PN-AAQ-065
ISN=34428

93808000162

Income Effect of Title II Commodities in Rural Panama

by:

Michael P. Demousis
Marielouise W. Harrell
and
David L. Franklin

Prepared for:

Program Policy and Evaluation Office
Bureau of Food for Peace and Voluntary Assistance
United States Agency for International Development
Purchase Order Number PDC-0800-0-00-2054-00

September 1982

Sigma One Corporation
Raleigh, North Carolina

Acknowledgements

The data for this study was developed as part of the Panama Nutrition Evaluation Project. The collaboration of Dr. Cutberto Parillon, Director of Nutrition, Ministry of Health, his staff, and the staff of the supplementary feeding program in Veraguas Province is gratefully acknowledged.

Dr. Parillon, Ms. Isabel Vial de Valdés and Ms. Betsy Frazão participated in the design of the data collection instruments and the training of the field personnel. Dr. Judit Katona-Apte made some suggestions based on her experience on the NAS Study of Title II commodities.

Ms. Julie Torrey patiently and accurately typed several drafts; her cheerful support is highly appreciated.

The content of this report is the sole responsibility of the authors and Sigma One Corporation.

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Income Effects of Title II Commodities in Rural Panama

Introduction

The prevalence of calorie deficient diets in developing countries and the growing awareness of the deleterious effects that malnutrition can have on the productive potential of the individual has focused attention on nutrition intervention measures, and attempts are being made to evaluate and improve their impact. One widely used nutrition intervention measure is food aid. The present study looks at "take-home" food aid, specifically the P.L. 480 Title II "take-home" food program in Veraguas Province in Panama, and examines the effect of income mediated food consumption impacts on a sample of participating households.

The P.L. 480 Title II Food for Peace program was established in 1954 and one of its main objectives is to provide supplemental feeding to nutritionally vulnerable populations. The United States Department of Agriculture selects and buys the commodities, the Office of Management and Budget funds the program and the Agency for International Development administers it. Voluntary agencies, such as the Catholic Relief Service (CRS) and Cooperative for American Relief Everywhere (CARE), as well as the World Food Program (WFP), are responsible for the distribution of the donated foods in the individual recipient countries. The donated foods are distributed under four program types i.e., Maternal and Child Health (MCH), Food for Work (FFW), School Feeding (SF), and Other Child Feeding (OCF), and two program

modes i.e., take-home and on-site feeding. Presently, 75 percent of the food is donated in take-home MCH and FFW programs.

The general assumption underlying these take-home programs has been that individuals participating in supplemental feeding programs would consume the donated foods in addition to what they would usually consume in the absence of the program. The accumulated empirical evidence from nutrition and economics literature, however, indicates that supplemental feeding programs have a positive but very small impact on the nutritional status (measured by physical growth and nutrient intake) of the intended beneficiaries. The sources of the apparent "ineffectiveness" of supplemental feeding programs have been traced to extensive sharing of the food, i.e., leakages among targetted and non-targetted members of the household and to the relatively low marginal propensity to consume (MPC) on calories (Franklin, 1979, Franklin and Vial de Valdés, 1979).

The present study examines the phenomenon of leakages in supplemental feeding programs and empirically estimates the impact on food expenditure patterns arising from the income transfer value of a package of donated foods. The study shows that despite the leakages, supplemental feeding programs significantly improve the quality of the recipients diets by means of income mediated changes in the food use patterns of the participating households.

Background

Many Title II supplementary feeding programs distribute foods through non-commercial channels to pregnant and lactating

women, infants and preschoolers; the objective of these programs is to improve nutritional health through increased intake of nutritious foods and, usually, through the promotion of improved health and feeding practices.

A review of over 200 reports on food distribution programs for young children indicates that most such programs are expensive for the measured benefit (Beaton and Ghassemi, 1979). The general results indicate that many supplemental feeding programs have had a positive and significant impact on participating women and children. Studies conducted in Guatemala, India, Colombia, Mexico, and the United States have found that food supplementation during pregnancy improves neonatal outcome. Studies with infants and children have shown that supplemental feeding programs are often associated with improved growth and/or decreased morbidity. The benefits produced, however, are usually small. Increments in birth weights attributed to the supplemental feeding programs are typically in the range of 20 to 60 grams. Similarly, the increases in growth of children, although significant, are small.

There are a number of reasons given for these small but significant effects. First, only a part of the food is consumed by the target population. Leakages of the supplemental foods occur when the food is shared with non-target family members, when the food is substituted for other food that normally would be consumed or when the donated food is sold or traded. Beaton and Ghassemi, in their review, have estimated that leakages can

account for 30-80 percent of the food distributed. Partly because of these leakages, supplementary feeding programs usually fill only 10 to 25 percent of the apparent energy gap in the target population. Given this small net increment in energy intake, it is not surprising that the observed effect on growth is small.

