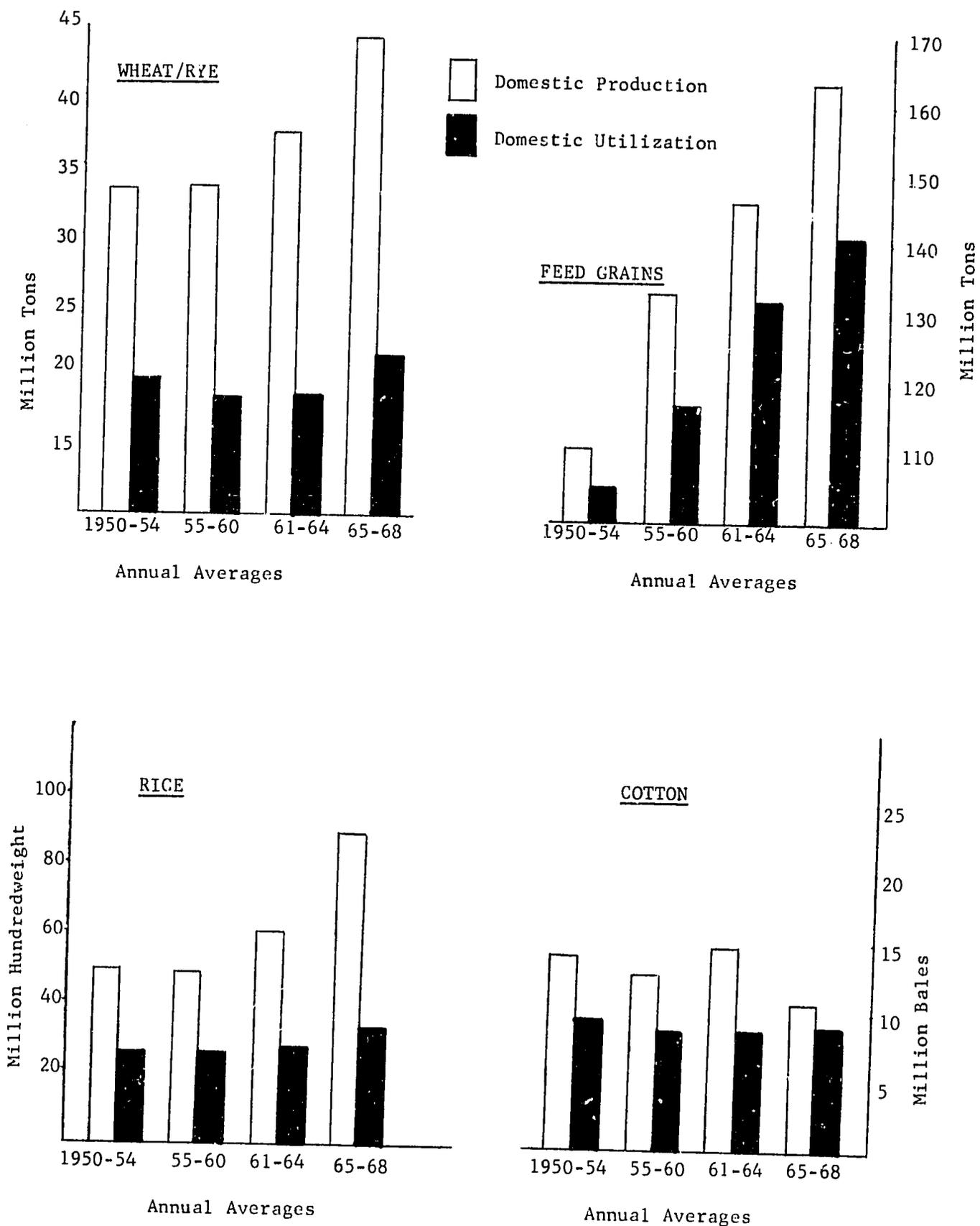
Production and domestic-disappearance data are not perfect measures of excess productive capacity. Net commercial exports also are a part of total demand. But production in excess of domestic disappearance does provide one measure of the effective capability of U.S. agriculture to outproduce domestic demand. Even with government policies and programs for production control, excess production of wheat and rye was consistently 19 to 26 million tons for the 1964-1968 period. Rice production exceeded domestic disappearance by steadily increasing amounts after 1961 with the exception of 1964. Not only has U.S. agricultural output exceeded domestic demands in the past, but the data for the most recent years indicate a rising trend in production relative to domestic disappearance for the grain commodities (Figure 1).

U.S. food-production capacity

Surplus production capacity is not unique to present day U.S. agriculture. The Agricultural Adjustment Act of 1933 (54, p. 31) was enacted specifically to "establish and maintain a balance between production and consumption." Although "surpluses" were not explicitly mentioned in the AAA of 1933, they were implicitly recognized. Congress

¹Effective demand is used in the context of the development literature to distinguish between total demand which reflects nutritional needs and economic demand which reflects buying power.

Figure 1. Domestic production and utilization of selected agricultural commodities in the U. S., 1950-68



Source: U.S.D.A. - Wheat, rye, feed grains, rice, and cotton situation reports.

passed legislation for the specific purpose of expanding consumption while promoting production adjustments of selected basic commodities (wheat, cotton, field corn, hogs, rice, tobacco, milk and milk products). Surpluses were further acknowledged by the establishment of the Federal Surplus Relief Corporation in October of 1933 under the authority of the National Industrial Recovery Act of June 1933 (55, p. 195). The next year "surpluses" were explicitly mentioned in legislation when the AAA of 1933 was amended "to enable the Secretary of Agriculture to finance ...surplus reductions" of basic commodities (adding cattle, rye, flax, barley and grain sorghums) (56, p. 528).

Surplus production referred to by the AAA of 1933 represented stored commodities held by farmers or offered on the market for unusually low prices. Creation of the Commodity Credit Corporation (CCC) in October 1933 by Presidential Executive Order (48, p. 73) represented the beginning of a second concept of surpluses. Although closely related, the second concept is distinctly different in that it related to stocks of commodities held by the CCC.

During the early stages of CCC price support programs, stocks were accumulated at levels considered reasonable to protect against emergencies and to carry out price stabilization policies of the government. But by the early 1950's CCC stocks had accumulated, as Egbert stated, "to a level far above conceivable emergency requirements" (14, p. 1), and the second concept of surpluses came into widespread use. The U.S. entered a stage where not only did U.S. farmers outproduce commercial demand, but the government often accumulated stocks far above estimated emergency reserves.

In May 1956 Congress passed Public Law 540 (P.L. 540) which, in Section 201(b), instructed the Secretary of Agriculture to report annually on disposal of CCC stocks. That report required the Secretary to show "(a) the quantity of surplus commodities on hand, (b) the method of disposition utilized and the quantities disposed of during the preceding twelve months, and (c) the method of disposition to be utilized and the

estimated quantities that can be disposed of during the succeeding twelve months" (50, p. 1). One recent annual report shows the estimated quantities which the U.S. had available for disposition during Fiscal Year 1969. As listed in Table 1, the quantities of several basic commodities were of considerable size.

Table 1. Estimate of U.S. surplus commodities available during fiscal year 1969^a.

Commodities	Units	Quantity
Wheat and rye	(tons)	8,429,115
Feed grains	(tons)	17,861,952
Rice	(cwt)	11,181,878
Cotton	(bales)	709,695
Tobacco	(tons)	17,500
Fats and oils	(tons)	281,441
Oilseeds and meal	(tons)	1,786,121
Dairy products	(tons)	719,753
Fruits and vegetables	(cwt)	300,000
Honey	(tons)	4,822

^aSource: U.S. Department of Agriculture. Orderly liquidation of stocks of agricultural commodities. Washington, D.C. December 1968. pp. 17-28.

World food needs

At the same time that U.S. agriculture was outproducing domestic and commercial export demand and the U.S. government was accumulating excess stocks of food and fiber commodities, many low income consumers of the world were experiencing inadequate diets. The Food and

Agriculture Organization reported that the average annual deficit of all grains (wheat, rye, barley, oats, maize, sorghums, millets, and mixed grains) for the 1961-63 period were 5.3 million tons in Latin America, 1.3 million tons in Africa, 2.9 million tons in the Near East, and 7.6 million tons in the Far East (18, p. 86). The same report projected the annual deficits to grow to 7.5, 6.2, 5.5, and 17.5 million tons, respectively, for the four regions by 1975 if past trends in harvested units and yield continued.

In 1964, the Foreign Regional Analysis Division of the U.S. Department of Agriculture projected 1970 grain deficits of 4.7 million tons in Latin America, 7.6 million tons in Africa, 11.4 million tons in the Near East, and 11.9 million tons in the Far East (51, pp. 97-98). In a 1967 analysis of the world food situation, Abel and Rojko, using 1954-66 trends, estimated 1970 grain deficits of 10.0 million tons for India, 3.4 million tons for Pakistan, and 25.2 million tons for the remaining less developed countries (excluding net exporters) (2, p. 12). Modifying historical trends to take account of the likely impact of agricultural policies and development plans had little effect on their 1970 trend projections. The modified projections affected their projections only for India and Pakistan, lowering projected deficits in these countries to 6.7 and 2.5 million tons, respectively. Using a combination of FAO and USDA trend assumptions and modifications for population growth, production increases, and demand growth rate, Blakeslee (4) and Framingham (21) projected "most probable" 1970 food grain deficits of 8.1 million tons in Latin America, 13.5 million tons in the Middle East, 8.0 million tons in Africa (excluding South Africa) and 8.2 million tons in India and Pakistan.

Although there are some differences in the magnitude of estimates of future food deficits in the developing countries, each of the studies projected deficits of approximately 35-40 million tons of food per year before 1975. In addition, world food needs may be even greater than the above projections, since they are basically projections of effective

demand for food and not of total nutritional needs. FAO statistics, for example, indicate that effective demand for food was providing an average daily calorie intake of 2,210 in Africa, 2,190 in the Near East, and 2,080 in Asia and the Far East in 1962, when an adequate nutritional diet would have required 2,250 in Africa, 2,330 in the Near East, and 2,230 in Asia and the Far East,¹ (18, p. 36). Abel and Rojko estimated 1959-1961 daily calorie deficits of 240 for India, 180 for Pakistan, and 160 for other less-developed countries (2, p. 7). Hidden in the averages are even greater deficits for low income consumers in the developing nations as well as most developed nations. These food deficits arise from the absence of adequate purchasing power among a segment of the population to provide minimum nutritional requirements.

U.S. food production and world food needs

Improving the adequacy of consumer diets in low income countries requires the expansion of domestic agriculture or development of export earnings to finance food imports where physical deficits exist, and increasing consumer purchasing power through expanded income or lower food prices where economic deficits exist. The basic question is whether the abundant productive capacity of U.S. agriculture can continue to meet immediate food deficits, both physical and economic, in the short run and yet promote economic development in the long run so that the gap between effective demand and adequate nutritional requirements can be closed.

Considerable literature exists on the use of U.S. stocks of agricultural commodities, accumulated through price support and income stabilization programs, to meet food needs in developing countries. Khatkhate wrote that "commodity imports under the foreign aid program should be a boon to underdeveloped countries" (34, p. 192). In a similar statement, Ezekiel proposed the use of U.S. surpluses to both satisfy food deficits in the developing nations and to bring about economic

¹Estimated requirements vary according to climate, age of population, and weight of individuals.

development: "Heavy surplus disposals to these areas over long periods if accompanied by corresponding speeding up of their general economic and industrial development, might help advance the day when they could begin to depend on industry as well as agriculture as substantial factors in both production and trade" (15, pp. 1075-76). In a later statement, Ezekiel pointed out that the use of surplus commodities "in helping to finance economic development can be an important contribution to the more rapid development of underdeveloped countries, except for any countervailing influence on retarding their agricultural development" (15, p. 1077). Schultz, however, called attention specifically to the "potentially serious long-run adverse effects" of surplus commodity disposal upon agriculture of the recipient countries (43, pp. 1027-29). Goering, while analyzing the P.L. 480 program in Colombia, stated that "Surplus farm stocks are viewed as potential assets in the war against hunger and poverty" (22, p. 992).

Perhaps the best summary of the two sides of the food problem was provided by Benedict and Bauer in their study of U.S. surpluses. "To many, it seems obvious that both of these problems could be solved by an enlightened policy of sharing our abundance with the needy people of other countries" (3, Forward). They were not alone in this view. Cochran suggested a general solution to food problems in his President-Elect Address to the American Farm Economics Association.

The transfer of surplus food and fiber supplies from the United States and their conversion into development supplies in underdeveloped countries becomes the policy bridge whereby the pressure of food and fiber supplies on population in the United States is moderated and the pressure of population on food and fiber supplies in the underdeveloped countries is moderated. By this policy bridge we buy the kind of adjustment time required in each social complex; and its construction would constitute political action at its best (10, p. 896).

These are but a few of the many persons who have proposed using food produced in developed countries to satisfy food needs in less developed countries. Although less has been written about the use of

government food stocks to improve nutritional levels of low income consumers in the developed nations, the low-income consumer in the ghetto of New York or Los Angeles faces many of the same problems as the poverty stricken consumer of Bombay, India or Seoul, Korea. Likewise, the same economic principles apply to both cases. Extensive distribution of food at less than market prices has been carried out in the United States under food stamp plans, school lunch programs, and through direct distribution programs of various nonprofit institutions. The recent emphasis on providing welfare benefits on a work output basis raises the possibility of using work projects to provide immediate welfare benefits as well as long run development in economically depressed regions of the U.S. It is these kinds of possibilities that cause considerable interest in the use of U.S.-produced food both at home and abroad. As a consequence of this interest, our study was undertaken so that all potential methods of food consumption and distribution could be examined.

This report examines the potential impact of distributing surplus agricultural commodities at concessional prices, at home and abroad, to provide direct benefits to low income consumers in the short run and to promote economic development and raise real income levels in the long run. Particular attention is given to the developmental aspects of increased employment, multiplier effects of increased income, substitution possibilities of commodities for capital in financing development projects, and alternative methods of using commodities to promote economic development without disrupting general market conditions.

Background of U.S. Surplus Disposal Activities

The U.S. government has financed surplus disposal activities for selected agricultural commodities through various price support and promotional programs for nearly four decades. Before 1954, surplus disposal activities were conducted under a number of independent authorizations. Since 1954, most disposal activities have been coordinated under P.L. 480

and its amendments. The concepts and experiences with previous disposal activities were directly reflected in the provisions of P.L. 480. In fact, several provisions of P.L. 480 simply extend authorization and financing of certain widely used sections of earlier acts. A brief review of several public acts that preceded P.L. 480, but influenced it greatly follows.

Section 32 of P.L. 74

The history of recent U.S. action to dispose of surplus agricultural commodities dates back to 1935 and the enactment of P.L. 74. Section 32 of P.L. 74 authorizes the use of import tax revenues to encourage exports and domestic consumption in an attempt to reestablish farmers' purchasing power. The broad language of Section 32 provides authority to subsidize exports, to conduct agricultural research, to carry out a food stamp plan, and to purchase and donate food to the school lunch program as well as to other needy and welfare institutions (11, p. 63). Since 1949, the main use of Section 32 authority has been to finance a flexible price-support program through direct purchases of selected commodities.

