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Sandeep Mohapatra, Christopher B. Barrett, Donald L. Snyder, and Basudeb Biswas

ABSTRACT

We examine whether food aid acts as a disincentive to agricultural production in recipient economies. Since structural deficiencies of markets are a central reason why low-income agrarian economies receive food aid, we adopt a modeling framework that accommodates market imperfections. Our nonseparable representative household model highlights the factor market effects of food aid overlooked in conventional, Schultzian analyses.
DOES FOOD AID REALLY DISCOURAGE FOOD PRODUCTION?¹

Food aid has long been criticized as a potential disincentive to recipient country agricultural production. Schultz argued that food aid can drive down local food prices by increasing the domestic supply of food, thereby reducing incentives to recipient country food producers and potentially retarding economic development. The existence of partial equilibrium price disincentives of this sort seems widely accepted in the literature (Maxwell and Singer). However, the theoretical literature relies on implausible Arrow-Debreu models, even though the structural deficiencies of recipient country markets are a central reason why they receive food aid, and may have important indirect effects through interrelated markets. This paper therefore revisits this issue by adopting a model that accommodates market imperfections. While the potential income effects on demand have caused some to question whether food aid depresses food prices in recipient economies (Fisher), factor market effects are usually disregarded despite their potential importance.

1. A Nonseparable Representative Household Model of the Recipient Economy

Recent advances in the theory of household decision-making emphasize complex relationships between consumption, labor allocation, and production decisions in peasant households that consume a significant proportion of their own output (Singh et al.; DeJanvry et al.). When (perhaps household-specific) market failures occur, household utility maximization no longer reduces production decisions to familiar profit-maximization choice rules. Rather, consumption, labor allocation, and production decisions become inextricable; these models are often called “nonseparable” household models. Nonseparable models accommodate selective market failures,

¹Graduate research assistant, assistant professor, professor, and professor, respectively. We thank Balraj Menon, Sanjeev Misra, and Les Reinhorn for constructive comments. Barrett’s work was supported by a Faculty Research Grant from the Utah State University Vice-President for Research and by the Utah Agricultural Experiment Station. Approved as UAES journal paper no. 4990.
e.g., for labor and/or finance, that condition producers’ response to external shocks, such as the
delivery of food aid. A nonseparable representative household model could be useful in depicting
the low-income recipient economy.\(^2\)

Almost a quarter of the world’s population belongs to peasant households in low- and
middle-income countries. These households are commonly found in villages where poor
transportation and communications infrastructure and low disposable incomes constrain market
participation. Selective labor and financial market failures are consequently common. In principle,
food aid flows to the poorest segments of economies characterized by such significant structural
flaws.

Following DeJanvry et al., consider a representative household that owns a plot of land and
produces agricultural commodities tradable in the market. Production of these crops employs labor
\((Q_l)\) and a purchased input \((Q_x)\) on a fixed amount of land \((T)\) to produce cash crops \((Q_c)\) and food
\((Q_f)\). The household maximizes utility defined over consumption of food \((C_f)\), a manufactured
product traded in the market \((C_m)\), and leisure \((C_l)\). Assume the utility function is monotonic, twice
differentiable, and concave in each of its arguments. The household faces a technology constraint,
a budget constraint, and a time constraint. Its problem is thus

\[
\begin{align*}
\text{Max} & \quad U \left( C, Q \right) \\
C, Q & \text{s.t.} \quad Z \left( Q | T \right) = 0 \\
& \quad P_c' C_f \leq P_q' Q_t + M \\
& \quad C_l + Q_l \leq T_l
\end{align*}
\]

where boldface type denotes a vector, \(P_c\) is the subvector of prices associated with tradable
consumption goods, \(C_t\) is the subvector of tradable consumption goods, \(P_q\) is the subvector of prices

\(^2\)Bezuneh et al. use a separable household model in their analysis of food for work schemes in Kenya. That
appears the only other use of household models in this literature.
associated with production netputs, \( \mathbf{Q}_t \) is the subvector of tradable production netputs, \( M \) represents exogenous income transfers, and \( T_t \) is the household’s time endowment. Food aid, \( A \), comprises part of transfers, i.e., \( M = A + B \), where \( B \) represents nonfood aid. Assuming \( U' > 0 \), constraints (3) and (4) will bind. The Lagrangian to this problem may be written as

\[
\mathcal{L} = U(C) + \psi Z(Q) + \lambda (P_{q} Q_t - P_{c} C_t + M) + \omega (T_t - q_t - C_t)
\]

where \( \psi \) represents the marginal utility of technology improvement, \( \lambda \) is the marginal utility of income, and \( \omega \) can be regarded as the marginal utility of leisure.