Most studies have concentrated on growth as the sole outcome measure of supplemental feeding. Beaton and Ghassemi have suggested that physical growth may not be the only benefit nor even the most important benefit that occurs as a result of supplemental feeding. For example, the P.L. 480 Title II programs in sub-Saharan Africa are being operated under the concept that leakages are acceptable so long as the household produces healthy and well-nourished children. In a sense, the household is being bribed to produce the desired outcome and the supplemental foods may be seen as the income incentive to stimulate the desired behavior.

The phenomenon of "leakages" or substitution by the household is widespread in types and locales for food assistance programs, even under carefully controlled conditions. Beaton and Ghassemi make the point that while any leakage in the food supplement has heretofore been seen as an "inefficiency" in the program, it cannot be assumed that the "leaked" energy provides no benefit to the family or community. Sharing of the donated foods is invariably present in take-home supplemental feeding programs, but this sharing may represent an important source of income to the household and income mediated effects could yield

significant nutritional improvement for the target population.

Food Supplement Programs as Direct Income Transfers

If leakages in a targetted supplementation program are large and represent an income transfer to the whole household, why not rely on direct income transfers to households with food intake deficits? In some cases such direct income transfers may be preferable to food gifts in a cost-effectiveness sense (Reutlinger and Selowsky, 1976). From a political point of view, direct income transfers tend to be less acceptable than food subsidy schemes or food supplementation programs, however. Political resistance to programs "directly" aimed at a reduction in starvation and malnutrition is likely to be much less severe than political resistance to direct income transfers, even though the former results in a transfer of real income that is at least partially convertible to spendable or tradeable resources.

A further argument against direct income (money) transfers in the case of the P.L. 480 Title II programs and some of the food assistance programs of the European community, is that the food resources become available as a consequence of domestic agricultural stabilization programs and the value of the food resources is not available as cash for direct income transfers. Additionally, some of the commodities that are made available through the programs have a higher income value to the beneficiary population than the sum of the U.S. cost of acquisition and the costs of transportation and distribution. Nonfat dry milk has this value to cost relationship in most Latin

American programs, rice has this value relationship in West Africa, and oil has this value relationship almost everywhere that P.L. 480 Title II programs are operated. Consequently, P.L. 480 Title II programs have the potential to provide income mediated benefits that could exceed the cost effectiveness of direct income transfer programs. This potential can be exploited through careful choice of the commodity mix and the ration size.

The manner in which the income mediated effects would work is illustrated as follows. Supplemental feeding programs are designed to supplement the existing diet with commodities that are already consumed in the dietary patterns of the intended recipients. With the possible exception of some blended and fortified foods, all other donated commodities can be purchased by the household in most local markets. If the commodity package received by the household represents an income transfer whose value equals the local market value of the package, the household can do several things with this added opportunity. It can:

- consume all of the donated foods in addition to what they already consume;
- consume all of the donated foods and cut their purchases of these commodities thereby freeing income that can be spent on other food and nonfood items;
- sell the donated foods in the market and purchase other food and nonfood items; or
- consume some of the donated foods, sell some of the donated foods, and then purchase other foods and

nonfoods in the market.

In take-home programs that are designed to supplement the existing diet by providing foods already in the diet, the food consumption effects would depend on the magnitude of the marginal propensity to consume out of income on different food items. Consider, for example, a household that consumes two commodities, milk and rice. Hypothetical income elasticities and budget shares and the levels of consumption that would prevail in the absence of the food donation are given in the table below:

	Income Elasticity	Budget Share	Pre-Donation Consumption Levels
Milk	1.0	.37	10 kg.
Rice	0.3	.37	20 kg.
Nonfood	2.0	.26	1 unit

Suppose that a cash income transfer representing a 25 percent increase is made to this household. How would the household dispose of the additional income? If the marginal propensity to consume (MPC) out of gift money income is the same as the MPC out of ordinary or earned money income, then the answer is given by the relevant income elasticities. Consumption of milk will increase by 25 percent, consumption of rice will increase by 7.5 percent, and consumption of nonfood items will increase by 50 percent. The desired post-transfer consumption would be:

Milk	12.5 kg.
Rice	21.5 kg.
Nonfood	1.5 units

Assume now that the household, instead of cash, receives a commodity gift consisting of 5 kg. of milk, whose money value represents a 25 percent increase in income. The expectation of

the donors would be that the household would consume the donated milk in addition to what it usually consumed. In other words, it would be expected by the donors that milk consumption will increase to 15 kg. Empirical evidence, however, has indicated that this is not the case. Selowsky (1978) writes:

> "Consumer's first reaction to a food program will be to convert the concessionary element of the program into an equivalent income transfer."