Food stamp plans

The original food stamp program was initiated in 1939 and operated until 1943 under the broad authority of Section 32 as a technique to expand domestic food markets by expanding the effective demand of needy persons. Under the original food stamp program, coupons or stamps were either distributed to needy families or sold to them at a discount for redemption at retail food stores. The retail stores, in turn, presented the stamps to the government for redemption in cash or payment in kind.

After the Korean War, many proposals to reestablish a food stamp plan were offered, but in 1956 Ezra Taft Benson, secretary of agriculture, recommended against reactivating the plan (11, p. 64). Later, in 1959, a new food stamp plan was authorized as part of P.L. 341, extending P.L. 480 operations. Initiation of the program was optional for the Secretary of Agriculture, and no plan was put into effect. A pilot

plan finally was initiated in 1961 under the Kennedy Administration, but it operated under the broader provisions of Section 32. The latest Food Stamp Act was enacted in 1964 with provisions for independent financing, (66, p. 703) and was extended in 1968 to cover the period through December 31, 1970 (67, p. 958).

Subsidized dollar sales

Since initiation of federal price support programs, the government has had authority to dispose of stocks through subsidized dollar sales whenever possible. Such provisions were included in the AAA of 1938 and the CCC Charter Act of 1948, but more specific rules were established for subsidized dollar sales in Section 407 of the Agricultural Act of 1949 (61, p. 1055). At that time CCC was required to reduce stocks only when market prices exceeded 105 percent of current support prices. Exports, however, were excluded from the minimum price requirement that allowed CCC to sell stocks overseas and to conduct export subsidy programs to dispose of U.S. commodities at the world market prices (11, p. 62). An example of special export subsidy programs is the International Wheat Agreement, first approved in June 1949. The Agreement provides for the sale of a fixed amount of wheat by 5 exporting nations to 37 importing nations at prices below U.S. domestic prices. Consequently, the CCC was required to reimburse commercial exporters for the difference between purchase and sale price, but the Agreement guaranteed a market for a large quantity of wheat below prevailing domestic prices without harming international relations.

CCC charter

The Commodity Credit Corporation was transferred to Federal Charter under P.L. 806, the CCC Charter Act of 1948, and the Commodity Credit Corporation of Delaware was dissolved as an agency of the U.S. government. Creation of the CCC was "for the purpose of stabilizing, supporting and protecting farm income and prices, of assisting in the maintenance of balanced and adequate supplies of agricultural commodities..., and

of facilitating the orderly distribution of agricultural commodities...." (59, p. 1070). In 1949 section 2 of the CCC Charter Act was amended to provide for the CCC "to accept strategic and critical materials produced abroad in exchange for agricultural commodities acquired by the Corporation" (60, p. 155). This provision constituted the first authorization for barter agreements to dispose of U.S. surplus commodities. The authority was amended and broadened as part of P.L. 480 in 1954.

School lunch programs

Federal aid to school lunch programs began in 1936 with donations of surplus commodities financed under Section 32, but no direct financial assistance was given until 1943. Between 1943 and 1946 cash grants were given to schools under Section 32 for local purchases of food for school lunch programs. With the passage of the School Lunch Act of 1946, appropriations designated specifically for cash grants to private and public school lunch programs were authorized (57, p. 230). Part of the cash was made available to the Department of Agriculture to purchase commodities, but 75 percent of the cash was restricted to state use for local purchases on a matching basis.¹ A special case of the school lunch program assistance has been the School Milk Program designed specifically to deal with the large dairy surpluses since 1954. Authorization for use of CCC funds to increase consumption of milk in private and public schools was provided in the omnibus farm bill of 1954 (65, p. 897). Later, the School Milk Program was expanded to cover nonprofit camps, homes, and other children's institutions (11, p. 64).

Marshall Plan

The Marshall Plan, officially known as the Foreign Assistance Act of 1948, provided materials and financial assistance to European countries to aid their economic recovery and protection of free institutions (58, pp. 137-159). Although the Marshall Plan was not specifically a surplus disposal program, Section 112 of the Act established the practice

¹ Matching arrangements were on a sliding scale requiring as high as three dollars of state money for one dollar of federal money.

of providing foreign assistance in the form of surplus commodities. Specifically, the Secretary of Agriculture was directed to advise all related departments, agencies and establishments of the government when surplus commodities were available, and these administering agencies were to make maximum use possible, subject to provisions and purposes of the Act and the interest of the recipient country, of the surplus agricultural commodities in providing foreign assistance to participating countries (defined as any country which signed the report of the Committee of European Economic Cooperation in 1947 and any other country wholly or partly in Europe) (58, p. 138). In addition to establishing commodity aid as a means of surplus disposal, commodity grants and loans under the Marshall Plan introduced an "almost new...concept" (36, p. 28) of counterpart or local currency funds that prompted careful consideration, particularly by Congress. The Marshall Plan proved to be very successful in the rapid transformation of the war stricken economies of the European countries into highly productive economies capable of sustained growth.

Section 416 of the Agricultural Act of 1949

Section 416 of the Agricultural Act of 1949 (61, p. 1058) became the primary authority for donation of commodities acquired by CCC to a wide variety of charities and welfare programs. Later amendments broadened the scope of authorized donations to include state and federal agencies, public assistance, needy persons, hospitals, nonprofit relief organizations such as CARE, and numerous others. Likewise, the list of commodities that qualify for distribution under Section 416 has been expanded to include cornmeal, wheat, flour, and fats and oils. All donations, however, are subject to a clause protecting commercial sales.

Mutual Security Act

The stated purpose of the Mutual Security Act of 1951 was "to maintain the security and to promote the foreign policy of the United States by authorizing military, economic, and technical assistance to friendly countries..." (62, p. 373). The Mutual Security Act increased the portion

of foreign aid allocated for military assistance from an average of about 5 percent in 1948 and 1949 to 32 percent in 1951, 53 percent in 1952, and as much as 66 to 67 percent of total foreign assistance in 1953 (3, p. 38). Only a small volume of surplus commodities were utilized under the 1951 and 1952 versions of the Act, but Section 550 of the 1953 Act increased commodity sales by providing for sale of not less than \$100 million and not more than \$250 million of surplus agricultural commodities in exchange for local currency (63, p. 159). This provision was similar to the provisions of the Marshall Plan, except that the local currency was to be deposited to the account of the U.S. Treasury for subsequent use to finance future projects, rather than an account of the recipient government. Specifying a particular amount of foreign aid funds to purchase surplus agricultural commodities in Section 550 marked the first time that legislation had specifically required a portion of U.S. foreign aid be provided in the form of surplus commodities. All subsequent versions of the Mutual Security Act contained a similar restriction (\$350 million in 1954, \$300 million in 1955, \$250 million in 1956, and \$175 million each year for 1957 through 1960)(11, p. 66).

P.L. 480

Successful experiences with the preceding surplus disposal programs, coupled with continuing availability of surplus commodities, resulted in the conception and enactment of P.L. 480, the Agricultural Trade Development and Assistance Act of 1954. P.L. 480 combined several different existing programs under one authority, some through extensions of previous legislation. It officially united agricultural surplus disposal techniques with U.S. foreign policy and drew together the export subsidy program conducted under Section 32 and the commodity assistance programs developed under the Marshall Plan and the Mutual Security Act.

When P.L. 480 was enacted, it contained three titles or major provisions (64, pp. 455-459). Title I authorized the CCC to finance the sale of \$700 million of surplus farm commodities to foreign countries

for local or "soft" currency.¹ The soft currency section of P.L. 480 drew upon the experiences of the Marshall Plan and Mutual Security Act provision of depositing soft currency to an account for the U.S. Treasury. The authorization required, among other things, that reasonable precaution be taken to prevent the soft currency sales from interfering with usual U.S. marketings and world prices.

Title II extended CCC authority, as granted under the Mutual Security Act of 1953, to donate up to \$300 million of surplus agricultural commodities from CCC stocks to relieve famine and other food emergencies overseas. The donation section of P.L. 480 incorporated the broad concept of famine relief and was similar to previous programs in the United States that attempted to expand effective purchasing power of the needy through food stamp and related plans.

Title III drew upon the previous authorization of Section 416 and provided for donations to the needy at home and abroad. Likewise, the barter provisions from the CCC Charter were incorporated into the new act. In both, previous provisions were broadened and expanded to provide more extensive coverage. Since both programs under Title III were extensions of permanent authorizations previously granted to CCC, no special financing was necessary.

Although numerous amendments and extensions were added to the original P.L. 480 Act, the objectives remained basically unchanged throughout the 1950's. Despite the original act carrying a "Trade Development and Assistance" title, the purpose continued to be disposal of U.S. surpluses.

From 1957 to 1960, there were indications that the objectives or goals of P.L. 480 were beginning to shift from a primary emphasis on surplus disposal toward a new emphasis on economic development. During this period, increasing amounts of local currency were designated for

¹Formulation of an agreement by the U.S. to accept soft currency as payment for surplus food commodities was cited by Cochrane as a "bright institutional innovation" (10, p. 891). Acceptance of soft currency provided relief for foreign exchange pressures of rigid commercial contracts in the recipient countries while expanding U.S. exports. But, even the drain on local currency is potentially competitive with domestic investment programs for economic development.

development loans and grants. Improved consultation was conducted with competitors to reduce their criticism of the program. In addition, the shift in usual marketing provisions from a U.S. to global basis helped to maintain market opportunities for competitors. A drastic revision and reduction of barter agreements during this period greatly eased the conflict with Canada (40, p. 5).

The 1961 extension of P.L. 480, P.L. 92, included a permanent amendment to permit food grants to be used for economic development instead of being restricted to famine or emergency relief. Drawing on U.S. experience with school lunch programs, the 1962 Food and Agriculture Act (P.L. 703) amended Title III to provide for donations for use in nonprofit school lunch programs in recipient countries. Various modifications and amendments were added to the basic legislation during the 1960's, but most changes dealt with the use of surplus commodities for programs in other countries even though the welfare and development aspects appeared equally applicable in the U.S. For example, the 1968 amendment to P.L. 480 authorized the use of proceeds from sales of surplus commodities to be used to finance voluntary birth control programs in the recipient countries, but ignored development of a parallel program for economically depressed areas in the U.S.

Importance of Distribution Methods, Income Levels and Commodity Aid in Welfare and Development Programs

The amounts and kinds of impacts from using food commodities to finance a welfare or development program depend on the type of distribution method used. The type of distribution method used, in turn, is closely related to which specific consumer group is reached by the program. Considerable similarity exists between the three distribution plans most widely used in developing countries--food grants, food used for wages-in-kind, and open market sales of commodities--and those used in the United States. Grants for emergency relief or welfare benefits to low-income families are similar to the direct-distribution programs used in the United States. Wages-in-kind programs are similar to the

stamp plan, since both are designed to distribute commodities at a low cost to the consumer. On work projects, the recipient is required to work in order to receive food or other commodities; this is similar to requirements in a food stamp plan, where the recipient is required to pay a percent of his income to participate in the program. The value of commodities the work project recipient receives determines the extent to which wages-in-kind tend toward an income subsidy. Sales to selected groups at less than market prices fall in a broad class of concessional sales that provide various levels of welfare benefits depending on the concessional sale price level relative to retail market prices.

In a broad sense, the primary objective of most welfare or development programs is to improve welfare in a pareto optimum framework--that is, to improve the welfare of at least one group in the economy without making any other group worse off. Because of the interdependence of agricultural income with consumer food prices, a program to provide consumer benefits through the use of food surpluses must be designed very carefully to avoid depressing farmer prices. Such a consequence could result in all consumer gains coming at the expense of farmers rather than being a pareto optimal gain. In the past, it has been argued that a surplus distribution program would by definition have a price depressing effect because the program would cause an exogenous shift in supply to the right while demand remained unchanged. As represented in Figure 2, if food aid augments supply by an amount equal to Q_1Q_2 , so that supply shifts from S to S' while demand remains constant at D, prices would decline from P_1 to P_2 . Consequently, income to domestic producers would be reduced from the area OP_1AQ_2 to OP_2BQ_1 . If the distribution program also creates additional demand so that demand shifts from D to D', however, prices would not decline in the domestic market, and domestic agricultural income will remain unchanged. The extent of the demand shift to maintain farm prices depends on the level of income of the individuals affected by the program, the increase in real income that the commodities provide, and the response of the recipients to increases

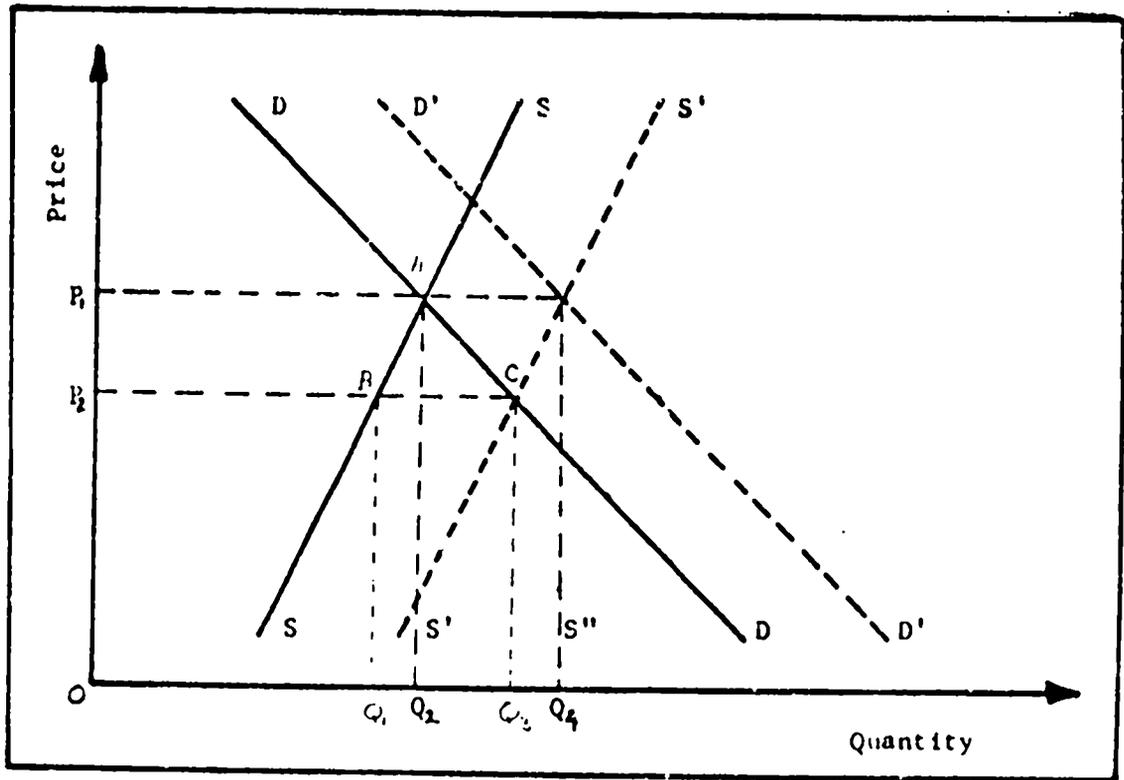


Figure 2. Equilibrium prices for aggregate food supply and demand

in income.