The problem's structure implicitly reflects the absence of markets in land and finance. We also treat labor as nontradable because, in the recipient economies of interest, the vast majority of labor is engaged on the worker's own farm at a shadow wage that differs from any market wage (DeJanvry et al.; Jacoby; Skoufias). Representing the shadow price of nontradable labor (\( C_t \) and \( Q_t \)) as \( P_t^* = \omega/\lambda \), and the price of the other tradable goods as \( P_i^* = P_i \), we then have the standard first-order conditions for constrained utility maximization.

\[
\begin{align*}
    U_i &= \lambda P_i^* \quad \forall C_i \\
    \psi Z_i &= -\lambda P_i^* \quad \forall Q_j \\
    Z_i (Q_i | T) &= 0 \\
    P_{c} C_t &= P_{q} Q_t + M \\
    C_t + Q_t &= T_t
\end{align*}
\]

Algebraic manipulation of these conditions yields a generalized profit function, \( \Pi^*(\mathbf{P}_q^*) = \mathbf{P}_q^* \mathbf{Q} \), a system of factor demand and output supply functions, \( \mathbf{Q} = \mathbf{Q}(\mathbf{P}_q^*) \), an expression for household full income, \( Y^* = \Pi^* + P_i^* T_t + M \), and a system of demand equations, \( \mathbf{C} = \mathbf{C}(\mathbf{P}_c^*, Y^*) \). One can also derive an equation for the endogenous shadow value of labor, \( P_t^* = P_t^* (\mathbf{P}_t^*, \mathbf{M}) \), where \( \mathbf{P}_t^* \) is the shadow price vector, \( \mathbf{P}^* \), excluding \( P_t^* \). The incentive effects of food aid come through its influence on \( Y^* \) and on the price vector, \( \mathbf{P}_q^* \).
II. The Opposing Effects of Food Aid on Peasant Producer Households

Not only does food aid increase local food supply, perhaps thereby depressing food prices, it also can relax balance of payments constraints that may impede import of intermediate goods (e.g., fertilizer, machinery) used in agricultural production. Since most low-income agrarian nations import a substantial portion of commercial agricultural inputs, relaxing the balance of payments constraint—the macroeconomic analog to the representative household's budget constraint—may stimulate food production in recipient economies. Just as increased supply of food is expected to reduce the domestic market price of food, \( P_f \), so would increased hard currency availability increase the local supply of commercial inputs, reducing \( P_x \).

Given the above model, the output response of food to an increase in food aid is

\[
\frac{dQ_f}{dA} = \frac{\partial Q_f}{\partial P_f} \frac{dP_f}{dA} + \frac{\partial Q_f}{\partial P_i} \frac{dP_i^*}{dA} + \frac{\partial Q_f}{\partial P_x} \frac{dP_x}{dA}
\]  

(11)

The first term on the right-hand side of (11) is the Schultzian negative partial equilibrium supply response, but two additional factor market effects must be considered. The third term will be positive if food aid permits additional intermediate imports and reduces their domestic price. The output response to food aid is thus analytically ambiguous because of the opposing partial equilibrium effects in product and factor markets. This ambiguity is reinforced by the labor allocation incentive effects of food aid shown in the second term of (11).

Although \( \frac{\partial Q_f}{\partial P_i^*} \) is unambiguously negative by the convexity of the profit function, food aid has ambiguous effects on the shadow wage, as is evident by totally differentiating (10) and the

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3While, in principle, food aid is to be fully "additional" to commercial food purchases, the empirical evidence is strong that food aid at least partly substitutes for commercial imports (Maxwell and Singer; von Braun and Huddleston).
expression for household full income, \( Y^* \), then rearranging terms (see the appendix for details). The response of the shadow wage to food aid depends on the induced fall in \( P_f \) on the one hand, and the increase in leisure demand stimulated by the income transfer and by the profit effect of induced reduction in \( P_x \), on the other. This is shown in expression (12).