Consequently, as a result of the transfer, the household would want to consume 12.5 kg. of milk, 21.5 kg. of rice and 1.5 units of nonfood; the same levels as would be obtained if the transfer were in cash. Purchases of milk from the market would fall to 7.5 kg. and with the freed income the household would buy rice and nonfood.

If, on the other hand, the marginal propensity to consume out of the food gift is higher, the impact would be different. Say that in this case the "income effect" for milk is 50 percent higher than that of money income, then the hypothetical household would want to increase milk consumption by 37.5 percent to a level of 13.75 kg. Their market purchases of milk would drop by only 1.25 kg. The freed income would then be allocated to additional purchases of rice and nonfoods, but this would result in smaller increments of rice and nonfoods since less income would be freed. If this were the case, i.e. MPC's for the income value of donated foods are larger than for regular income, then the MPC's out of donated foods would undoubtedly vary by commodity--

they must for the Engel aggregation condition* of neoclassical economics to hold. That is, if the MPC to consume milk out of the value of the milk gift is higher than the MPC for money income, then the MPC to consume rice or nonfood (or both) out of the value of the milk gift has to be lower than their MPC out of money income.

The assertion, "that only the money value of the donated foods is important in commodity selection for the P.L. 480 Title II take-home food supplementation programs," requires that the MPC out of the income value of food be equal to the MPC out of money income. The central issue for the empirical analysis in this report is the estimation of these MPC's and a test of the hypothesis of equality of MPC from income and from the income value of donated foods.

Econometric Approach

Several authors (West et al, 1976, Hu et al, 1976) have estimated the MPC out of different sources of income i.e., assets, income transfers, ordinary income, etc. Their results indicated that the marginal propensity to consume may be different for different income sources. These findings, however, created some controversy and raised questions, because the empirical model specification is not consistent with the implied theoretical underpinnings. The core of the issue here is whether the traditional demand theory, which underlies the empirical

*The Engel aggregation condition simply states that all additional income is allocated to the budget and that if more is allocated to milk less income is available for rice and nonfoods.

models used in the above studies, can lead to the observed differences in the MPC's out of different income sources.

Traditional demand theory postulates that the household maximizes a utility function in market goods alone subject to a budget constraint. Formally, the problem that the household faces is to:

$$\max U = U(X_1, X_2, \ldots, X_n) \qquad (1)$$

subject to:

$$\sum P_i X_i = M \qquad (2)$$

where P_i is the price of commodity X_i and M is income. Notice that both income and prices are exogenous to the household. Upon solving the maximization problem the resulting demand equations have the following general form:

$$X_i = X_i\ (P_1, P_1, \ldots, P_n, M) \qquad (3).$$

The income elasticity for good i is given by:

$$N_i = \frac{d\log Xi}{d\log M} \qquad (4)$$

and it shows the impact that changes in exogenous income would have on the quantity consumed of good i.

Now let us denote the market value of the donated foods by G. For a participating household G would represent an increase in exogenous income. The budget constraint for a program participant is now given by:

$$\sum P_i X_i = M + G = M' \qquad (5).$$

The resulting demand equations are given by:

$$X_i = X_i(P_1, P_2, \ldots, P_n, M') \quad i = 1, 2, \ldots n \qquad (6).$$

Studies which have tried to estimate the impact of income

transfers, however, do not estimate an equation similar to (6). Instead, they separate the sources of exogenous income in the following way:

$$X_i = X_i(P_1, P_2, \ldots, P_n, M, G) \qquad (7).$$

Equation (7) would be a correct specification only if G is not convertible to cash through sale of the donated foods or through displacement of specific foods in the household's expenditure pattern. In this case, G would simply be a shifter of each of the demand functions given by equation (3). Specification of the demand function as (7) is inconsistent with economic theory, i.e. it can not be derived from utility maximization, and it is also inconsistent with observed empirical evidence; households do sell and substitute foods in their expenditure pattern when they receive a package of donated foods. Equation (7) would require specific theories on why G would be treated differently. While many hypotheses could be offered, such as the "moral pressure" to consume the gift, these would be difficult if not impossible to test econometrically. Equation (7) is misspecified, particularly if participation and/or the size of the gift are dependent on household characteristics which determine food demand, such as income.