Grants, donations, and direct distribution of food commodities

Distribution of food aid through grant programs in less developed countries has been used primarily in less developed countries to supply food to a broad class of consumers incapable of supplying labor to earn cash wages or wages-in-kind. Primary recipients are children, pregnant women, senior citizens, and the handicapped. As a group, these recipients are normally characterized by very low income and, hence, their marginal propensity to consume food approaches 1.0. As a result of their high preference for additional food, grants of food would have little impact upon their nonfood demand. Because the recipient group is physically incapable of supplying labor, grants of food to this group would have no direct impact on the domestic supply of agricultural or industrial commodities. In the short run, food grants increase the total food supply (domestic production plus concessional imports) in developing countries by an amount equal to the quantity of food aid, but since the food is given directly to consumers, the grants also shift demand to the right by a similar amount.¹ Distribution of food commodities in the United States on a grant basis has a similar effect, except that the food commodities for distribution come from government stocks rather than imports.

When very low income consumers receive food grants, the impact of food aid on an economy is negligible. The additional food supply has little effect on the price structure because the income effect of the grants motivates consumers to increase their demand for food by a similar amount. As a result of an equal increase in supply and demand, there

¹The shift in supply results from adding the additional food from the food aid program to the domestic supply and commercial imports. The shift in demand results from the distribution of commodities, with real value for resale or replacement of commodities that would otherwise be purchased, to consumers. The increase in resource endowment or real income results in a shift, to the right, in the demand curves for food of consumers receiving the grants. Summing over all consumers for the aggregate demand curve, aggregate demand for food also shifts to the right.

is no resulting change in price to disrupt domestic supply. With the strong preference for food, grant recipients trade away insignificant amounts of food for other items so that there is little effect on demand for items from other sectors of the economy. With little change in prices or domestic supply, there is almost no effect on incomes of producers in any sector of the economy. The major impact is an increase in the incomes of grant recipients. From a welfare standpoint, the grants have an immediate impact by increasing food consumption for the recipients, but have no lasting positive impact on food consumption or welfare after the grants were discontinued. Upon termination of the grants, total supply would shift back to the level of domestic plus commercial imports. The loss of income in the form of food grants would likewise shift effective demand back to the levels that existed before the availability of the grants. The only lasting effect of the grants is the investment in human capital. Supplying grants of food improves nutritional levels of recipients and potentially contributes to the development of a productive resource, labor, which ultimately contributes to increased domestic output. The effect of added food on productivity is of special importance in countries where the production processes are heavily dependent on human effort. These aspects will be examined further in the next section.

Grant programs, nutrition levels and labor productivity

A positive relationship between nutrition and productivity has been found in several countries (19, pp. 13-25). Coal miners of the Ruhr district in Germany increased their labor productivity by 13 percent for a 10 percent increase in calories. A group of railroad construction workers in the United States increased their labor output 22 percent for a 10 percent increase in calories. Providing rations of approximately 4500 calories per day to South African miners increased their labor productivity more than enough to compensate for the additional cost. In Ruanda Urundi, one cooked meal per day supplied to workers was sufficient to increase labor productivity by 30 percent. In Zanzibar,

well-balanced meals for the workers increased productivity to pay for the added cost of the meals even though the meals increased the labor cost by 50 percent. The availability of liberal diets for rubber plantation workers in Viet Nam increased productivity by 50 percent. Srivastava cites an Indian study that estimated a 2.27 percent increase in worker productivity for a 1.0 percent increase in calorie intake (44, p. 97).

These examples deal with the productivity of labor as engaged directly in the production of goods or services. As such, the impact of additional food is measured as an increase in labor units or as increased productivity of each unit, depending on the way labor is measured in the production process. In all these examples, increased productivity of workers already employed was considered. However, in most developing countries with a sizable portion of the total labor force unemployed, food aid is programmed not as a means of expanding the output of the work force, but to reach unemployed or underemployed laborers and, when possible, to bring them into production in such a way as to contribute to development. Similarly, use of surplus food for welfare programs in the United States puts primary emphasis on reducing unemployment rather than increasing per unit productivity. Although food aid could be used to contribute to increased labor productivity, the examples used in this study will assume an excess of labor in the developing countries or a regional employment problem in the U.S. so that emphasis is on increasing total employment rather than labor productivity.

Grant programs and the response to changes in income levels

Although food grants have traditionally been supplied to consumers with extremely low income levels, grant programs could be designed to reach consumers who already have some income, but need additional income to reach an acceptable minimum living standard. According to Engel's Law, as income level rises, the relative proportion of the budget spent on food declines.¹ Thus, food expenditures represent a high proportion

¹ For a presentation of theory and empirical data supporting Engel's Law, see Appendix A (16, p. 87).

of the total budget at low income levels and a declining proportion at higher income levels. At low income levels the consumer is surviving on a minimum of all commodities and a high percentage of the budget is used for food. As income increases, food consumption expands rapidly at first and then begins to decline as an adequate nutritional level is approached. Food expenditures continue to increase, but at a decreasing rate as proteins are substituted for carbohydrates and the physical limit for individual consumption is approached.¹ Clark cites both the familiar generalization by Adam Smith that "the desire for food is limited in every man by the narrow capacity of the human stomach" and his own international consumption study as proof of a definite upper limit on food consumption (8, p. 237). As a consumer's desire for food declines relative to other commodities, his marginal propensity to purchase food declines. Consumer responsiveness to price changes, measured as the price elasticity of demand, also is associated with level of income. Mellor argues that, at low income levels, price elasticity and income elasticity of demand for food will be close in absolute value because, although the cross-price elasticity of food demand with nonfood demand will be very small, it is unlikely that it will be negative (39, p. 72).² Consequently, price elasticity will be equal to or greater than income elasticity, and will probably decrease as income level rises. As supporting evidence, Mellor hypothesizes that price elasticity at low income levels may be as high as -0.85 to -0.90 for all food (39, p. 72).

¹The Engel Curve and the food consumption function are closely related since they are both measures of the same basic relationship. Either curve can be derived directly from the other.

²Considerable reliance has been placed on the working assumption that the sum of the price elasticity, income elasticity, and cross-price elasticity is equal to zero. The mathematical proof, as cited by Mellor (39, p. 71), that the income elasticity is equal to the sum of the price and cross-price elasticities is provided by Wold in H. Wold and L. Jureen (70).

At a relatively high income, Brandow estimated the price elasticity of demand for all food at -0.34 for the United States during the period 1955-57 (5, p. 17). On this basis, consumers will allocate smaller amounts of additional income for food purchases and become less responsive to price changes as their income rises. Consequently, distribution of food commodities as grants to consumers will result in greater substitution of food assistance for market purchases as consumer incomes vary from lower to higher levels. The process of substituting other purchases for food purchases effectively decreases market demand for food and implies a market price decline. With a price elasticity of demand of less than unity, the price decline will lower consumer expenditures for food, and consequently lower income received by agricultural producers. Depending on producers' responsiveness to prices, lower prices may cause a decrease in production, which would lower gross income to agricultural producers even further.

In summary, the use of grants to distribute food aid to consumers has varying impacts depending on the income level of the recipients. As we shift from low to high-income recipients, the marginal propensity to consume food decreases for the grant recipients. Under these conditions, the distribution of food commodities to subsidize consumer incomes causes an increasing depression of gross-agricultural income. A decline in gross income to agriculture implies a decline in per capita welfare of agricultural producers unless out migration occurs at a rate equal to or greater than the rate of decline in total income to the agricultural sector. Consumer welfare, on the other hand, is increased as a result of the food aid grants. Consumers who receive food directly realize higher levels of welfare through the income effect of the grants. At the same time, consumers who do not receive the grants realize an increase in their welfare through lower food prices. In aggregate, consumers are able to consume more food for less money and, consequently, can expand nonfood consumption as well.

The welfare impact of distributing food aid commodities as grants is almost exclusively short run. The increase in available food and the shift in demand are direct functions of the availability of the food grants. As soon as the grants are interrupted, supply and demand will revert to previous levels, and the improved welfare position will be lost. Three exceptions are notable as long-run effects of the food aid grants. First, people in both developed and developing countries have a strong tendency to resist backward movement. If the grants continue for an extended period of time before interruption, it is possible that the higher consumption level and adjusted patterns will have a permanent effect on the tastes and preferences of the individual consumers so that their demand schedule for food, other items, or both may experience a permanent shift. Second, if the food received for grants is initially secured under a grant agreement to meet an emergency supply deficit, it may substitute for commercial imports that the government would otherwise be forced to purchase. Such emergency commercial imports could result in diversion of scarce foreign exchange from current investments to promote development and have the long-run effect of slowing developmental progress. Depending on the allocation of the added government investment for development, output from either the agricultural sector or the industrial sector may be increased during the period of food aid availability, so that after termination of food aid, supply may not return to its original position. Third, providing food grants may have an impact on labor productivity through improved consumption levels, and in turn, on level of income received by laborers. The increases in income and productivity may have the lasting effect of increasing both the demand and supply of food commodities.

Work projects that utilize food commodities as wages-in-kind

Unlike the distribution of food through grant programs, distribution through work projects implies a more restricted group of recipients. Work projects basically limit recipients to individuals who would be available to earn regular wages if such employment opportunities existed.

Although it is possible for work projects to be competitive with other job opportunities, this should not happen unless wage-in-kind rates are set above competitive wage rates. The shift of previously employed workers to work projects would be inefficient because of the transitional unemployment it would create and the effect of locating 'permanent' employees in 'temporary' employment provided by work projects. Establishing wage-in-kind rates for work projects below competitive wage rates would offer a greater attraction for unemployed and underemployed workers than for those who are employed.

Wage-in-kind payments have essentially the same impact on consumption patterns and domestic production that grants do, with one major exception. With both, distribution of food aid commodities represents an increase in the aggregate food supply available to recipients, and an increase in demand depending on the marginal preference to consume food from incremental income. The difference with wage-in-kind payments arises from the terms of distribution. With grants, no labor is provided in return for the food commodities and no productive activity results. But with work projects, the recipients are brought into the nation's productive labor force. The amount of productivity provided by the recipients and their contribution to the economy depends on the nature of work projects financed with food commodities.

There are three broad classes of projects: direct production projects, short-run overhead projects and long-run overhead projects. Direct production involves labor utilization to provide goods and services for immediate consumption. Short and long-run overhead investments include construction of a modern transportation system, building schools, training teachers, construction of improved housing, and similar projects that affect the welfare of the people but have a much longer and indirect impact on productivity of human resources and, ultimately, the supply of goods and services produced.

As with the food aid grants, the income level of recipients is a significant element in evaluating the interrelationships of food aid and

work projects. Just as commodity grants replace regular purchases whenever the recipient's marginal propensity to consume that commodity is less than unity, wages-in-kind will displace regular purchases if they exceed the proportion of additional income that the recipient prefers to spend on that commodity group. By matching wage-in-kind payments of food to marginal preference for food and providing the balance of the wages in cash, negative impacts on the market for the wage-in-kind commodities can be avoided.

For a given investment, an a priori estimate can be made of demand for food and other commodities that will be derived from the increase in income. For a single round of expenditure, the model can be written as follows: Disposable income (DI) is equal to gross income minus deductions for taxes (T), savings (S), and imports (M). Disposable income can be calculated as gross income times the difference between 1.0 and the sum of the marginal taxes, savings and import rates.

$$DI = GI [1.0 - (T + S + M)] \quad (1)$$

The retail demand for food (RF) is equal to disposable income times the marginal propensity to consume food (MPC) out of income.

$$RF = DI (MPC) \quad (2)$$

Wholesale demand for food (WF) is equal to retail demand for food minus marketing costs, or retail demand times the difference between 1.0 and the fraction marketing margins represent of the retail price (MM).

$$WF = RF (1.0 - MM) \quad (3)$$

Collectively, the wholesale demand for food can be redefined directly as

$$WF = GI [1.0 - (T + S + M)] [MPC] [1.0 - MM] \quad (4)$$

where only the variables T, S, M, MPC and MM must be specified to adapt the calculations to a specific economy or regional project. For a total multiperiod impact that considers the Keynesian income multiplier, the first period income must be expanded by a factor of 1.0 divided by the

sum of the rates for taxes, savings, and imports. Since food aid is introduced exogenously to the system (imports in developing countries and government stocks in the United States) the appropriate factor is the reciprocal of the quantity $(T + S + M) + [1.0 - (T + S + M)] (MPC)$ $(1.0 - MM)$, and the total derived demand for wholesale food can be calculated directly as

$$WF = \frac{GI (1.0 - T - S - M) (MPC) (1.0 - MM)}{(T + S + M) + (1.0 - T - S - M) (MPC) (1.0 - MM)} \quad (5)$$

by substituting specific values for the five parameters and the amount of gross expenditure to be made for labor and other domestic goods and services.

Applying the analytical framework presented in Equations 1-5 to a specific case, an investment of 100 units (dollars, pesos, rupees, or any other currency) for labor and domestic goods or services to finance a development project would increase gross income by 100 units. In a country or region where consumers have an average per capita income of \$450, such an investment would increase aggregate income by about \$385 based on a Keynesian multiplier and a marginal tax, savings, and import rate of 26 percent (0.26).¹ With a marginal propensity to consume of 0.26 and a marketing margin of 25 percent (0.25) on food,² the initial investment of 100 units would generate demand for wholesale food of 56 units if all food is supplied by domestic producers. But if surplus food commodities were used to satisfy the increase in food demand, the leakage from the system would be increased so that consumer income and derived demand for food would be decreased. Substituting the appropriate

¹Ezekiel uses 9 percent for marginal savings rate, 9 percent for marginal taxation rate, and 8 percent for marginal propensity to import for a total leakage of 26 percent (20, p. 9).

²Empirical studies and summaries for these estimates were developed by Rogers in an earlier study of food aid utilization in developing countries (42, pp. 34-106).

coefficients in Equation 5, the derived demand for food at wholesale is 35.7 units, or only about two-thirds the previous estimate. The estimate of 35.7 units of food demand is an a priori estimate of the portion of the total investment that could be financed with food commodities (imported or surplus) without having a negative impact on food prices of the recipient economy.

