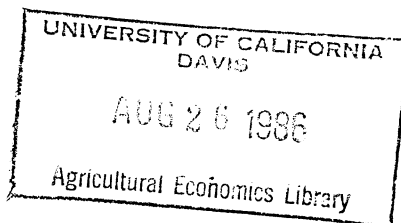


Food Aid Impacts in Rural Kenya

by

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Kenya

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The role of food aid in economic development has been the subject of substantial debate for many years (Maxwell and Singer, Mellor, Deaton, Hall). Food aid is important, constituting approximately 15% of official development assistance (Maxwell and Singer), and recently has been used extensively to lessen the effects of severe food shortages in sub-saharan Africa. Many observers question its potential, however, for accelerating long term growth in less developed countries. Concern has been expressed over possible disincentive effects on agricultural production, both as a result of price reductions due to increased food supplies and because of dependency effects that reduce recipient country government incentives to emphasize agricultural development.

Others have argued that as a long term development tool, food aid can be used by governments to generate capital for development through sales of the food and by saving foreign exchange that would otherwise have gone for food imports. Human capital improvements also can be realized through nutritional gains and through job skills acquired on food aid projects. It has been reasoned that if food aid can make a contribution to employment, nutrition, and income, then it may provide incentives to reduce family size and thereby help reduce population pressures. The importance of careful program planning and project implementation as requisites of success is universally recognized.

Evidence to substantiate these (and other) claims is uneven and inconclusive (Maxwell and Singer). Policy measures that have been used to avoid the most severe negative effects and to encourage economic development have rarely been identified and most likely are specific to social and political conditions in individual countries (Deaton). The

effectiveness of food aid in promoting development clearly depends on the conditions under which food aid is disseminated and the skill with which it is administered (Schuh).

The purpose of this paper is to examine, in a microeconomic framework, the effects of a particular type of food aid program, food-for-work (FFW), on agricultural production, income, capital investment, employment, and the mix of foods consumed by participants in the project. The study is based on primary survey data collected in the Baringo District, Rift Valley Province, Kenya. The analysis addresses how FFW affects the allocation of household time between production and leisure activities and the relative effects of FFW on landed as opposed to landless households. The program is addressed theoretically and assessed empirically using a peasant-household-firm model which incorporates a linear programming model on the production side and an Almost Ideal Demand System (AIDS) on the consumption side of the model.

Food-For-Work in the Baringo District

Food-for-work in the Baringo District provides payment-in-kind directly to people who provide labor for local public works projects, particularly erosion control and water harvesting devices. The purpose is to provide basic food needs while utilizing "surplus" labor to create production capital for longer term income growth. The hope is that income earned on the projects (food received by participants can be consumed or sold) will also ease the capital constraints of individual farmers without diverting needed labor from on-farm production. Ideally, the program would lead to higher levels of food consumption and improved nutritional status of rural households over a longer time period.

The UN/FAO World Food Program (WFP) supports the FFW project as part of the Baringo Pilot Semi-Arid Project (BPSAP), an integrated rural development project, sponsored by the Government of Kenya (GOK) and the World Bank. FFW began in 1981 and was designed to utilize 800 workers per month within the BPSAP.

The WFP provides the food and the GOK implements the project by providing necessary management personnel and financial inputs including storage and transport. Maize, beans, and vegetable oil are the main food items provided to WFP-supported FFW projects in Kenya.

All participants are adults and most of them work from 8:00 am to 1:00 pm, twenty days per month. Participants are employed on a first come, first serve basis on the assumption that FFW will attract only the very poor, a residual labor force not engaged in either own-production activities or other wage-earning activities at the time of participation.

The Study Area

Farm production activities in the study area occur primarily on rainfed farms planted near the farmer's homestead once a year during the wet season, and on irrigated farms located near a river, usually far from the farmer's homestead. The major crop activities in the area are finger millet, sorghum, and maize. Both a traditional technology which depends on own seed, family labor, simple hand tools, and own work animals as well as an intermediate technology which utilizes improved seed are employed in the study area. The use of fertilizer or other chemical inputs, other than manure, is almost negligible.

Farms in the area average .75 hectares of cropland and livestock, particularly goats, are a major economic enterprise and are grazed on common pastureland, though there appears to be certain grazing patterns

based on historical use by a particular family or community. Households have, on average, 29 goats, primarily small local East African breeds. Much of the crop and livestock production is consumed in the same household where it is produced, but farmers engage in buying and selling activities for both crops and livestock during surplus or deficit periods. In general, the study area is the most food deficit region in the Baringo District.