The appropriate test of the hypothesis of the equality of MPC's from income and from the market value of donated foods is based on the statistical estimation of equation (6). Equation (6) can be summed over all foods to obtain a food expenditure equation which is commonly referred to by economists as an Engel Function. With cross-sectional data, prices are constant across

households in homogeneous regions so that the Engel function becomes:

$$F = F(M') \qquad (8)$$

where $M' = M + G$ and F represents the household's total food expenditures or the total money value of food consumed (even if the household produces all its own food).

A statistical specification of (8) is the simple linear function:

$$F = A + b\,M' \qquad (9).$$

The estimate of b is the marginal propensity to spend on food out of gift inclusive income, i.e.

$$\frac{dF}{dM'} = b.$$

Recall now that $M' = M + G$ so that with this specification

$$\frac{dF}{dM} = \frac{dF}{dG} = b, \qquad (10)$$

which is the hypothesis to be tested.

What this means is that equation (9) can not be used <u>alone</u> to test the hypothesis $\frac{dF}{dM} = \frac{dF}{dG}$.

To test the hypothesis, we use data from the non-participating households to obtain an estimate of b and then impose a restriction on (9) that $\frac{dF}{dG}$ be equal to b. The restricted equation is then used to test the validity of the restriction. Notice that for non-participants G = 0 so that equation (9) becomes:

$$F = A + b(M + G = 0) = A + bM \qquad (11).$$

Equation (9) can be written, but not estimated*, as

$$F = A + bM + bG \qquad (12).$$

The value obtained for b from estimating (11) with the data from non-participants, denote it b_N, can be imposed on (12) and the terms can be re-arranged to obtain:

$$(F - b_N G) = A + bM \qquad (13).$$

The test of hypothesis requires both that the restriction (imposing b_N on G) not be rejected and that the estimate of b, denote it b_p, obtained from (13) be equal to b_N. These three Engel functions have been estimated with participant and non-participant data from a take-home supplementary feeding program in rural Veraguas in Panama.

Description of the Data

The data used in this study were developed as part of the Panama Nutrition Evaluation Project. Some of the nutrition intervention programs which are being evaluated are the following:

(1) The Supplementary Feeding Program (SFP) - The objectives of this program are the prevention of malnutrition in the most vulnerable groups, specifically pregnant and nursing women and children under five years of age, the recuperation of individuals who have suffered from some level of malnutrition, and incorporation of program participants into an active food production process. The principal intervention is the CARE Title II feeding program, although foods other than Title II commodities are used

*In general this estimation is not unbiased because eligibility criteria and other program rules usually make G and M correlated or G even directly dependent on M.

as incentives for program participation.

(2) The Maternal and Child Health Program - This program is supported by Title II food from CARE. The objectives of the program are to improve the nutritional status of pregnant and nursing mothers and preschool children, and to support child and mother health care services.

The province of Veraguas was selected for this study. It was chosen because it is the province with broader and longer study coverage of all kinds of projects. Additionally, Veraguas is one of the provinces with a large proportion of actually malnourished preschool children (as measured by weight-for-height).

Selection of the sample was done in a purposive manner. Thirty rural communities were chosen at random from a list of communities with at least one nutrition project. All families (within a selected community) participating in a nutrition project were to be included in the study. Additionally, an equal number of households not participating in the nutrition project (neighbors to participating households) were to be included as controls within each community.

The data collected in both samples includes anthropometry, food intake, food production, employment, hours of work, sources and amounts of income, health practices, housing and sanitary conditions, health experience (morbidity, birth weights, etc.), asset ownership, program participation, farm technology and family characteristics. The data for the analysis of income

effects of Title II commodities consist of income, expenditure, consumption and limited demographic information from each household. The following describes the specific variables used in the analysis:

(1) Money Value of Donated Foods - The Ministry of Heatlh nutrition programs in Veraguas province provide direct food aid and food production services as well as the typical maternal child health services. The most important source of food aid is the Title II food package provided through the MCH program. Table 1 presents the ration which is intended to be provided to each eligible participant and its money value computed from local retail prices.

In addition to the Title II foods, some households receive surplus domestic and other commodities provided as part of the community gardens food production projects. The commodities provided through these projects include wheat flour from the World Food Program, maize, beans, and sugar. The complete ration received by each participating household varies appreciably due to availability of the various commodities. Table 1 presents the information regarding the commodities received in the month prior to the survey in October/November of 1981.