Examining Equation 5 more closely, it can be seen that the factor MPC can be isolated to generalize the impact of changes in magnitude of MPC. Let the quantity $(T + S + M)$ in the denominator equal α , and $[(1.0 - T - S - M)(1.0 - MM)]$ in the numerator equal β . Equation 5 then is of the general form

$$WF = \frac{(GI)\beta(MPC)}{\alpha + \beta(MPC)} \quad (6)$$

Differentiating the wholesale food function with respect to marginal propensity to consume food, we see that the wholesale demand for food decreases as MPC decreases. In general, therefore, the greatest derived

$$\frac{\partial WF}{\partial MPC} = \frac{\partial[(GI)\beta(MPC)][\alpha + \beta(MPC)]^{-1}}{\partial MPC} > 0 \quad (7)$$

demand for food would occur when low-income consumers received the additional income because they have a high marginal propensity to consume food. As income levels rise and MPC declines, less demand for food would be derived and, consequently, a smaller portion of total wages could be paid as wages-in-kind if negative impact on the domestic market for the wage-in-kind commodities is to be avoided.

Open-market sales to augment domestic supply

Distributing food aid through open-market sales at competitive market prices affects the supply side of the food market exclusively. Introducing food into the market shifts the aggregate supply to the right as do grants and wages. With open-market sales, however, there is no associated shift in demand because there is no increase in consumer

income levels. Open-market sales also take income from the private sector and transfer it to the public sector. The extent of the impact of food aid on prices determines whether the income transfer will result in a loss for agriculture and other sectors or just for the agricultural sector. The other aspect of open-market sales concerns the use the government makes of the revenue that is collected from the food sales. It is entirely possible for the government to use the revenue derived from food sales to finance overhead-investment projects identical to those financed with wages-in-kind. If so used, the revenue will presumably produce the same types of income changes that result from wage-in-kind financing. On the other hand, the government is free to use the revenue to finance other types of governmental activities. In theory, it is possible for the government to use the revenue to relieve taxes paid by the public and actually achieve an income effect that will equal that of grants or wages-in-kind. In practice, it would be difficult to reach low-income consumers in this way since they are usually affected little by taxes, if at all. Another reason this approach is not widely used with foreign disposal activities is that the United States attempts to remain involved in the disposition of the funds generated from sales. Allowing the revenue to be used as tax relief quickly incorporates the funds into the internal budgeting of the recipient country and removes it from U.S. influence. The most common contracting arrangement involves the designation of the funds for specific development projects even before the food is granted in an attempt to insure that the food will make a contribution to development and not just lead to expanded consumption. Realistically, the same types of projects approved for wage-in-kind financing should be equally productive with regular financing since no restrictive assumptions were made about wage-in-kind impacts.

Sales on the open market will of necessity reach consumers who have an income and are operating in the market system. With this method, it is more difficult to regulate the composition of the recipient group than with the grants and work projects, but techniques such as food stamp

plans or other types of regulatory authorization can be used to influence the characteristics of the recipients. Another control technique is to distribute the food aid through government regulated shops such as the fair price shops in India. Distribution through a government shop system would enable relatively close control on recipient groups so that income stratification of recipients also is possible with the open-market system.

To provide welfare benefits to consumers through open-market sales without competing with domestic production for "normal" marketing, demand must be expanded. Sales of surplus commodities at concessional prices would provide benefits to consumers operating in the market system, but if the surplus commodities are similar to domestic commodities, consumers would presumably substitute lower priced surplus commodities for higher priced domestic commodities and drive down domestic prices. In fact, the price-depressing effect of substituting surplus commodities for domestic production has been the essence of the main criticism of supplying surplus agricultural commodities to depressed areas. To provide welfare benefits to consumers while avoiding the negative impact of depressing agricultural prices and production, effective consumer demand must be expanded. Increased investments through work projects, as discussed earlier, represent one specific technique for expanding demand by increasing employment and consumer income.¹ A second case which relates directly to sales involves price discrimination to increase total demand and consumption.

Open market sales and demand expansion

The theoretical basis for expanding the demand for food was set forth by Waugh, Burtis, and Wolf in an article analyzing controlled distribution of a crop among independent markets. They stated that "in

¹Even where labor for a development project is supplied by workers who were previously partially employed, the additional income, employment, and consumption represents a total gain if the vacancies are filled by other unemployed or underemployed workers (6, pp. 920-922).

most cases, maximum net income could be obtained from a distribution aimed definitely at maintaining higher net prices in some markets than in others" (68, p. 6). To increase revenue by lowering the price in a second market, it is necessary that the two markets are at least partially independent.¹

Several methods of market differentiation have been used in the United States that could be applied to food aid distribution in other countries. Supplying the commodities in a slightly different form than that of normal marketings would be one of the easiest to administer (i.e., supplying U.S. commodities that are similar but not perfect substitutes for domestic products). Product differentiation allows for a lower price to be charged without experiencing a major decline in the primary market demand. Consumer differentiation can be achieved by issuing special purchasing passes that provide for lower prices, increased rations, or shopping privileges at special markets (i.e., food stamp or coupon distribution to low income consumers). Geographic or economic isolation provides for still another possible means of market differentiation.

In any case, if total demand could be expanded by differentiating the market, food aid could be supplied to low income consumers through one or more of the differentiating techniques without, or at least with a minimum, negative impact on prices. As Wetmore *et al.* pointed out in the study analyzing the expansion of demand for farm food products, demand expansion seemed the logical solution to the twin problems of surplus commodities and underconsumption of food (69, p. 3). Although applying the concepts of demand expansion to distribution of food aid is a slightly different framework, the objectives are the same as long as producer welfare and consumer welfare are a joint concern. Fisher suggests in his discussion of the impact of open-market sales and donations (17, pp. 863-867) that the negative impact on prices is reduced when food aid is distributed without entering the market in competition

¹The only way revenue could increase if the two markets are direct substitutes is if price elasticity of demand is greater than unity, implying a price decline in the single market situation would have increased total revenue.

with domestic supply. Waugh, Burtis, and Wolf concluded that "if the system of differentiated prices were such that poorer consumers could buy a commodity at lower prices than could richer consumers it appears quite possible that there might be a net gain in the sum total of satisfactions obtained by consumers from the consumption of the commodity" (68, pp. 34-35). Distribution of surplus commodities at differentiated prices is one such means of improving consumer welfare while minimizing negative impacts on producers.

The government-controlled distribution systems for P.L. 480 imports in India, the "fair price shop" system, has established a condition of price discrimination in the cereal market based on product differentiation that may have general application in other countries or selected regions of countries. Pricing cereal at the fair price shops below the open-market price has drawn some, especially low income, consumers from the open market to the fair price market. Independently, this movement from one market to the other is not evidence of an increase in aggregate demand. In fact, removing part of the consumers from the open-market causes aggregate demand in that market to decrease because of a decrease in the number of consumers. The response of consumers who shift from the open market to the fair price market determines the magnitude of the net increase in demand.

There also is an increase in consumer welfare associated with purchase from the fair price shops. Every unit of cereal purchased from the fair price shop instead of the open market represents an increase in real income for consumers equal to the price difference between the open market and the fair price market. If consumers allocate the additional income according to marginal preference, from 0 to 100 percent of the increase will be spent for food. At the lower limit, none of the increase in real income would be allocated for food purchases and fair price sales (in quantity) equal the reduction in quantity sold in the open market. Under these conditions, open-market demand would shift to the left by an amount equal to the distribution of food aid, and the

total demand would remain unchanged. Because of the shift in supply resulting from the availability of food aid and an unchanged demand, however, trading would occur along the demand curve down to the intersection with the new supply curve where the quantity of food demanded would be greater than before P.L. 480 imports due to the lower prices.

At the upper limit, all the additional real income would be allocated for food purchase in the fair-price shops (implying a marginal propensity to consume food of 1.0.) In that case, fair price purchases would be larger than the reduction in open-market sales, the quantity being determined by the ratio of open-market price to fair price shops. Under these conditions open-market demand would decrease, but when demand from the fair-price shops is added, a net increase may occur. Except where the fair price is C, the demand shift will be less than the supply shift and a price adjustment would result in an increase in quantity demanded also. Consequently, when P.L. 480 commodities are distributed at a concessional price, the distribution produces a real income effect for consumers and demand changes according to the marginal allocation of consumer income. For this reason, as indicated earlier in Figure 2, it is not necessary for prices to be depressed as severely as previous writers have indicated for a new equilibrium to be reached. In fact, if P.L. 480 commodities are distributed in such a manner that aggregate demand shifts by an amount exactly equal to the P.L. 480 imports, the price need not be depressed at all for a new equilibrium to exist.

Open-market sales and the impact on producer prices

In an earlier study of the impact of commodity aid by Mann, an econometric model was developed to measure the impact of P.L. 480 imports on the Indian economy (38, pp. 131-146). An implicit assumption underlying the model was that demand for P.L. 480 imports was homogeneous with demand for domestic commodities and that P.L. 480 commodities entered the market in the same way as domestic production. In reality, the contrary is true. P.L. 480 commodities enter the market through the

fair-price shops at a fixed price, set below the open-market price for domestic cereals. There is strong evidence, as explained later in this section, that the fair price system provides market differentiation and, in turn, expands demand as a result of the real income effect from lower prices at the fair price shops.

Using secondary data from India and an econometric model, Rogers analyzed the impact of P.L. 480 imports within a framework that gives explicit consideration to the concept of differentiated market demand (42, pp. 128-137). The coefficients, or impact multipliers, from the reduced form equations of the model indicate that increasing P.L. 480 imports by 1.0 kg. per capita¹ would depress cereal prices by 0.1314 units of the price index (mean value of \$9.12) while increasing demand on the open market by 0.0727 kgs. per capita and distribution through the fair price shops by 0.8557 kgs. per capita.² Based on these relationships, every ton of P.L. 480 imports has increased consumption by 0.93 tons. Associated with a 1.0 kg. per capita increase in P.L. 480 imports was a 0.0119 kg. decrease in commercial imports and a 0.0597 kg. increase in government stocks.

The net impact on domestic supply is measured most accurately by the sum of individual year impacts as the market traces out a cobweb pattern returning to equilibrium. The sum of the production impacts over the twelve-year period considered totals 0.0278 kgs. of domestic production per kilogram of P.L. 480 imports. Translated to tons, 1.0 kg. per capita of P.L. 480 imports (450,480 metric tons) would depress domestic production by 12,600 metric tons, spread over three or four years.

The differentiated market model is unique from previous attempts by various individuals to evaluate the impact of P.L. 480 imports on the

¹In the last year of data used, the population of India was estimated at 511.3 million (27, p. 72) so that imports of 1.0 kg. per capita involves 511,300 metric tons of cereal.

²See Appendix B for development of the econometric model and tabular summary.

recipient economy in that it explicitly considers the case where P.L. 480 imports are distributed to consumers so that a demand shift occurs as well as a shift in total supply.¹ As a consequence of recognizing the shift in demand as well as supply, the impact of P.L. 480 food aid on domestic supply is estimated to be less than 9 percent of the magnitude estimated by Mann (38, p. 143) that assumed only a shift in supply. In contrast to a reduction in domestic supply of 12,600 metric tons estimated in the Rogers study, Mann's interim multiplier implies a negative impact of 143,200 metric tons on domestic supply. With empirical evidence to support the theoretical arguments presented by Fisher (17, pp. 863-867) and Waugh, Burtis, and Wolf (68, pp. 34-35), it must be concluded that previous analytical work that did not consider the real income effect on demand, but only a shift in supply, overestimated the negative impact of P.L. 480 imports on domestic prices and domestic production. For the same reason, the contribution of P.L. 480 imports to welfare in the recipient country has been underestimated.

From a policy application standpoint, the conclusions of the differentiated market analysis indicate that distribution of surplus commodities to low income consumers through a differentiated market can significantly reduce potential negative impacts on domestic prices and production. The analysis indicates that distribution of surplus commodities through fair price shops in India has significantly increased consumption of food commodities rather than displacing or substituting for consumption of domestic production. Since fair price shop distribution is at lower prices than local market prices, consumer welfare has been improved by providing more food at lower average prices. At the same time, domestic prices were depressed only slightly so that gains in consumer welfare were not at the expense of domestic producers.

¹For a price elasticity of demand of -0.39, a decrease in price of 0.1314 implies a change in quantity demanded of 0.07227 kgs. per capita if adjustment is along the demand curve as compared with the actual increase of 0.9284 kgs. per capita which implies a shift in demand.

The theory and empirical evidence indicate that a system of market differentiation, such as the fair price shop system in India or other methods of differentiating the market on a product or regional basis, have general application for distribution of surplus commodities in developing countries or depressed areas of developed countries. The demand expansion resulting from the availability of commodities through a differentiated market provides a means to utilize surplus commodities to improve consumer welfare while protecting producer welfare.

Applications to Domestic and Foreign Welfare
and Development Problems

The use of surplus food commodities to improve consumer welfare directly through welfare programs or indirectly through development of the general economy is limited only by the imagination of policy and administrative officials who design and direct the programs. Low income consumers have a high marginal preference for food and, to the extent that their real income can be increased, a proportionately large share of the income will be allocated to additional food consumption. Where surplus food commodities can be matched with the additional demand, food aid can substitute for other forms of assistance or development resources.

U.S. welfare programs - old and new

Two basic programs, direct distribution and food stamp plans, have been used in the U.S. to expand demand of low income groups. Direct distribution, as it originated under the authorization of Section 32 of the Agricultural Act of 1935, was designed to serve two primary objectives: (a) to remove commodities from government stocks accumulated by the government through price support activities and (b) to provide food commodities to needy families to help improve their level of welfare.

The original food stamp program began in 1939 with similar objectives which included: (a) expansion of effective demand for farm products, (b) distribution of food to undernourished families, and (c) utilization of existing marketing channels to distribute food. The food stamp plan, as operated in the United States, has utilized regular retail outlets for

distributing the food rather than requiring special food lines or distribution centers.

From the standpoint of administrative costs, complete data is not available to evaluate the total costs of both programs, but some conclusions can be drawn from the operational knowledge of the two programs. In both cases, consumers who are eligible to participate in the programs must be identified; thus, there should be no major cost difference in this aspect of the programs. In contrast, it is likely that purchasing, processing, storage and distribution of food will cost considerably more for direct distribution through special centers than will the comparative costs of printing, distribution, and redemption of stamps for the food stamp program which operates through retail distribution stores. Consequently, "marketing costs" per unit of food would be considerably higher for direct distribution than for a stamp plan (25, p. 2).

To evaluate the comparative efficiency of the two programs, several assumptions should be made. To achieve efficient allocation of resources from a consumer's standpoint, the distribution program should allow a consumer to express his personal tastes and preferences given a set of market prices. In particular, the last dollar spent on each class of goods should provide the same satisfaction to the consumer for all classes of goods.

Relative to cash welfare payments, direct distribution restricts consumer freedom. If the food items given to the consumer are those that he would otherwise choose to purchase, the direct distribution is essentially the same as a cash payment because it frees funds for reallocation to other items of the consumer's choice. In contrast, the food stamp plan establishes levels of expenditure that must be made to qualify for the program, usually above preprogram expenditures. Food stamps allow for expression of preference in choosing the mix of various food commodities desired, but do not allow for freedom of allocation between food and nonfood commodities.