Theoretical Model

An analysis of the developmental consequences of international food assistance as it impacts peasant-household behavior must consider both production and consumption effects. Interpretations of the impact of such programs must be seriously questioned in the absence of either set of effects. Building on earlier theoretical analyses of peasant-household behavior by Chayanov, Sen, Nakajima, and Hymer and Resnick, there have been a number of recent theoretical and empirical household firm models (HFM) which have incorporated both production and consumption (Barnum and Squire; Ahn, Singh, and Squire; Strauss, 1981). The dual nature of the farm-household as both a producing and consuming unit makes the HFM a particularly attractive approach for studying the micro-level impacts of food assistance. To our knowledge, this approach has not been used elsewhere to evaluate the effects of FFW.

The typical or basic theoretical HFM consists of four elements: a household utility function, a production function, an income constraint, and a time constraint:

$$U = U (C, M, L; a), \quad (1)$$

$$F = F (D, I; A, K), \quad (2)$$

$$T = V + D + L, \text{ and} \quad (3)$$

$$qM = wV + P (F - C) - rI + Y. \quad (4)$$

Utility (U) is a function of own-consumption of agricultural output (C), consumption of market purchased goods (M), leisure (L), and a set of household characteristics (a). Agricultural output is a function of labor (D), other variable inputs (I), land (A), and capital (K). Total time (T) is spent in production, leisure, and can be sold or purchased (V). The income constraint specifies the value of market purchased goods (qM) equal to the value of labor sold (wV), plus the value of agricultural products sold (P(F - C)), minus the cost of inputs purchased (rI), plus net income from other sources (Y).

The planning horizon for the model is assumed to be one agricultural cycle, land and certain types of capital are assumed to be fixed in the short run, and risk is excluded. Utility is maximized subject to the production function and time and income constraints.

The above model can be modified to include the effects of introducing FFW into the rural economy. The utility function can be modified to include a variable (G) for consumption of food from FFW programs:

$$U = U(C, M, L, G; a). \quad (5)$$

The introduction of G into the utility function implies that food under the FFW program is not a perfect substitute for either food from own production (C) or for market purchased goods (M) since it may be of different quality and hold certain social characteristics that give it less than "normal" appeal.

Relaxation of a capital constraint facing farm households may occur as a result of FFW. If so, then FFW may allow for purchase of additional inputs (I) or may stimulate additional longer term investment (K), perhaps with a lagged effect. The FFW projects themselves may generate

productivity enhancing physical capital items that affect multiple farms such as erosion control devices, irrigation infrastructure, or fences. A variable (X) can be included in the production function to capture the distributed lag effect of the latter type of investment:

$$F = F(D, I; A, K, X). \quad (6)$$

The introduction of a FFW program expands the number of productive activities to which the household can choose to allocate its time. Therefore, a variable J for time spent on FFW projects can be included in the time constraint:

$$T = V + D + L + J. \quad (7)$$

The quantity of food from FFW available to the household is a function of J and can be represented by the production function:

$$Z = Z(J). \quad (8)$$

Finally, the total quantity of food earned under FFW can be valued at market prices (n) and included in the full income constraint as both a production and consumption good:

$$qM = wV + P(F - C) - rI + n(Z - G) + Y \quad (9)$$

Equations (1)-(4) can be considered a theoretical model for non-participants in FFW programs, while equations (5)-(9) a model for participant households. Simplified versions of these models without the production component can be used to represent landless households.

The peasant farm-household participating in a FFW program is assumed to maximize its utility function (equation 5) subject to the production functions (equations 6 and 7) and time and income constraints (equations 8 and 9). Maximizing (5) subject to (6), (7), (8), and (9), assuming capital (K and X) are fixed for the moment, and eliminating the Lagrangian multipliers yields the following first order conditions:

$$U_C/U_M = P/q \quad (10)$$

$$U_L/U_M = w/q \quad (11)$$

$$U_L/U_G = w/n \quad (12)$$

$$PF_D = w \quad (13)$$

$$PF_I = r \quad (14)$$

$$nZ_j = w \quad (15)$$

$$qM + PC + WL + nG = PF(D, I; A, K, X) - WD - WJ + Y - rI + nZ \quad (16)$$

Equations (10)-(12) represent traditional first-order conditions from consumer demand theory. Equation 12 explicitly indicates that the marginal rate of substitution between consumption of leisure and consumption of food generated by FFW should equal the ratio of the wage rate to the price of the food. Equations (13)-(15) represent profit maximizing conditions for the allocation of labor in F production, other variable inputs in F production, and labor in food for work. The marginal value product of labor used in FFW activities must equal the wage rate. Equation (16) combines the time and income constraints with the technological relationships presented in the two production functions. The left hand side says that the expenditures on market purchased goods, leisure, and the value of home consumption of own food production

including FFW equals the value of own farm production, the value of FFW produced, and other income minus the cost of labor and other variable inputs.