The rations received by each household were valued at local market prices; the range of values for the reported foods received is from $2.4 per month to $76.4 per month per household. The modal value is $10.96, which is very close to the nominal value of the CARE - Title II package for one participant per household ($11.35 as shown in Table 2). The average value of the

Table 1: Number of Households Reporting Receipt of Each Donated Commodity

Commodity	Number of Households
Nonfat Dry Milk	126
Oil	37
Soy Fortified Oats	97
Sugar	50
Beans	14
Wheat Flour	14
Maize	28
Corn Soy Milk	0
Total Participants in Donated Food Programs	140

Table 2: Composition and Market Value of the CARE - Title II Food Package for the Take-Home Supplementary Feeding Program in Rural Veraguas Province in Panama

Commodity	Ration	Local Value
Nonfat Dry Milk	2.2 kg.	$ 9.24
Corn Soy Milk	0.9 kg.	$ 0.60
Soy Fortified Oats	0.9 kg.	$ 0.71
Oil	0.5 kg.	$ 0.80
Total		$11.35

Source: Sigma One Corporation and Ministry of Health

donated foods equals $15.20 per month per household.

(2) Monthly Household Income - Household income was elicited in several manners in the basic socio-economic questionnaire. The concept of income used in this study includes income earned from wage labor and from the estimated value of agricultural production as well as from all other sources. Since the data was collected prior to harvest time many households report no income during the previous three months. The study uses data for households with non-zero money incomes.

(3) Monthly Food Expenditures - A variable, denoted as money value of total food, was formed by adding food expenditures to the retail value of household produced food. For participataing households this variable included the money value of the donated foods.

(4) Nutrient Intakes - Nutrient intakes were obtained from 24-hour recall questionnaires.

Similar data were collected in 1980 in a nationwide sample for the Nutrition Evaluation Project. These data have been reported in Parillon et al (1982), and have been econometrically analyzed for the Consumption Effects of Agricultural Policies (Franklin et al, 1982). A few summary statistics from these reports are presented here for comparison and background purposes with the results of this study that are presented in the next section.

Table 3 presents the distribution of calorie intakes for the central provinces, including Veraguas, rural sample, as well as

Table 3: Percentile Distributions of Energy Intake and Household Food Costs for Households in the Central Provinces in Panama (1980)

		Percentiles				
	n	5th	25th	50th	75th	95th
Calories per Calorie Equivalent Person Per Day	180	1190	1875	2514	3168	4310
Food Costs $/Month	182	33.3	63.6	96.9	139.4	239.4

Source: Parillon et al (1982).

the associated food costs. More than half of the sample reports energy intakes below the levels recommended by INCAP.

Table 4 presents the budget shares in the food budget for the rural population in Panama in 1980. As can be seen rice constitutes the basic staple, providing over a third of calories, over a fourth of protein and absorbing a fifth of the food budget. Oils and roots and tubers (included in vegetables) are next in importance as energy sources; beans, beef and fish are important as protein sources and oils and fats as well as beef are important as items of food costs.

These patterns are also reflected in the expenditure elasticities presented in Table 5. The rural population in Panama would spend proportionately more of additional income on sources of animal protein (poultry, beef and milk) than on energy or vegetable protein sources. Furthermore, poultry, beef and milk are the most expensive sources of calories in the rural diet, which suggests that the rural population will use income to improve the palatability and protein content of the diet before satisfying energy recommendations. This is also reflected in the protein densities of the rural diet, since it contains approximately 30 grams of protein per thousand calories. Given all this, it is clear that if the rural population were to satisfy calorie needs, the diets would be more than adequate in protein. Finally, a food gift that was principally milk, oils and animal protein would tend to yield higher direct and income mediated nutritional impacts than one that was intense in grains

Table 4: Calorie, Protein, and Expenditure Shares for Principal Food Commodities
Rural Households (N=418)

Commodity	Average Percent of Daily Calories	Average Percent of Daily Protein	Average Percent of Daily Food Expenditures
Corn	3.6	2.7	2.8
Cereals	.3	.4	.4
Breads	5.6	5.9	4.3
Beans	6.1	13.2	5.7
Rice	36.0	26.9	20.0
Fish	2.1	10.5	6.2
Milk	3.0	5.3	5.5
Poultry/Eggs	3.2	8.0	9.0
Beef	4.8	12.4	10.6
Pork	1.0	1.8	2.2
Oils	11.3	0	6.7
Vegetables/Fruits	14.5	8.0	14.1
Sugars	5.3	0	2.5
Others	3.2	4.9	10.0
TOTALS	100.0	100.0	100.0

Source: Household consumption data collected for the Nutrition Evaluation Project: the share each principal food commodity contributes to households total caloric intake, protein intake and expenditures on food, as presented in Parillon et al, 1982.

Table 5: Estimates of Expenditure Elasticities of Selected Commodities for Rural Households

	N	Expenditure Elasticity	R^2	F
Corn	149	0	--	--
Beans	188	.32	.18	4.90
Rice	380	.30	.39	29.50
Milk	247	.49	.25	9.80
Poultry	74	.89	.44	6.33
Beef	166	.71	.27	7.27

and vegetable protein sources.