On the basis of work incentive, direct distribution provides for no variation in the value of commodities distributed as income rises, and,

consequently, has no disincentive effect within the range of participation (25, p. 3). At the limit of qualification for participation in the distribution program, the disincentive is substantial because of the "all or nothing" basis of the program. The food stamp program is administered with a steady decline in value of food stamps provided as income increases so that the net gain from additional income is less than the total gain by the amount of food stamps given up. The food stamp plan has a constant disincentive factor for additional work, but does not have the abrupt disincentive at the upper limit of participation that is embodied in the direct distribution program. Consequently, the two programs have greatest similarity and lack of disincentive at low income levels.

From a balanced nutrition standpoint, the two programs differ significantly in potential and actual achievement. Direct distribution provides little freedom of choice and puts the burden of balancing the diet on consumers' remaining resources or the administrators of the program who determine the mix of food commodities distributed. Assuming the recipient has no other resources to allocate for consumption, the nutritional considerations rest with the program administrators. The potential exists for a balanced diet to be provided, with the consumer having little opportunity to misallocate resources and avoid a diet of nutritional balance unless the recipient wastes or sells part of the commodity bundle. In practice, however, commodities often have been selected for distribution because they exist as surplus stocks rather than because they contribute to balancing the diets of the recipients.

On the other hand, the food stamp plan provides the opportunity for the recipient to choose among a wide range of food products and achieve a balanced diet. The same freedom provides the opportunity for misallocation of resources and consumption of a diet far from nutritional balance. The extent to which administration of the program allows for determination of the commodities made available, and the extent to which nutritional standards are to be imposed on the recipient, determine the rating of the two programs from the standpoint of achieving adequate diets.

As alternatives to the current welfare programs that involve distribution of food commodities, Hoover and Maddox have suggested three types of food stamp programs (25, pp. 7, 34). The three programs include (a) a fixed purchase plan, (b) a free stamp program, and (c) a variable purchase plan. The fixed purchase plan would provide sufficient free stamps to families who are without income to allow for the purchase of a nutritionally adequate diet. Families with incomes less than 3.33 times the cost of a minimum diet would receive some free stamps in addition to the purchased stamps. To the extent that the minimum required expenditure on food would be lowered from 40 percent to 30 percent of the consumer's budget, the program would provide for greater freedom of allocation between food and other commodities. At the same time, the stamp plan would permit greater consumer freedom of choice than direct distributions.

The free stamp plan would give enough stamps to families or individuals below a specified poverty line to acquire an adequate diet. Individuals or families above the poverty level would receive a smaller amount of free stamps on a graduated scale until the amount of stamps diminished to zero at some specified higher income level. The free stamp plan again would provide for considerable consumer freedom of choice. Free stamps would expand demand beyond the quantity that would be purchased if cash payments were made. The desirability of the expanded consumption is a question of comparing a gain in individual consumer welfare with a loss in welfare for the society as a whole resulting from the misallocation of resources. Greater participation would be anticipated under the free stamp plan than under the fixed purchase plan because no specified private expenditure of income is required for participation in the program.

The variable purchase plan is similar to the fixed purchase plan in that stamps must be purchased for families above a specified poverty level. As in the fixed purchase plan, stamps would be given to families below the poverty line. Above the poverty line, stamps would be available at varying rates per dollar of face value depending on the income level of the recipient with the scale going from zero to 100 percent as income

increased. Under this plan, the consumer could choose the amount of stamps desired rather than being faced with an all or nothing package. As with the two preceding plans, the variable purchase plan would allow for expression of consumer choice in selecting the desired food bundle, but also provide maximum freedom in choice between food and nonfood commodities. If stamps are sold rather than given away, the misallocation of resources would be minimized. Maximum consumer choice could be exercised under the variable purchase program so that the expected participation would be greater than under a fixed purchase plan but less than under the free stamp plan. Sale of stamps above a specified poverty line would further reduce the cost of the variable purchase plan so that a choice between it and the free stamp plan as possible distribution plans would rest on the relative weights of participation as opposed to cost and efficiency of resource allocation.

Welfare programs for developing countries

The two distribution programs utilized in the United States to provide welfare benefits to low-income recipients and expand the consumption of food provide a model for developing differentiated markets in developing countries. The essence of supplying food aid for consumer welfare purposes is to increase consumer welfare without having a negative impact on producer welfare through depressed prices of agricultural commodities. One method of accomplishing both objectives is to achieve sufficient market differentiation so that price discrimination can be practiced in distributing surplus commodities without replacing existing effective demand. Realistically, this can only be guaranteed when food is distributed to consumers having no income so that there can be no reallocation of income that would have been spent on food to purchase other commodities.

In practice, the development of a differentiated market can be expected to compete for some of the existing effective demand so that the objective is to create a demand which is supplementary to the existing demand. In the United States, direct distribution has achieved increased consumption and consumer welfare because of the low income levels of recipients

to whom food was supplied. The same program applied to higher income recipients would have been much more competitive with the existing demand for food because of income reallocation and, consequently, a smaller increase in total food consumption.

A similar response occurs in the developing countries with respect to low income levels. Distribution of food to very-low-income consumers in India, Pakistan, Korea, or other developing countries expands total food consumption by an amount close to the quantity of food distributed. If the food for distribution comes from imported surplus commodities, then consumer welfare is improved while having little impact on domestic prices and supply. The lower the income level of the recipients, the less chance there would be for the additional commodities to compete with domestic commodities.

Direct distribution has had the characteristic in the United States, and would have in a developing country, of limiting consumer choice in selection of a desired food bundle. This characteristic can be capitalized upon in two particular cases. For illiterate consumers, supplying food in a fixed bundle nutritionally balanced provides a means to achieve nutritionally adequate diets where the ability does not exist to do so by free choice. A second situation that would lend itself to direct distribution is when a particular commodity or class of food is in short supply such as high protein foods. In this case, even though there was a limitation on consumer choice, there presumably would be little objection to a distribution program to supplement existing diets and bring them up to a level of balanced nutrition.

With recipients who have a minimal level of income, but need additional income to provide an acceptable minimum standard of living, the food stamp plans probably offer more potential than direct distribution for expanding food consumption in developing countries while avoiding a negative impact on prices. First, the stamp plans provide for freedom of consumer choice in filling the food basket. Second, a stamp plan for distribution of P.L. 480 imports through the retail stores in recipient countries would simultaneously provide for improved consumer welfare and be a

stimulus for developing the marketing distribution system.

Stamp plans can provide for differentiated product preferences by providing various numbers of different classes of stamps to the consumers. If consumers visualize surplus commodities as less attractive than domestically-produced commodities, two classes of stamps could be used so that one could be redeemed only for the purchase of surplus commodities, while the other would be good for all other food commodities. For use with uneducated recipients, it should be easy to color code stamps so that color association is all that is necessary to distinguish between commodity groups.

A food stamp plan such as the variable purchase plan discussed in the previous section would not create a disincentive for the recipients to work and thus create a chronic welfare problem. The variable purchase plan would also require a minimum amount of government subsidy for operation and make the government costs primarily a function of the extent to which it chooses to subsidize recipient income.

The fair-price shop used in India represents still another means of differentiating the market. The principle behind the fair-price shops and their use is that the P.L. 480 commodities distributed through them are, at least in the eyes of some Indian consumers, an inferior product to the domestic cereals sold on the open market. As such, a lower price can be charged at the fair-price shops for wheat, rice and other cereals without experiencing a complete substitution of fair-price shop purchases for open-market purchases.

Distribution of food through fair-price shops has had some depressing impact on prices in the open market since a small percentage of the cereal imported under P.L. 480 is substituted for domestic commodities by consumers, but the substitution has been relatively limited. Over 85 percent of the P.L. 480 commodities reach consumers through the fair-price shops without competing with domestic commodities.

The fair-price shop method of distribution allows maximum freedom of choice for consumers with an income. Pricing commodities below the prevailing open-market price improves the welfare of recipients through the

distribution of P.L. 480 commodities, but not nearly as much as do direct distribution or stamp programs. The fair price distribution functions on the basis of an effective market demand so that it represents a secondary marketing system based on a differentiated product and reduced prices. Because the distribution method does not involve an income subsidy as large as that of the other programs discussed, costs of operation are limited to procurement of the P.L. 480 commodities, operation of the fair-price shops, and a price differential between P.L. 480 contract price and fair price shop price.

Unless the fair price shop system is developed as a means of increasing employment, it seems that program costs could be reduced even more if the retail marketing system is utilized to distribute P.L. 480 commodities under the same price control policies exercised in the fair price shop. Allowing the commodities to be distributed on the basis of effective demand, at a reduced price, would minimize administrative costs associated with identifying and distributing food or stamps to needy families. On the other hand, use of fair price distribution alone would not provide the opportunity to deal with individuals or families without sufficient income to purchase an adequate diet even if all their income were used to purchase low-priced P.L. 480 commodities.

Foreign and domestic development programs

Note the difference between welfare improvement programs and economic development programs. As mentioned earlier, direct distribution or grant programs have little impact on increasing investment and level of economic activity. Similarly, sales, even at concessional prices, have little impact on development unless the sales serve to (a) control inflation or (b) provide financing for development investments. Controlling inflation can be a significant element of growth and development policy because inflation tends to shift income from wage earners and fixed asset or fixed income recipients to holders of productive resources.

Economists are in general agreement that rapid inflationary price spirals must be avoided to establish and maintain rapid economic growth

(32, pp. 573-574). A controlled rate of moderate inflation may actually stimulate a shift in income and a corresponding increase in aggregate savings, but may hamper growth by contributing to inefficient investments made primarily to avoid the impact of future inflation. Speculative hedging may result in decreased investment for production purposes. (One method of preventing speculative hedging is with the use of fiscal policy, to tax away the marginal income earned and then invest it in high-priority projects.) There is some evidence that disincentives inherent in such taxation schemes defeat their overall purpose. More effective government involvement may be accomplished by creating political and economic atmospheres which stimulate private investment directly in the high-priority projects. Government imports of foreign capital to supplement private investments is one method of creating a desirable atmosphere. The two greatest drawbacks are that low-income countries often are also low-wealth countries with low limits on their borrowing power, and the types of social overhead investments necessary to create a conducive atmosphere for private investment often have low and (or) long-run payoff periods not consistent with standard loan terms. In addition, the earnings from social overhead investments seldom accrue directly to the government, posing a revenue problem.

Increasing investments has an even more direct impact on welfare. Given the basic production relationships within an economy, some functional relationship exists, explicit or otherwise, between investment and output. In existing development literature, the functional relationship is reduced, for simplification, to the capital-output ratio. Inherent in this relationship is the assumption that a change in output results from a change in investment. Investment within a system is a function of savings, which, in turn, is a function of income. Because savings is an increasing function of income, it is difficult to accumulate capital in low-income countries where a majority of the income is spent for consumption. For the same reason, the greater the inequity of income distribution within a society, the higher is the rate of aggregate savings and capital accumulation.

Although ignoring the very poor is not the humanitarian approach to

take, it may be an economically expedient method of encouraging development. From a humanitarian standpoint, the groups that need the help most are the ones that lack the knowledge and incentives to help themselves. When dealing with food aid, it may be wise development policy to use food to increase incomes of groups which already have relatively high incomes since less will be consumed and more will be converted into savings and investment. Those who advocate aggregate growth even if it results in disproportionate distribution rationalize by saying that the resources will eventually be redistributed to the poor. Many developed and developing nations have learned, however, that redistribution cannot be postponed too long or it is inevitable that the plight of the poor will threaten internal social, political, and economic stability.

With these relations as a basis, there are at least two primary reasons for increasing per capita income of low income consumers. Low income consumers have high positive marginal utility for consumption, which implies that consumer welfare is improved as a consequence of increased incomes and resulting consumption. Second, because low income consumers do have a high marginal propensity to consume, they, in turn, have low marginal propensities to save and contribute to investment, output, and aggregate income. Raising their income level may allow them to contribute to overall economic development of the nation rather than representing a constant burden.

The achievement of rapid economic development has, in the experience of most nations, involved extensive planning and high levels of investment. As Ezekiel points out (15, p. 3), one form of investment to facilitate economic development involves the use of surplus agricultural commodities to engage idle or underemployed workers, and other resources, in projects which will increase productivity such as building roads, wells, dams, irrigation canals, schools, warehouses, processing plants, etc. Although Ezekiel was speaking specifically of developing nations, the same argument applies to unemployed or underemployed workers of the U.S. and other developed nations. To secure the services of the excess labor, it is necessary to pay wages or similar compensation. The wages represent

a direct increase in national income, but in addition they will be used by the workers in part or total to purchase food, clothing, housing and other consumer goods, thus increasing consumer demand.

In addition to the initial impact of wages on demand, usually some quantity of goods and services must be purchased locally to support development projects. These purchases represent increased income to domestic producers, either through expanded sales or higher prices. The additional income will, in turn, be used to purchase consumer goods for the producer or resources for future production. Part of the additional consumer purchases will represent demand for food and further expand the quantity of food aid that can be utilized without disrupting domestic prices. Purchases of additional resources, labor or commodities, represent still further income to other workers or producers. These purchases, in turn, will result in additional purchases of food and other commodities. The respending of additional income received from the sale of domestic goods and services creates a multiplier effect that spreads through other sectors of the economy. The magnitude of the multiplier depends on leakage from the economy (i.e., imports, taxes and savings). Since food aid represents an import and leakage from the economy of the recipient countries, and is similar to collecting taxes when sold in the United States, the multiplier effect on national income is affected by the proportion that food aid represents of the total project investment and subsequent derived demand.

As discussed in the earlier section on work projects, the extent to which food aid can be used to "finance" development without depressing prices and domestic production depends upon the amount of derived food demand generated from the investment. The higher the income level of recipients, the lower the proportion of the total aid that can be provided as food, because there is a corresponding lower marginal propensity to consume food with higher incomes. If more food is supplied to consumers as wages-in-kind than the consumer demands, he will either sell or trade part of the commodities away or reduce his demand for domestic commodities by substituting wage-in-kind commodities. In either case, demand for food

on the open market will decrease causing a decline in prices. Assuming producer responsiveness to price changes, lower food prices would cause a decrease in domestic production and lower income for agricultural producers. To avoid this negative impact on producers, it is necessary to supply wages-in-kind as only a part of total wages and not to exceed the portion that consumers would choose to spend on food.

Summary

Direct welfare programs and economic development programs can be consistent with one another. Both types of programs can be designed to provide welfare benefits for the recipients and raise the standard of living and quality of life. Development programs are of a longer-run nature, and are capable of becoming self-supporting. Welfare programs tend to provide more immediate benefits and do not have self-sustaining characteristics. Ideally, consumer welfare would be improved through general economic growth and development, but certain groups within an economy (orphaned children, aged, sick, etc.) do not always participate directly in the benefits of economic development.