In this model, total labor demand is determined by the profit maximizing conditions. Given an estimate of the production function for F, equations (13) and (14) can be used to determine the variable inputs into F production and the total output of F. Given an estimate of the production function for Z, equation (15) can be used to determine the level of J and the total output of Z. These results can then be used to calculate net farm profit and net income from FFW. The impacts of own-farm production and of FFW activities on the consumption side of the model are transmitted through the income constraint.

Turning to the consumption side of the model, assuming the second-order conditions are fulfilled, equations (10), (11), (12), and (16) can be solved for the demand functions for the four consumption goods C, M, L, and G in terms of the four prices q, p, w, and n, the household characteristics, a, and the total household expenditures. The latter are the sum of the right hand side components of equation (16).

Before considering the empirical implementation of the model, let's return to the assumption of fixed own-farm capital (K). The model can be extended by including an investment equation for K such as:

$$K = K(K_{t-1}, S, B) \quad (17)$$

where K_{t-1} is capital in the prior period, S is accumulated savings, and B is accumulated debt. Income generated through FFW could increase S or reduce B and affect K with a 1 period lag. Consequently, K, or the service flow of capital, could be included as a variable factor of production.

In equations (4) and (9), the value of interest earned on savings or paid on debt is assumed to be included in Y . Those interest earnings or payments could be explicitly separated out in the income constraint. Maximization of the model to derive the first-order conditions would then consider explicitly the effect on production and consumption in more than one agricultural cycle due to the lagged investment effect.

The above discussion illustrates the diversity of theoretical effects at the farm-household level from FFW. The potential impacts of FFW on output, employment, and consumption depends not only on the pattern of household time allocation in the short run, but on the extent to which FFW draws into production an idle or underemployed resource (labor) and uses it to increase the productivity of that very resource. That productivity enhancement could occur with a lagged effect and be based on capital investment and nutrition effects (although nutrition effects are not explicitly included in the above model).

The theoretical model incorporating FFW is empirically implemented in the next section. It is possible to state theoretically and unambiguously that household income will increase when all resources used in FFW were previously idle. However, when those resources were previously employed in other productive activities, an empirical assessment must be made to determine if expected net returns are higher with FFW participation. Furthermore, changes in the quantity and mix of goods produced and/or consumed, and the effects on hired farm labor and capital investment can only be evaluated empirically.

Empirical Model

The empirical model employed to implement the above theoretical HFM requires both production and consumption components. The assumption that

markets exist for all goods and for labor and that prices are exogenous to the farm-household enables the production and consumption sides of the model to be estimated separately (Strauss, 1984b). The farm-household is assumed to maximize profits subject to its production functions and then to maximize utility subject to its time and income constraints with the latter affected by income generated on the production side.

Previous empirical HFM's have employed different approaches for both the production and consumption components. Using data from Taiwan, Lau, Lin, and Yotopoulos estimated a profit function model with one output (rice) and one variable input (labor). They then estimated a linear logarithmic expenditure system (LLES) on the demand side for three aggregate commodities (agricultural, non-agricultural, and leisure). Barnum and Squire, using data from the Muda River Valley in Malaysia, estimated a production function for a single commodity (rice) and a single variable input (labor). They estimated a linear expenditure system (LES) for rice, non-agricultural goods, and leisure. Ahn, Singh, and Squire used data from South Korea and a linear programming model on the production side with farm output disaggregated into rice, barley, and other farm produce. They employed an LES on the consumption side for six commodities. Strauss (1982, 1984a, 1984b) also used a profit function approach and jointly estimated six output supply functions and a labor input demand function. On the consumer demand side, he employed a quadratic expenditure system (QES) for those same six commodities and leisure.