The response of a sample of low income rural households from a central province in Panama to a food gift of Title II and other commodities is presented in the next section.

Results

Table 6 presents the averages and standard deviations for selected income and food expenditure variables for participants and non-participants. The average value of the donated foods represents 17 percent of the average reported incomes for the participating households. As can be seen in Table 6, the households receiving donated foods have per capita monthly incomes which are approximately 14 percent lower than the non-participants. On average the income value of the donated foods is just enough to equate the "food gift inclusive income" of the recipient households and the non-participating households' income on a per capita basis. The money value of the food used by the participating households is 36 percent higher than that of the non-participating households. This result may have several ex-

Table 6: Descriptive Statistics for Participants and Non-Participants in Donated Foods Programs

	Non-Participants (N=160)		Participants (140)	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Family Size (persons)	6.32	2.03	6.9	2.6
Money Income (M)	91.0	86.5	87.3	64.5
Income Plus Value of Donated Foods (M + G)	-	-	102.2	64.4
Food Expenditures	40.4	61.3	39.6	57.3
Money Value of Donated Foods	-	-	15.2	8.9
Money Value of Total Food	40.4	61.3	54.8	65.2
Agricultural Income	66.7	56.7	74.1	56.6
		Per Capita Values		
Money Value of Total Food	7.2	9.8	9.8	13.1
Money Income	17.62	19.7	15.2	13.4
Income Plus Value of Donated Foods (M + G)	-	-	17.8	13.6
Money Value of Donated Foods	-	-	2.4	1.4
		Budget Shares		
Money Value of Food as a Share of Money Income	44%	-	63%	-
Money Value of Food as a Share of Gift Inclusive Income	-	-	54%	-

		Budget Shares		
Food Gift as a Share of Money Value of Food	-	-	28%	-
Agricultural Income as a Share of Money Income	73%	-	85%	-

planations. For example, the participating households could be using all the donated food as a supplement to their usual purchases, or they have self-selected themselves into the food donation programs because they have a higher preference for food than for nonfoods. In this regard, it is also noteworthy that the participating households derive a higher percentage of their real income from food production on their own farm as opposed to working for wages off the farm. Participants derive 85 percent of their income from food production versus 73 percent for the non-participants. Thus, it could also be that participants consume more food because they produce more of their food needs and non-participants must purchase more of their food in the market. Attempts at explaining the differences in average food use other than participation in programs yielded no statistically meaningful results.

Participation Analyses

Several logistic equations were estimated to explain the participation decision. These equations included income variables, demographic variables and farm technology variables. All models tested proved to be non-significant. Only two variables seemed to be statistically associated with the "participation/non-participation" variable, farmsize and use of modern inputs in agricultural production. Smaller farm sizes and use of modern inputs were significant predictors of participation in the supplementary feeding programs. This is not surprising since the programs are aimed at promoting the use of modern inputs and technology among low income farmers. The participa-

tion equations do not permit, however, an operationally useful explanation of participation or of the reasons why the average expenditures on food are higher for participants than for non-participants. The issue of how the participants were selected remains as yet an unresolved question.

Calorie and Protein Consumption

Table 7 presents the percentile distributions of calorie and protein intake levels on a per calorie equivalent person per day basis. The energy and protein content of the diets of the two groups are essentially equivalent, with energy intakes nearly equal to the recommended level of 2700 calories per adult equivalent per day for approximately half of each group. Protein intakes are approximately adequate for more than 75 percent of the households. These results are consistent with the nationwide results developed in the 1980 National Nutrition Survey (Parillon, et al, 1982), and indicate that the food consumption problems in Panama are essentially energy intake rather than protein intake problems. A calorie income regression estimated for the whole sample yielded a significant but low estimate of the calorie income elasticity of 0.03.

Engel Function Analysis

The principal aim of this study is to econometrically estimate the impact of the income value of the donated foods on the food acquisition and consumption behavior of the households receiving donated foods. Table 8 presents estimates of Engel function parameter estimates for participants and non-partici-

Table 7: Percentiles of Calorie and Protein Per Calorie Equivalent Person

	n	10th	25th	50th	75th	90th
Calories per CEP[a]						
Participants	140	1453	1824	2539	3174	3934
Non-Participants	232	1481	2022	2654	3420	3833
Protein per CEP (grams)						
Participants	140	34	47	78	110	158
Non-Participants	232	37	54	89	129	180

[a]CEP = Calorie equivalent person

pants, equations (9), (11) and (13). It can be seen that on average participants in the donated foods programs would acquire--through purchases, production or gifts--significantly more food than the non-participants. The value of food used by participants is on average 36 percent more than the value of food used by non-participants on a per capita basis. Since their diets are approximately equivalent in nutrient content, this result suggests that unit costs of the diets of participants is substantially higher than for non-participants. This implies that the participants consume more expensive calories, perhaps as a result of the freed income resulting from the food gift.