Although economic growth in developing as well as developed countries is designed to increase the average per capita income level, it does not follow that all groups participate equally. On the basis of indices such as per capita production, income, investment and wealth, various comparisons are made regularly among nations as well as among sectors within nations. One major shortcoming of these aggregate indices is that they do not expose the disproportionate distribution of income and wealth within a society. It is this disproportionate distribution of economic gains, along with certain human physical handicaps, that make it necessary to combine both development activities and direct welfare plans to provide welfare benefits for all.

No single plan for development is directly applicable to all nations or even all developing nations. Emphasis on the development effort depends upon the natural endowments of the particular country, adaptability of resources to various products, current stage or level of supply, effective

consumer demand for various products, source and volume of potential investment funds, restrictions attached to importing investment funds, extent of scale economies in various industries, comparative advantages in world market, and the availability of entrepreneurial resources in particular industries.

Surplus food commodities used as food aid have a unique potential to substitute for capital in both direct welfare and development programs that involve low income consumers since they often allocate more than 50 percent of their income to food purchases. Because a large portion of most low income budgets is allocated to food, food supplies must expand rapidly during periods of development and rising incomes to prevent severe price inflation. Since many developing countries have experienced difficulty in adequately expanding domestic agricultural production in the past, it is unlikely that they can expand production rapidly enough to meet additional demand from expanded development investments.

Providing food commodities to consumers at concessional prices (that is, below market price) improves the welfare of the consumer by adding to his ability to consume goods and services. In general, food aid has an impact similar to cash welfare payments because it increases consumer income or resource endowment and allows increased demand for consumer goods. With food aid, the consumer can still consume all the commodities previously chosen and is able to consume additional commodities as well. He may wish to increase total food consumption less than the amount of food aid and may reallocate part of his previous food budget to other commodities. The consumer, if rational, will never reallocate his food budget so that he reduces his total food consumption below previous levels. The reallocation of the food budget to purchase other items indicates that the consumer will demand more of each commodity at the same price and, hence, a shift in demand will occur. If the presence of food aid commodities in the economy produces a decline in food price, the consumer also may choose to expand his food consumption. If this process is widespread, food aid will increase the total demand for food.

Three major programs or plans (direct distribution, food stamps, and

fair price shops) have been discussed as possible methods of using U.S. surplus agricultural commodities to provide direct welfare benefits to consumers, while minimizing negative impacts on food prices and production. Direct distribution provides the greatest administrative control over the food bundle provided, but for the same reason, allows the least freedom of choice for the consumer. Direct distribution could be particularly effective when dealing with illiterate recipients who lack the knowledge to select a combination of commodities that will provide a nutritionally balanced diet. Administrative costs of the program would be relatively high because of the food handling involved and the effort necessary to identify needy recipients and the quantity of food they are to receive.

A variable purchase stamp plan would allow for the welfare aspect of subsidizing income while reducing the cost of administration by handling stamps instead of food commodities. Second, this plan can be designed to utilize the established marketing system and stimulate the development of this sector of the economy as a beneficial side effect. Costs of a stamp plan could be controlled primarily by the amount of income subsidy desired for welfare purposes.

A fair price distribution program operated in conjunction with the retail marketing system would provide the least administrative control over the food bundle consumers chose, but allow consumers maximum freedom of choice. Because of the lack of income subsidy, controlled price distribution would involve the lowest administrative costs of the three programs.

If a minimum cost program to distribute food aid is the goal, a combination of a variable purchase stamp program and a controlled price distribution program could be operated at various levels at the government's option. The combination program would capitalize on the market differentiation to minimize the negative impact on domestic prices and production of food.

Development programs could be partly financed with surplus commodities under any of the three plans. The essence of using food to finance development is that the food serves as a wage for idle or underemployed

labor that can be actively engaged in productive activities. It is immaterial whether the food is distributed directly as wages-in-kind, stamps are distributed that can be redeemed for surplus food, or cash wages are paid and prices restrained with the sale of surplus food items at local markets. Regardless of the distribution system, the food provides the wages to hire labor. The difference between the direct welfare programs and the development programs is in (a) the group of individuals allowed to participate and (b) the length of time necessary to gain the full impact of bringing resources into production.

In welfare programs in the United States, emphasis has shifted toward requiring physically capable individuals to work when employment is available to qualify for welfare benefits. This philosophy is in keeping with the relationship between welfare and development which was described earlier. When President Nixon recommends a welfare program to provide a minimum salary of \$1,600 for a family of four, he is talking about a group of recipients with an income level as low or lower than many of the developing countries where P.L. 480 commodities have been used to finance work projects. When the per capita income of \$400 in the United States is compared with similar levels of income in other countries, it may be that the United States welfare recipient is relatively worse off living in the United States with the higher cost of living than is the foreign counterpart in the countries receiving U. S. food aid. At any rate, the welfare recipients in the United States have similar consumer behavioral characteristics to the foreign recipients and could utilize food aid in a similar manner.

To what extent should the United States undertake to finance welfare and development programs at home and abroad with U. S. surpluses? As Abel and Cochrane have pointed out, providing welfare benefits through direct distribution or concessional pricing is costly. In the case of surplus food, however, the real question is, how costly? With U. S. agriculture routinely out-producing domestic and commercial export demand, the U. S. government has chosen, as one means of maintaining income levels in the agricultural sector, to take excess production off the market and hold it

in government storage. Storage costs and rapid deterioration of food commodities make the marginal cost of releasing the stored food for welfare and development programs relatively low. From a humanitarian standpoint, taking resources out of production while many individuals at home and abroad are starving seems irrational. Encouraging the use of surplus food for development programs where labor can be provided, and welfare when work cannot be provided allows U. S. farmers to contribute to the welfare of the citizens around the world at a reasonably low marginal or real cost to the U. S. government. Should domestic and commercial export demands catch up with production capacity so that food commodities are not available in storage, or if a less expensive means of controlling production can be initiated, the marginal cost of supplying food aid to foreign countries or depressed regions in the United States will increase sharply. Under the current domestic agricultural policy, however, the marginal cost of using surplus food for welfare programs is low. Use of the food as wages-in-kind increases the level of income of recipients while providing labor inputs for various productive activities. Extensive use of this approach should be used to handle the problem of surplus production capacity in the United States and the problem of individuals around the world who have insufficient income to provide a minimum acceptable diet.

Appendix A: A Review of Selected Consumption Studies

The validity of Engel's Law was verified by Houthakker in a cross-sectional study of personal expenditure patterns using international data (26, pp. 532-551). Although the Houthakker study reports total expenditure instead of income which is used in the strict formulation of the law, the results confirm the more rigorous formulation of Engel's Law.¹

By using data published by Houthakker, an attempt was made by Rogers (42, pp. 77-79) to develop an international Engel Curve for food.² Three functional forms were considered: (a) the percentage of budget spent for food on total expenditures, (b) the percentage of budget spent for food on the log of total expenditures, and (c) the log of percentage of budget spent for food on the log of total expenditures.³ The semilog function, displayed in Figure A.1 resulted in the best fit (R^2 for semilog = 0.68, R^2 for linear = 0.63, and R^2 for double-log = 0.65).

¹Total expenditure differs from disposable income by the amount of savings and hoarding. Since income elasticities normally are smaller than expenditure elasticities, formulation of the test with income would only further emphasize the results obtained from using expenditures for the associated income levels.

²An Engel Curve is the locus of points developed when plotting the percentage of the budget spent on a particular commodity or aggregate bundle against total budget expenditures.

³Regression of the percent of budget spent for food on total expenditure directly fits a linear relationship with a constant slope which implies a constant change in food consumption with respect to a change in expenditure (i.e., constant marginal propensity to consume food) and assumes that the coefficient of elasticity tends toward unity as income increases indefinitely. The linear form is inconsistent with consumer behavior by precluding the asymptotic approach to a plateau of maximum consumption. Regression of the log of the percentage of budget spent for food on the log of total expenditure fits a double-log relationship which implies constant elasticity. The double-log form is often rejected on the basis of empirical evidence denying constant elasticity of demand for food. This form probably is used more often than the functional form merits simply because the elasticity coefficient is determined directly as the regression coefficient. The double-log form often is satisfactory over a relatively narrow income range and particularly, when food consumption is expressed in terms of expenditure rather than quantity (23, p. 2). The semilog function has neither the handicap of constant marginal propensity to consume nor constant elasticity and allows the elasticity to vary with level of expenditure.

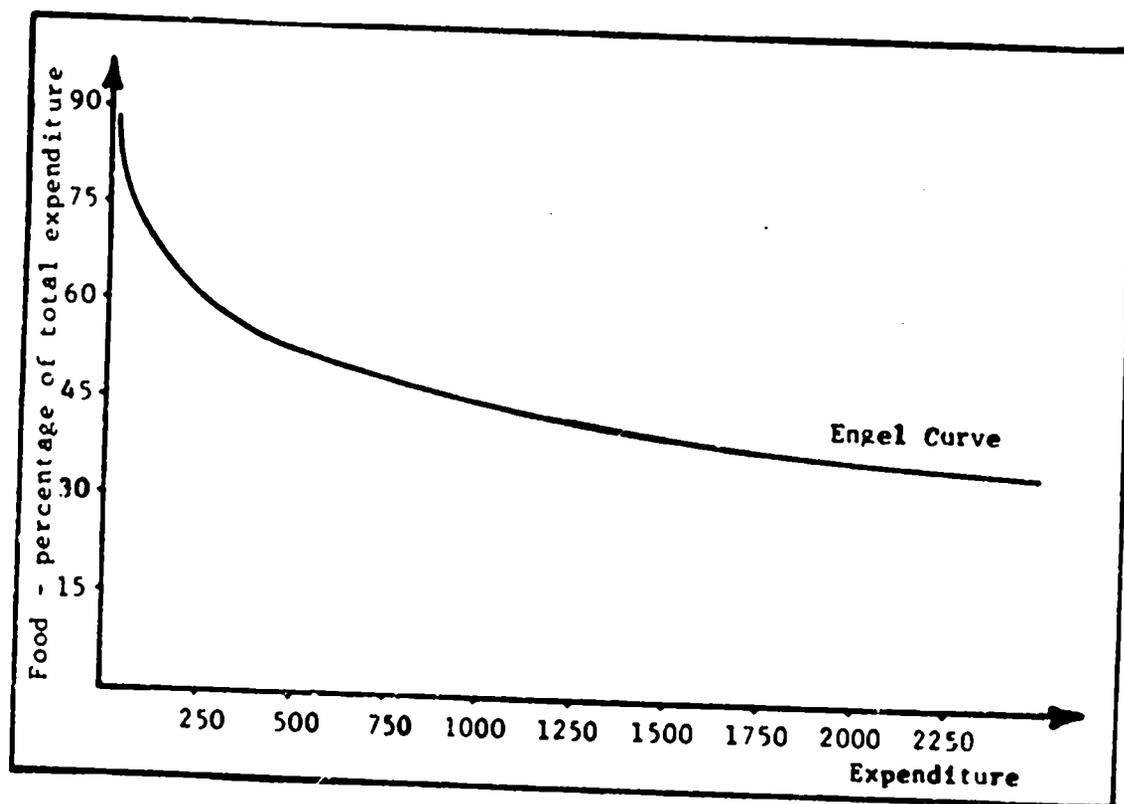


Figure A.1. Estimated international Engel Curve for food consumption based on a semilog function

Values on the estimated Engel Curve range from a high of 100 percent at the very low budget levels down to approximately 35 percent at a total annual per capita expenditure of \$2,500. At the low budget level the proportion spent on food decreases rapidly as expenditure increases up to about \$750 where the slope of the function begins to stabilize.

Mellor argues that, because tastes and preferences differ so widely between countries, comparisons of international data are not likely to be useful for detailed studies. However, he agrees that for broad aggregates of commodities, the international comparisons provide estimates surprisingly close to those from intracountry cross-sectional studies (39, p. 52). Similarly, Stevens has stated that "international comparisons of Engel Curve data provide more convincing evidence¹ on the general

¹Wold and Jureen state that budget study elasticities are not the same conceptually as time series elasticities and that they should be smaller than the time series estimates (70, p. 56). Stevens points out that if Wold and Jureen are correct, budget study elasticities "could not be relied upon for estimates of the elasticity of food during development" (45, p. 17). For further discussion of the differences between time series and budget estimates, see Manderscheid (37).

Magnitude of the income elasticity of total food during development" (45, p. 18). With the high degree of aggregation used when classifying demand into two commodity groups, food and other items, the international data should provide reasonable estimates for food consumption at various income levels.

In a recent study of food consumption by the National Council of Applied Economic Research of New Delhi (28), the data indicate that the average yearly expenditure of an Indian consumer was \$67.36, of which 52.5 percent was spent on food, 5.9 percent on clothing and 34.6 percent on other items (Table A.1). Expenditures ranged from less than Rs. 101.8 (about \$22) to more than Rs. 672 (about \$140) while food expenditures ranged from 65 percent down to 30 percent (Table A.2). Income elasticity of demand for wheat was estimated at 0.58 and, for rice, at 0.47. Elasticity for all cereals was estimated at 0.27 with maize, jowar, and small millet all having negative coefficients (28, p. 86).

Table A.1. Average per capita expenditure per month and year in India^a

Commodity group	Per month	Per year		Percentage of expenditure
	(Rs.)	(Rs.)	(^b \$)	
Food	14.11	169.32	35.39	52.5
Fuel and light	1.58	18.96	3.96	5.9
Clothing	1.88	22.56	4.71	7.0
Other	9.29	111.48	23.30	34.6
Total	26.86	322.32	67.36	100.0

^aSource: India, Government of. National Council of Applied Economic Research. All India consumer expenditure survey. p. 49. New Delhi. Author. June 1967.

^bOfficial exchange rate for period covered by the study, 1964 and 1965, averaged 4.785 Rs./\$ U.S. (30, p. 162).

Table A.2. Monthly per capita food expenditure in India^a

Income class (Rs.)	Total expenditure (Rs.)	Total food (Rs.)	Total food _b (\$)	Food percentage expenditure
Under 8.9	11.57	7.49	1.57	64.8
9.0 - 11.9	14.64	9.02	1.89	61.6
12.0 - 13.9	18.52	10.37	2.17	56.0
14.0 - 15.9	18.08	10.98	2.29	60.8
16.0 - 18.9	24.55	13.52	2.83	55.1
19.0 - 21.9	22.45	12.77	2.67	56.9
22.0 - 24.9	29.50	16.07	3.36	54.6
25.0 - 28.9	- ^c	- ^c	- ^c	- ^c
29.0 - 34.9	33.80	15.96	3.34	47.3
35.0 - 43.9	37.01	17.91	3.74	48.4
44.0 - 55.9	51.30	23.49	4.91	45.8
Over 56.0	99.84	29.77	6.22	29.8
Average	26.86	14.11	2.95	52.5

^aSource: India, Government of. National Council of Applied Economic Research. All India consumer expenditure survey. pp. 118-119. New Delhi. Author. June 1967.

^bOfficial exchange rate: 4.785 Rs./\$ U.S. (30, p. 162).