To summarize, previous empirical peasant household firm studies have used three basic approaches on the production side (production function, profit function, and linear programming) and three types of expenditure

systems, LES, LLES, and QES, on the demand side. Each of these approaches has advantages and disadvantages which are discussed in depth in literature dealing with the individual techniques. Rather than discuss that literature here, the most important criteria influencing the choice of particular production and consumption models for the current study are presented below along with descriptions of the models used.

Production Model

Important criteria influencing the choice of the production model for the current study were the ease with which (1) commodities could be disaggregated, (2) capital investment due to FFW could be incorporated, and (3) data could be collected in a cost-effective manner. A production function approach presents difficulties for commodity disaggregation. A profit function approach is at a disadvantage compared to linear programming with respect to criteria (2) and (3). The LP approach has the disadvantage of being normative and it assumes a fixed proportions production function, but it meets all three criteria above and facilitates sensitivity analysis. Consequently an LP model is employed in the current study.

A two-year planning horizon is used in the model to capture the lagged investment effect of FFW. The objective is to determine levels of production activities, with and without FFW, that maximize income subject to available resources and minimum subsistence requirements. The model is presented in aggregate form in Table 1 and contains 96 activities and 82 constraints. Crop activities include maize, millet, and sorghum at two technology levels while livestock activities include goats and cows. Because livestock feed on non-arable community grazing land, input

Table 1. Aggregated LP Tableau for Participant Households.

Obj.Fn.	Year 1														Year 2													
	CP	CS	CC	LP	LS	LC	FR	FS	FC	LT	HL	BO	SA		CP	CS	CC	LP	LS	LC	FR	FS	FC	HL	BO	SA	ET	RHS
Obj.Fn.	-C	C		-C	C			C			-C	-C			-C	C		-C	C			C		-C	-C	C	1	Max
<u>Year 1</u>																												
Resource Con.	A			A			A				-1																	≤ B
Capital Con.	A			A							A	-1	1															≤ B
Crop Trans.	-A	1	1																									≤ 0
Live Trans.				-A	1	1					1																	≤ 0
FFH Trans.							-A	1	1																			≤ 0
Nutrient Tr.				A			A				A																	≥ B
<u>Year 2</u>																												
Resource Con.															A			A			A			-1				≤ B
Capital Con.	A	-A		A	-A			-A				-A			A			A						A	-1	1		≤ B
Crop Trans.															-A	1	1											≤ 0
Live Trans.										-1								-A	1	1								≤ 0
FFH Trans.																					-A	1	1					≤ 0
Nutrient Tr.																		A		A				A				≥ B
Equity				-A																	-A						1	≤ 0

Definitions: CP, crop production; CS, crop selling; CC, crop consumption; LP, livestock production or purchase; LS, livestock selling; LC, livestock consumption; FR, food for work received; FS, food for work sold; FC, food for work consumed; LT, livestock transfer; HL, hire labor; BO, borrowing; SA, savings; ET, equity transfer; RHS, right hand side; A, B, and C, non-zero or one coefficient.

requirements, except labor, are minimal. Crops, milk, and meat are sold or consumed. Purchase of goats and cows is allowed.

The FFW commodities, maize, beans, and oil, can be either consumed or sold each month. Representative participant households are allowed to work on FFW activities up to 100 hours per month. A full 100 hours earns 45 kgs. of maize, 4 kgs. of beans, and 1.5 kgs. of oil. Participant households must receive all three items in these proportions. Consequently, the production function for FFW presented above, $Z = Z(J)$, is consistent with the fixed proportions assumption implicit in the L.P. formulation.

Although the family supplies most of the labor, several farm-households hire labor during land preparation, planting, weeding, and harvesting. Thus, activities are included to allow hiring-in labor in several months. An arable land constraint of .75 hectares per farm household and a capital constraint of 1000 Kenya Shillings (Kshs.) are included in the model. In addition, households are allowed to borrow up to 1000 Kshs. per year at 20% interest or save at 5%.

Minimum subsistence requirements that conform to the farm household's basic nutrient requirements (protein, fat, and carbohydrate) are incorporated into the analysis.¹ These requirements (based on UN/FAO statistics) are calculated using the average size of the study area family of 4.4 people and are included in the model as nutrient transfer rows.

Consumption Model

The consumption side of the model is specified econometrically to conform to the Almost Ideal Demand System (AIDS) of Deaton and Muellbauer. Unlike the LES, LLES, and QES models, the AIDS allows for flexibility in both price and income elasticities. Flexibility with respect to the