As developed in the methodology section, marginal propensities to spend on food out of income and gift inclusive income were estimated for non-participants and participants, respectively. The estimates are 0.24 as the marginal propensity to spend on food from income for the non-participants, and 0.28 as the marginal propensity to spend on food out of gift inclusive income.

The estimate of the marginal propensity to spend on food out of money income estimated from equation (9) for the non-participants' data (MPC = .24) was directly imposed on the data of the participants by subtracting 0.24 times the value of the donated foods from the money value of total food. The resultant datum was then regressed on the participants money income to estimate equation (13). The results for equation (11) yield an MPC out of gift inclusive income ($MPC(M') = 0.28$) that is neither statistically nor operationally different from each of the

estimates obtained from equations (13) and (9), 0.29 and 0.24 respectively.

As can clearly be seen in Table 8, equations (11) and (13) are nearly identical. Furthermore, the restriction of equation (9) imposed on (11) was tested econometrically with the SYSREG procedure in SAS, and the results were identical to the more intuitively appealing results presented in Table 8. It is important to note that this result applies only to the slope of Engel function and not its position.

The major result of this study is that the marginal propensity to consume food out of additional income in the form of donated foods is not different than the marginal propensity to consume food out of money income for households participating in the Veraguas supplementary feeding programs.

The question now relates to the income mediated nutritional impact from the money value of the donated foods. Table 9 presents the food use patterns in money terms for participants and non-participants. Participants use more rice, beef, roots and tubers, fish, plantain and sugar in their food budget than do non-participants. Econometric estimates of Engel functions by commodity, in Table 10, suggest that the income value of the donated foods is used to acquire primarily more rice and milk, and secondarily, fruits and vegetables and poultry products. This indicates that the income value of the donated foods is used to improve the protein content of the typical diet and perhaps its palatability, but not necessarily its energy content. The

Table 8: Engel Function Estimates

	Non-Participants (Equation 9)	Participants (Equation 11)	Participants Restricted Equation (Equation 13)
Intercept	-49.78 (-2.04)	18.09 (.867)	18.02 (0.890)
Money Income (M)	0.24 (2.91)	-	0.29 (2.52)
Gift Inclusive Income (M')	-	0.28 (2.45)	-
FAMSIZE	11.61 (3.43)	1.10 (.401)	1.09 (0.40)
D.F.	103	79	
R^2	0.15	0.08	0.08
F-Value for Model	8.76	3.36	3.51

Adjusted Total Sum of Squares	349366	350498
Model Sum of Squares	28360	29671
Error Sum of Squares	321006	320827
F Test for the Restriction	1.05	NS

*t-statistics in parentheses

Table 9: Food Budget Shares for Food Expenditures
Rural Veraguas Province (1981)

	Participants (%)	Non-Participants (%)
Rice	23	22
Corn	7	10
Bread/Wheat	2	3
Other Cereals	2	3
Legumes	3	6
Roots and Tubers	9	4
Fruits and Vegetables	2	2
Poultry and Eggs	3	7
Fish	6	5
Beef	17	11
Milk	9	11
Plantain	5	2
Fats and Oils	4	7
Sugar	2	2
Other	7	5

Table 10: Engel Functions by Commodity

Commodity	Marginal Propensity to Consume[a]
Rice	.155
Fruits and Vegetables	.030
Milk	.120
Poultry	.053
Beans	.010

[a]Estimated MPC's for other food commodities were not significantly different from zero.

expenditure patterns of the study sample in 1981 are not appreciably different than the rural sample for the whole of Panama for 1980. The income elasticities implied by Table 7 are approximately 0.43 for rice, and 0.86 for milk. These numbers are somewhat higher than for the population as a whole, reflecting the relative poverty of this sample.

It is interesting to note that while the diets may be below energy recommendations for almost a half of each group, the estimated calorie income elasticity for the sample as a whole is only 0.03. Additional income in the form of either money or donated foods would have a small impact on removing the energy deficits without specific targetting, since additional income would tend to change the composition of the diet more than increase its energy content. The principal effect would be to reduce the consumption of maize in favor of rice, milk, fruits and vegetables, and poultry with little impact on total energy.

Ration Size Considerations

In general, these results suggest that the commodity selection and ration sizes for these programs are, on average, approximately correct. The donated commodities tend to be consumed by the households; the donated foods displace foods which are less preferred and the income mediated effects result in an improvement of the quality of the diet.