^cData inconsistent due to reporting of unusual wedding expenditures.

In a similar study of food consumption in Korea for 1964-1967, income elasticity for grain was estimated at 0.55 and for all food at 0.54 (41, p. 77). Total per capita expenditure in the Korean study ranged from about \$58 up to about \$125, with the average being \$80 (Table A.3). The range on percentage of expenditure for food was from 79 down to about 54, with an average of 65.6 percent.

Table A.3. Food expenditure in Korea by household^a

Income class (in 1,000 Won) ^b	No. per household	Total expenditure (Won)	Total food (Won)	Total food (\$) ^c	Food expenditure percentage
Under 72	4.2	60,767	48,220	189.10	79.3
72 - 96	5.3	85,022	63,810	250.02	75.0
96 - 120	5.6	107,235	76,642	300.56	71.5
120 - 144	6.5	132,528	87,340	342.55	65.0
144 - 168	7.3	156,193	97,677	383.05	62.6
168 - 192	6.9	180,221	106,395	417.24	59.0
Over 192	7.9	249,100	133,916	525.16	53.8
Average	6.0	123,934	81,307	318.85	65.6

^aSource: Pak, Ki Hyuk and Hau, Kee Chun. An analysis of food consumption in the Republic of Korea. p. 81. Seoul, Yonsei University. 1969.

^bUnit is 1964 Won.

^cOfficial exchange rate 255 Won/\$ U.S. (30, p. 196).

In summarizing several studies of elasticity by F.A.O., Goreux estimates the income elasticity of food demand to be 0.85 at an annual per capita income of \$50 and 0.25 at \$1,500 (23, p. 6). For selected commodities, his estimates are much higher at low income levels. Milk and milk products reach 2.2, and sugar reaches 1.5, at \$50. Coale and Hoover cite Palvia as estimating the elasticity of demand for food at 0.8 in India for the period up to 1971 (9, p. 125). In an analysis of international data from 35 countries, Stevens estimated the elasticity at about 0.8 at \$50 and about 0.6 at \$1,000. In a similar analysis of data from 13 different countries, Stevens obtained estimates of 0.8 and 0.56 at low income levels (\$75) and high income levels (\$600) respectively (45, p. 19). Analyzing data published in a study by Kuznets, Stevens estimated the elasticity

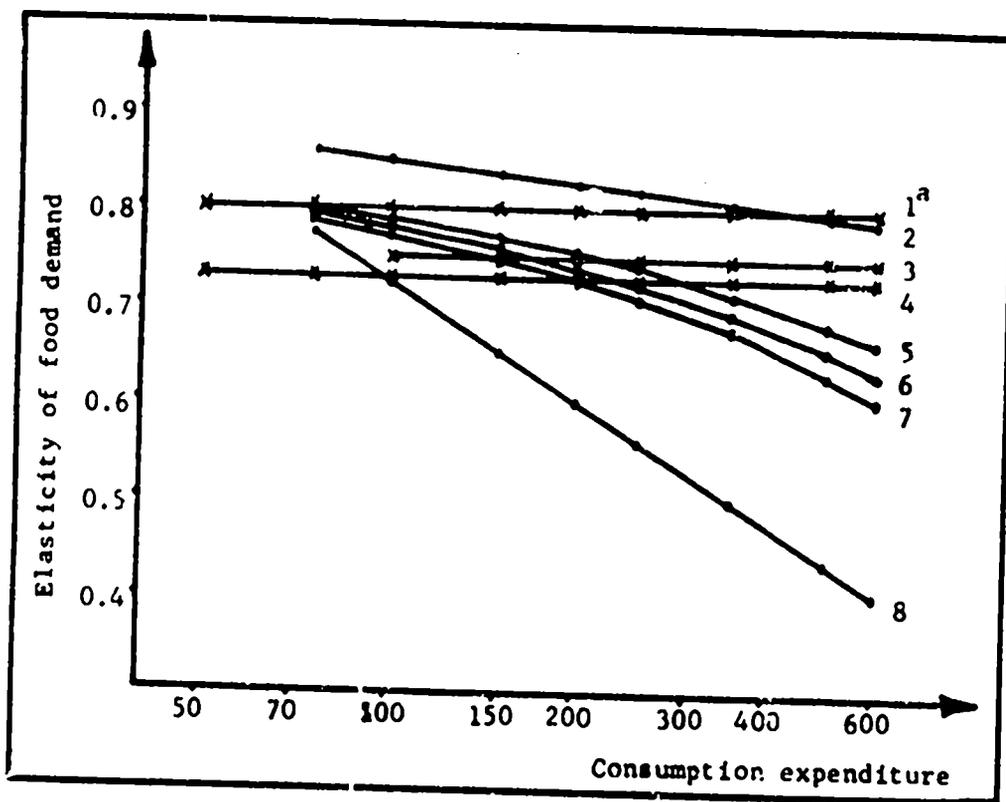


Figure A.2. Income elasticity estimates

^aSource: 1--Palvia by Coale and Hoover (9); 2--Houthakker (26); 3--Kuznets (35); 4--Brown (7); 5--Stevens with 35 countries (45); 6--Stevens with 13 countries (45); 7--Pak and Han (41); and 8--Goreux (23).

coefficient at 0.75 with a double-log function (45, p. 21 and 35, p. 24). Using a double-log function to analyze data from a study by Brown, Stevens estimated the elasticity coefficient at 0.73 (45, p. 21 and 7, pp. 42-44). Mellor suggests that the appropriate elasticities for developing countries range from 0.9 at low income levels down to 0.5 at high income levels (39, p. 78). Elsewhere, Johnston and Mellor estimate that the elasticity is 0.6 or higher in developing countries (31, p. 339).

Results of these studies are summarized in Figure A.2 by plotting the resulting price elasticity of demand estimates against consumption expenditure on a semilog scale.¹ Over the range from \$75 to \$600, the elasticity

¹Results of the Indian study were observed to be unusually low estimates compared to the other studies and omitted. The low estimates may be attributed to the collection of data, through budget studies, which previously have been identified as tending to provide low estimates.

estimates are bounded by data from Houthakker at the upper limit and from Goreux at the lower limit. At the low income levels (below \$100), the estimates are quite close with the spread increasing at high income levels.

Comprehensive estimates of the proportion that food represents of total consumer expenditures are quite limited. Of the 101 countries of the world for which the United Nations has estimated per capita income under \$600 (47, pp. 48-53), they have food consumption estimates for only 17 (46). The plot of the 17 country estimates in Figure A.3 with the Engel Curve estimated by Stevens ($F/E = 116.83 - 29.34 \log E$) indicates that the small sample is not sufficient to improve on earlier estimates of the Engel Curve. Only half the countries fall within the area outlined by the broken lines identifying points which are 10 percent above or below the estimated Engel Curve at each income level.

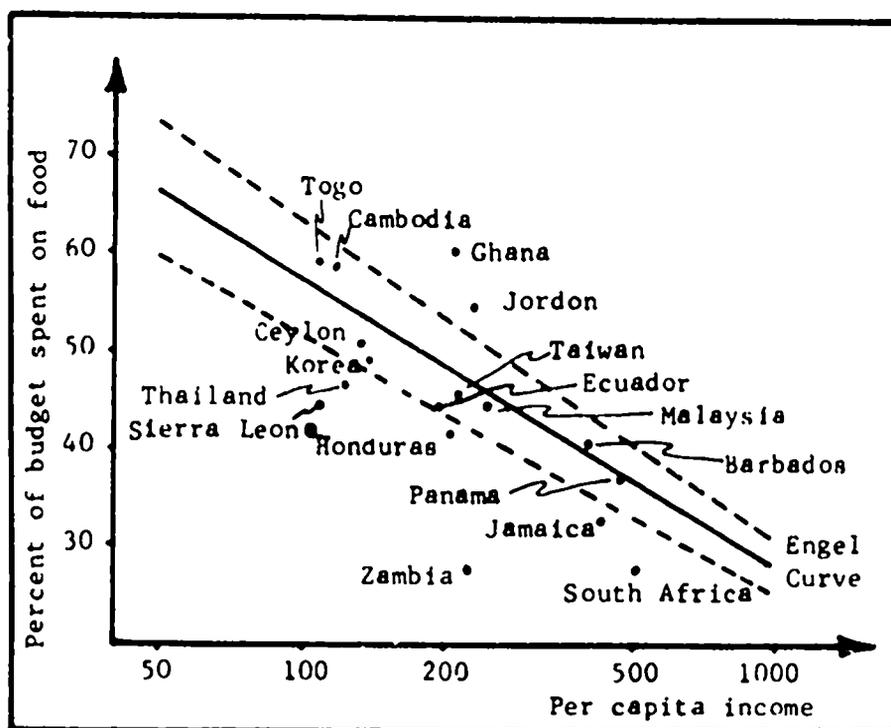


Figure A.3. International comparison of proportion of consumer budget spent on food (46 and 47).

Of the P.L. 480 contracts authorized for 37 countries during 1968, approximately 70 percent of the food was contracted by countries with per capita incomes of \$50 to \$100 per year (Table A.4). Another 21 percent was contracted by countries with per capita incomes over \$300. In addition, a wide distribution of income underlies the average for any given country so that any or all the above income levels might be observed for select groups within that country.

Table A.4. Percentage of 1968 food aid contracted--by per capita expenditure level in recipient country^a

Expenditure in dollars	Percentage of food aid	Cumulative percentage
50 - 74	18.64	18.64
75 - 99	50.61	69.25
100 - 149	10.10	79.35
150 - 199	8.64	87.99
200 - 299	2.95	90.99
300 - 399	2.80	93.74
400 - 499	0.44	94.18
Other	5.82	100.00

^aSource: Food and Agriculture Organization. Agricultural commodities --projections for 1975 and 1985. Rome, F. A. O. 1967.
United States Congress. Food for peace. House Document 104-91/1. April 1969.

Appendix B: A Model for Analyzing Market Differentiation

In an earlier study by Rogers, a model was developed (42, pp. 116-149) to analyze the impact of P.L. 480 imports on a recipient economy when market differentiation is used to distribute the commodities to consumers. The model presented in the next sections, has been applied to Indian data, and the results have been compared with previous estimates of P.L. 480 impacts on prices and domestic production.

A theoretical model

To incorporate the concept of market differentiation into the analytical framework developed by Mann (38, pp. 131-146), it is necessary to add an additional equation to the system so that provision is made for cereal purchases on both the open market and through the fair price shops at concessional prices. Incorporating a second "demand" equation and modifying various other equations in the basic Mann model to reflect stronger causal relationships and improve their reliability, a model is specified by defining several a priori functional relationships presumed to exist as indicated on the basis of theoretical considerations. The model includes (1) a supply equation, (2) an open-market demand equation, (3) a concessional market distribution equation, (4) an income equation, (5) a commercial import equation, (6) a withdrawal from stocks equation, and (7) an excess demand equation. The reduced form of the system of seven equations will provide estimates for the quantitative impact of P.L. 480 shipments of cereal distributed through a concessional market arrangement.

The quantity of cereal produced during the current year depends on production decisions, weather conditions, and available technology during the previous growing season. In developing economies, producers' primary source of information with respect to market price is prices received for the previous crop. Consequently, if the quantity available for consumption in period t is a function of production during $t-1$ and expected price is based on the price in the previous period, supply in period t is a function of price in $t-2$.

The theoretical supply function is specified as

$$Q_t^s = f_1(P_{t-2}^c, R_{t-1}, T_{t-1}) \quad \text{B.1}$$

where

- Q_t^s is per capita quantity of cereal available from domestic production for consumption in period t ,
 P_{t-2}^c is an index of wholesale cereal price (deflated by a consumer price index for all commodities) in the period before production,
 R_{t-1} is a rainfall index as a proxy for weather conditions during the producing season, and
 T_{t-1} is cereal yield as a proxy for other factors affecting production, such as adoption of technology.

Formulating the open-market demand equation from microeconomic theory, quantity of cereal demanded is assumed a function of cereal price, price of substitute commodities (other food) and income level. The demand equation is specified as

$$Q_t^d = f_2(P_t^c, P_t^r, Y_t) \quad \text{B.2}$$

where

- Q_t^d is per capita quantity of cereal demanded in the open market for consumption in period t ,
 P_t^c is wholesale cereal price (deflated by a consumer price index) in period t ,¹
 P_t^r is price of noncereal foods (deflated by a consumer price index) in period t , and
 Y_t is per capita consumer income (deflated by a consumer price index) in period t .

¹Strictly speaking the supply equation is formulated in terms of wholesale prices and the demand equation in terms of retail prices, but with an assumption about stable marketing margins, a demand function can be derived in terms of wholesale prices.

Distribution of P.L. 480 imports through the fair price shops in India is a function of economic variables at the minimum level and a physical restraint at the upper level because of the fixed price offering. At least part of the consumers consider imported cereal an inferior commodity and will continue to purchase cereals on the open market even when there is a price differential between the open market and the concessional market. As the two prices diverge, however, more and more consumers are willing to substitute imported cereal for domestic cereal. Consequently, the demand for cereals through the fair price shops is a function of price at the concessional market, price of cereal in the open market as a substitute, and income level of consumers. At the upper limit, price adjustment cannot serve as a balancing mechanism to equate demand with a limited supply because the price is fixed by the government and has been held relatively constant. Consequently, the upper limit on distribution through the fair price shops is the quantity that the government chooses to release for distribution. Since the primary source of commodities for distribution through the fair price shops has been P.L. 480 imports, quantity of imports are entered in the concessional distribution equation as a proxy for the maximum quantity available for distribution. The concessional distribution equation is specified as

$$Q_t^c = f_3(P_t^p, P_t^c, Y_t, M_t^p) \quad B.3$$

where

- Q_t^c is per capita quantity of cereal distributed through the concessional market in period t ,
- P_t^p is predetermined cereal price charged in the concessional market (deflated by a consumer price index) in period t ,
- M_t^p is per capita quantity of concessional imports of cereal under P.L. 480 in period t , and the other variables are defined as in B.2.

In developing countries, the economy usually is predominately agricultural so that production in the agricultural sector has a significant impact on aggregate income in the economy. The other dominate sector in

India is the industrial sector. The third major source of income in India has resulted from government expenditure, particularly through the involvement of the government in financing development investments. The income equation is specified as

$$Y_t = f_4(Q_t^s, Q_t^i, G_t) \quad \text{B.4}$$

where

- Q_t^i is the value of per capita industrial output (deflated by a consumer price index),
- G_t is per capita government expenditure (deflated by a consumer price index) in period t , and all other variables are defined as in B.1 and B.2.

Commercial importing of cereal is handled through the government of India and is used as a policy instrument to relieve inflationary pressure on food prices when domestic food shortages occur. As such, the government imports food to satisfy consumer demand, and commercial imports of cereal are effectively a function of the same factors that determine the demand for cereal on the open market. The commercial import equation is specified as

$$M_t^o = f_5(P_t^c, P_t^r, Y_t) \quad \text{B.5}$$

where

- M_t^o is per capita quantity of commercial imports of cereal in period t , and the other variables are defined as in B.2.

Withdrawals from government stock provide a residual source of cereals to balance other government programs. As the government increases internal procurement of domestic production to support prices, the need for withdrawals to control inflation of cereal prices and to satisfy other government demand (such as feeding military personnel and inhabitants of public institutions) decreases. In the opposite direction, as the government increases the availability of cereal for distribution through the fair price shops, withdrawals from government stock must increase if other sources of supply remain constant. Finally, commercial and concessional

imports are alternative sources for satisfying government demand for various programs; thus, withdrawals from government stock are a function of the level of import activities. The withdrawal equation is defined as

$$W_t = f_6(Q_t^C, M_t^O, M_t^P, C_t^P) \quad \text{B.6}$$

where

- W_t is per capita net withdrawals of cereal from government stocks in period t ,
- C_t^P is per capita internal procurement of cereal by the government in period t , and the other variables are as defined in B.3 and B.5.

The last equation is an excess demand or market identity equation to close the system by forcing excess demand for cereal to equal zero and is specified as

$$Q_t^d + Q_t^C - Q_t^S - M_t^P - M_t^O - W_t = 0, \quad \text{B.7}$$

where the variables are all defined as in B.1 - B.6, inclusive.

The model consists of 7 equations and 16 variables. Since the purpose of this model is to evaluate the economic impact of P.L. 480 imports on prices and domestic supply of cereal, certain variables are treated as given or predetermined outside the system. The predetermined or exogenous variables include T_{t-1} , R_{t-1} , P_t^R , P_t^P , C_t^P , M_t^P , G_t , P_{t-2}^C , and Q_t^i . The values for these variables are given at a particular point in time and are not subject to determination by the econometric model. The remaining seven variables, which include Q_t^S , Q_t^d , Q_t^C , P_t^C , Y_t , M_t^O , and W_t , are the object of determination within the constraints of the model. These seven variables make up the set of jointly determined or endogenous variables for which estimates are desired.

The seven structural equations provide the joint interactions of the variables in the system. To provide for independent examination and analysis of the jointly determined variables, the structural form is solved to obtain the reduced form, where each dependent variable is uniquely defined as a function of the independent variables and the constraints of the system in the derived reduced form.

Applying Johnston's procedure for determining identification,¹ all seven equations are overidentified (33, pp. 250-251). Under conditions of overidentification, the two stage least squares method of regression will provide consistent and unbiased estimates of coefficients of the structural form (33, pp. 262-263). With estimates of the coefficients for the endogenous variables (β 's) and the predetermined variables (γ 's), the reduced form coefficients can be derived as

$$\hat{\Pi} = -\hat{\beta}^{-1} \hat{\Gamma} \quad \text{B.8}$$

where

- $\hat{\Pi}$ is the matrix of reduced form coefficients,
- $\hat{\beta}$ is the matrix of endogenous variable coefficients, and
- $\hat{\Gamma}$ is the matrix of predetermined variable coefficients.

An empirical model

An empirical model was estimated using secondary data from India covering the years 1956 to 1967 inclusively. The data indexes for consumer prices, cereal price, noncereal food price, and consumer price were taken from Brief on Indian Agriculture 1969 (52, Table 20). Data on midyear population, cereal production,² and national income were taken from Economic Survey 1969-70 (27, pp. 61, 72). The data on net imports and P.L. 480 imports (wheat and rice) were taken from Brief on Indian Agriculture 1970 (53, Tables 15-17). Data on cereal withdrawals from government stocks, cereal demand, distribution of cereal through the fair price shops, internal procurement of cereal, fair price for wheat, and industrial output were taken from Bulletin on Food Statistics (12, pp. 48, 196, 250, 260). Rainfall and yield data was taken from the Economic and Political Weekly (13, p. A-166). Government expenditure data were taken from International Financial Statistics (30, p. 164). Units of measure used in the model

¹The number of predetermined variables not in the equation (K^{**}) must be equal or greater than the number of endogenous variables minus one included in the equation ($G^{\Delta-1}$) to be identified.

²Production was adjusted downward by 12.5 percent to allow for feed, seed, and waste in calculating the amount available for consumption (27, p. 72).

were: kilograms for Q_t^s , Q_t^d , Q_t^c , M_t^o , W_t , C_t^p , and M_t^p ; rupees for Y_t and G_t ; kilograms per hectares for T_{t-1} ; and indexes for P_t^c , R_{t-1} , P_t^r , P_t^c , P_{t-2}^c , and Q_t^i which do not have unit values.

Two-stage least squares was used to estimate the coefficients of the structural equations except Equation B.1. Since Equation B.1 contains only one endogenous variable, ordinary least-squares was used to estimate the associated coefficients.

Writing each estimated equation with the normalized variable on the left-hand side and all other variables on the right-hand side provides an over view of the estimated structural model. The supply equation

$$Q_t^s = -13.89343 + 0.09118 T_{t-1} + 0.56808 R_{t-1} + 0.24424 P_{t-2}^c \quad B.9$$

has positive signs on all three independent variables indicating that supply of cereal (Q_t^s) reacts positively to increases in the weather variables (R_{t-1}), the proxy for technology (T_{t-1}), and price (P_{t-2}^c). The estimated price elasticity of supply at the means is 0.156, which compares with National Council of Applied Economics Research (N.C.A.E.R.) estimates of 0.22 for rice, 0.16 for wheat, and 0.16 for barley (29, p. 168). The multiple R^2 for the supply equation is 0.82 and the regression is significant at the 99 percent level. The open-market demand equation,

$$Q_t^d = -10.54661 - 0.553321 P_t^c + 0.72847 Y_t + 0.047698 P_t^r \quad B.10$$

has signs on all coefficients that agree with economic theory indicating that demand for cereal (Q_t^d) is negatively correlated with price of cereal (P_t^c) and positively correlated with the price of other food (P_t^r) and income (Y_t).¹ The estimated price elasticity of demand is -0.39, slightly higher than the N.C.A.E.R. estimate of -0.34, but well between their estimate of -0.19 for rice and -0.73 for wheat (29, p. 80). The multiple R^2 for the open-market demand equation is 0.89, and the regression is significant at the 99 percent level. The concessional market distribution equation

¹An alternative formulation of the open-market demand equation was considered that included the price charged at the fair price shops, but the regression coefficient was insignificant even at the 50 percent level and did not improve the multiple R^2 . Consequently, the concessional price was excluded from the final equation.

$$Q_t^C = 60.91986 + 0.289881 P_t^C - 0.251656 Y_t - 0.22217 P_t^P + 0.89376 M_t^P \quad \text{B.11}$$

indicates that purchases at the concessional market (Q_t^C) are positively correlated with price of cereal in the open market (P_t^C) and negatively correlated with income level (Y_t) and price of cereal at the fair price shops (P_t^P).¹ The relatively large coefficient on M_t^P supports the argument that distribution through the concessional market is highly correlated with imports under P.L. 480 contracts and the associated decision to make those commodities available for distribution through the fair price shops. The multiple R^2 is 0.90 and the regression is significant at the 99 percent level. The income equation

$$Y_t = 118.91530 + 0.80042 Q_t^S + 0.28386 Q_t^I - 0.00092 G_t \quad \text{B.12}$$

indicates that income (Y_t) is positively correlated with agricultural (Q_t^S) and industrial supply (Q_t^I) but negatively correlated with government expenditure (G_t). In examining the correlation matrix for the variables in the model (Table B.1), it was noted that government expenditure was positively

Table B.1. Correlation coefficients for government expenditure and income

	Government expenditure	Deflated government expenditure
Aggregate income	.9625	.7633
Per capita income	.9515	.7483
Deflated per capita income	-.5568	-.2228

¹An alternative formulation of the concessional distribution equation included price of other food, but the regression coefficient was insignificant even at the 50 percent level and caused the ratio of regression sum of squares to residual sum of squares to decrease.

correlated with both aggregate income and per capita income, but negatively correlated with deflated or real income. This indicates that although government expenditure increased money income, sufficient inflationary pressure on prices was created to force the consumer price index up faster than money income. As a consequence, government expenditures had a positive impact on money income, but a negative impact on real income for the period under study. The multiple R^2 is 0.89 and the regression is significant at the 99 percent level. The commercial import equation

$$M_t^O = 27.84666 + 0.09045 P_t^C - 0.14608 Y_t + 0.03172 P_t^R \quad B.13$$

indicates that imports vary inversely with per capita level (Y_t) and directly with cereal prices (P_t^C) and other food prices (P_t^R).¹ The multiple R^2 is 0.77 and the regression is significant at the 99 percent level. The stocks equation

$$W_t = -1.52758 + 0.97393 Q_t^C - 0.53062 M_t^O - 1.62118 C_t^P - 0.89938 M_t^O \quad B.14$$

indicates that withdrawals from government stock (W_t) are directly related to distribution through the fair price shops (Q_t^C) and inversely related to commercial imports (M_t^O), internal procurement (C_t^P) and P.L. 480 imports (M_t^P).² The multiple R^2 is 0.84 and the regression is significant at the 99 percent level. The identity equation

¹ Alternative forms of the import equation were considered that included concessional imports and the ratio of cereal prices to other food prices, but regression coefficients for both were insignificant even at the 50 percent level.

² Alternative forms of the withdrawal equation were considered that included consumer demand factors such as prices of cereal and other food and income levels, but none of the regressions of this nature produced ratios of regression to residual sum of squares that exceed 1.0 and consequently were insignificant.

$$Q_t^d + Q_t^c - Q_t^s - M_t^O - W_t - M_t^P = 0 \quad \text{B.15}$$

states that demand on the open market (Q_t^d) plus distribution through the fair price shops (Q_t^c) cannot exceed domestic supply (Q_t^s) plus imports (M_t^O and M_t^P) and withdrawals from government stocks (W_t).

The coefficients from the reduced form of the system of equations, Table B.2, that were of particular interest in study are those associated with variable M_t^P or P. L. 480 imports. The coefficients, or impact multipliers, from the reduced form model indicate that increasing P.L. 480 imports by 1.0 kg. per capita¹ would depress cereal prices by 0.1314 units (π_{47}) of the price index, but increase demand by 0.0727 kgs. per capita (π_{27}) and concessional distribution by 0.8557 kgs. per capita (π_{37}) so that 92.84 percent of the increase in P.L. 480 imports would result in increased consumption. In other words, each ton of cereal imported by India has resulted in increased consumption of 0.93 tons. As an example, the data indicates that P.L. 480 imports for 1967 (4.055 million metric tons) increased consumption by 3.771 million metric tons or about 7.38 kgs. per capita for the year. Associated with a one kg. per capita increase in P.L. 480 imports was a 0.0119 kg. (π_{67}) decrease in commercial imports and a -0.0597 kg. (π_{77}) withdrawal from government stocks. Because of the time lag in supply response, supply is unaffected in period t .

In summary, a one-unit increase in P.L. 480 imports in India between 1956 and 1967 was associated with a decrease of 0.0119 units of commercial imports for a net increase in supply of 0.9881 units. The increase in supply resulted in an additional 0.0727 units being demanded on the open market, an additional 0.8557 units being demanded from the fair price shops, and 0.0597 units of accumulation in government buffer stocks. The new equilibrium price was reduced by 0.1314 units on a price index with a mean of 89.12, or less than two-tenths of 1 percent.

¹In the last year of data used, the population of India was estimated at 511.3 million (27, p. 72) so that imports of 1.0 kg. per capita involves 511,300 metric tons of cereal.

Table B.2. Estimated reduced form coefficients to measure impact of P.L. 480 imports on Indian economy, 1956-1967.

	Intercept	T_{t-1}	R_{t-1}	P_t^r	P_t^p	C_t^p	M_t^p	G_t	P_{t-2}^c
Q_t^s	-13.8934	0.0912	0.5681	0.0	0.0	0.0	0.0	0.0	0.244
Q_t^d	-5.9595	0.0847	0.5275	0.0168	0.0054	-1.5250	0.0727	0.0	0.226
Q_t^c	7.2528	-0.0349	-0.2173	0.0162	-0.2250	0.7989	0.8557	-0.0001	-0.093
P_t^c	133.6264	-0.0569	-0.3547	0.5578	-0.0098	2.7561	-0.1314	-0.0012	-0.152
Y_t	107.7947	0.0730	0.4547	0.0	0.0	0.0	0.0	-0.0009	0.195
M_t^o	24.1866	-0.0158	-0.0985	-0.0368	-0.0009	0.2493	-0.0119	0.0	-0.042
W_t	56.2758	-0.0256	-0.1593	-0.0038	-0.2189	-0.9754	-0.0597	-0.0001	-0.068

To measure the price impact in succeeding years, it is necessary to use an interim multiplier that, for price in this model, equals $\pi_{47} \pi_{49}^{\frac{1}{2}p}$ where $p = 0, 2, 4$, etc. because of the two-year lag between P_t^c and P_{t-2}^c (38, p. 139). Therefore, the interim multiplier for cereal price would be 0.020039 in the second year, -0.003056 in the fourth year, and 0.000466 in the sixth year. The first interim multiplier represents a change of less than three hundredths of 1 percent, using the mean value of the price index, and the multiplier values in succeeding years are essentially zero.

The impact on supply is measured by the interim multiplier $\pi_{19} \pi_{47} \pi_{49}^{\frac{1}{2}p-1} + \pi_{16}$ where $p = 2, 4$, etc. because of the time lag of price impact on production (38, p. 141). Evaluated at $p = 2$ to measure the impact of a change in price during the period where P.L. 480 imports occur upon production two periods later, the interim multiplier is -0.032088 (Table B.3). In other words, each ton per capita of cereal supplied through P.L. 480 to India has depressed domestic production by 0.032088 tons per capita during the production season 2 years later. Similarly, at $p = 4$, the multiplier would be 0.004893 so that P.L. 480 imports of one ton of cereal would result in 0.004893 tons per capita of increased cereal production. At $p = 6$, the multiplier is again negative at -0.000746. In quantity terms at the mean population of India for the period 1956-67 (450.48 million), P.L. 480 imports of 450,480 metric tons (1.0 kg. per capita) of cereal are estimated to have depressed domestic production by 14,455 metric tons 2 years later, increased production by 2,204 metric tons 4 years later and depressed production by 336 metric tons 6 years later.

The net impact on supply is most accurately measured by the sum of the interim multipliers over several years. Each kilogram of P.L. 480 cereal imported is estimated to have depressed production by 0.027841 kgs. so that, for each kilogram per capita (450,480 metric tons), production was depressed by 12,600 metric tons over a 12-year period with the major impact coming as a result of the first and second price change.

Table B.3. Total effect of P.L. 480 imports on domestic production in India.

Year	Interim multiplier	Sum of interim multiplier
2	-0.032088	-0.032088
4	0.004893	-0.027195
6	-0.000746	-0.027941
8	0.000114	-0.027827
10	-0.000017	-0.027844
12	0.000003	-0.027841

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