To explore the issue of ration size, the Engel functions were also estimated with a semi-logarithmic functional form. This form allows the estimates to vary as a function of level of expenditures. The MPC computed at the respective average food

expenditure levels for participants and non-participants was the same as that obtained with the linear function.

Using this functional form, it was possible to estimate the impact on food purchases, from the market, which might arise from increasing the ration and therefore the value of the income transfer. This calculation indicates that the size of the ration in money terms required to increase the income of a participating household sufficiently to increase food purchases by 25 percent is almost equal to the value of income from all other sources, i.e. a 100 percent increase in income or a package of food at least five times as large in value terms as that being distributed now. A package of food 25 percent larger than the present ration would displace market purchases valued at approximately 95 percent of the value of the food gift. Accordingly, it would appear that the current ration size is, on average, approximately correct if it is intended that it have a supplementary effect at the margin. If, on the other hand, program planners deem it acceptable that the last dollar of value in the food gift offset one dollar's worth of market purchases of food, then the average ration size in the Veraguas take-home feeding programs could be increased by a fourth to a third, but the commodity selection should be shifted away from cereals and milk to more oil.

The present Title II package which contains nonfat dry milk, CSM, soy fortified rolled oats, and oil could be increased in direct and income mediated efficiency (at the same cost level),

eliminating the CSM and oats and using the saved commodity costs to increase the ration of oil by a factor of two. This would increase the income transfer value of the ration by a small amount, (approximately 25 cents), but would give the recipients more of a desired commodity (oil) in exchange for less preferred commodities, i.e. CSM and oats. Since the income elasticities for maize and cereals other than rice are zero, it is clear that CSM and fortified rolled oats are not what the households would want to consume out of additional income. The resulting level of expenditure on oil would remain infra-marginal and the slight increase in income value could make milk infra-marginal for more households. The additional oil would also help fulfill the food energy gaps for some households.

Conclusions

The results of the econometric estimation of the marginal propensity to spend or acquire food out of the income value of donated foods, suggest that Title II take-home programs can have significant and important income mediated nutritional impacts and that the mechanism by which these impacts are achieved are through the consumption of the donated foods which are used to displace less preferred foods in the diets of the recipients and that the freed income, represented by the value of the displaced foods, is used to acquire more palatable or otherwise more preferred foods. These results, however, should be interpreted with some caution. One importatnt consideratain is that the quantities of donated foods used in food programs in Panama are generally infra-marginal quantities, i.e. less than what the consuming households would want to consume either out of their own income or out of the gift inclusive income. Importantly, the donated foods are foods that are already in the dietary pattern of the participating households.

Consider, for example, the case in which milk were to be the only donated commodity. In order to account for a 17 percent increase in income, 9 lbs. of milk would have to be donated. Given that the milk income elasticity is approximately 0.9 for this sample and that the present level of milk consumption is 5 lbs., then the household would want to consume approximately 5.8 lbs. of milk. How is the household going to dispose of the additional 3.2 lbs. of milk? One possibility is that the milk

would be sold in the market. In the absence of transaction costs a supra-marginal quantity is simply treated as additional income. In the presence of transaction costs, however, the way in which the additional milk is disposed is not clear. If the transaction costs exceed the expected returns from the sale, then the household would most likely consume the supra-marginal quantities and possibly cut the purchases of milk substitute commodities. In this case, the nutrient content of the substitute commodity in comparison to milk's nutrient content is of importance. This condition could arise if, as has been suggested by some, the Title II take-home programs were specialized to a single high value commodity.

The implications for program design that arise out of the results in this study are, first, that commodity selection and ration size must be determined with careful consideration of the existing dietary patterns. That for high value foods to have significant income mediated and direct nutritional impact, the high value foods must already be in the dietary pattern of the recipient households and they must be principally infra-marginal quantities. Furthermore, it appears from the results of this study, that there is a limit in the extent to which the income value of donated foods can work to close household energy gaps, since the donated foods tend to displace less preferred foods in favor of more preferred foods with resultant small increments of total food energy in the diet. It would appear, then, that in conditions similar to those that exist in rural Panama, i.e. diets nearly adequate in calories and adequate in most other

nutrients, that other more precise targetting mechanisms are required to close the energy gaps observed among households.

It is important to note that these results are appropriate for a situation where diets are nearly adequate for the bulk of the population. It is quite probable that in conditions of severe energy deficits, or of specific nutrient deficiencies, the direct nutritional impact from massive food transfers of even non-preferred foods might be quite substantial, particularly if delivered and consumed through an on-site feeding program.

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