\[
\frac{dP^*_f}{dA} = - \frac{\Omega + \Sigma}{\frac{\partial Q_l}{\partial P^*_f} + \frac{\partial C^*_l}{\partial P^*_f} + \frac{\partial C^*_l}{\partial Y} \frac{\partial \Pi}{\partial P^*_f}}
\]

where \( \Omega = \frac{\partial P^*_f}{\partial A} \left[ \frac{\partial C^*_l}{\partial P^*_f} + \frac{\partial Q^*_l}{\partial P^*_f} + \frac{\partial C^*_l}{\partial Y} \frac{\partial \Pi}{\partial P^*_f} \right] \)

\[
\Sigma = \frac{\partial C^*_l}{\partial Y} \left[ 1 + \frac{\partial \Pi}{\partial P^*_x} \frac{dP^*_x}{dA} \right]
\]

The denominator of (12) is unambiguously negative given a convex profit function. As reflected in (13), the first term in the numerator, \( \Omega \), is the sum of three terms multiplied by the (assumed) negative effect of food aid on food prices. The first term is positive if food and leisure are gross substitutes. The second term is the positive partial response of labor supply to output price. The third term represents the income effect on the consumption of leisure due to change in \( P_f \) and is positive if the household is a net seller of food. Thus, for net food sellers for whom leisure and food are gross substitutes, \( \Omega \) is unambiguously negative. The second term in the numerator, \( \Sigma \), contains two terms. The first is simply the positive marginal income effect on leisure consumption from an extra monetary unit of transfer due to food aid. The second is the positive profit effect of (assumed) reduced input prices, \( P_x \), due to food aid’s salutary effects on the balance of payments. The shadow wage effects of food aid are thus likewise ambiguous, reflecting the broader juxtaposition of product market disincentives and factor market incentives to food production.
Moreover, a careful study of equations (11) and (12) reveals that it is not possible to predict easily whether factor market or product market effects will dominate. The balance of payments effects that stimulate output by reducing purchased input prices simultaneously exert upward pressure on the shadow wage (through $\Sigma$), thereby discouraging agricultural employment at the margin. Conversely, the product market disincentive effects to food production exert downward pressure on the shadow wage (through $\Omega$), inducing countervailing employment effects at the margin. Schultz's prediction becomes analytically ambiguous once one considers the richness of incomplete markets and nonseparable household decision-making in poor agrarian economies. The economic effects of food aid are fundamentally an empirical question, one warranting further research.

**III. Conclusion**

This paper revisits the long-standing debate concerning effect of food aid on the incentives to food production in recipient economies. We explore the implications of nonseparable household decisions caused by widespread nonparticipation in labor, land, and financial markets, which characterizes the low-income, agrarian, food recipient economies in which this issue is of greatest concern. The classic Schultzian findings do not hold under our more general approach.

Our model demonstrates analytically common anecdotal accounts (Maxwell and Singer): because food aid is not wholly additional (i.e., it is to some degree a substitute for commercial food imports), relaxing recipients' balance of payments constraints may stimulate factor employment even as food prices fall in product markets. The classic theoretical work on food aid (Schultz; Fisher) and subsequent modeling efforts essentially ignore these effects. Much as it is preferable to investigate the incentive effects of trade and exchange rate policies by studying effective rates of protection
(which consider both factor and product market effects) rather than nominal protection coefficients (which are based only on product prices), so too is it important to emphasize the multiple, countervailing impacts of food aid across the full range of markets in which low-income food producers operate. Ascertaining the economic effects of food aid thus fundamentally requires empirical study.
References


Appendix

Begin with equation (10) and the expression for household full income derived from the first-order conditions (6)-(10).

\begin{align*}
(i) & \quad C_t(P^*_e, Y^*) = T_t - Q_t(P^*) \\
(ii) & \quad Y^* = A + B + \Pi^* + P^*_1 T_t
\end{align*}

Next, totally differentiate both expressions.

\begin{align*}
(iii) \quad & \frac{\partial C_t}{\partial P^*_1} \cdot dP^*_t + \frac{\partial C_t}{\partial P_t} \cdot dP_t + \frac{\partial C_t}{\partial Y} \cdot dY = - \frac{\partial Q_t}{\partial P^*_1} \cdot dP^*_t - \frac{\partial Q_t}{\partial P_t} \cdot dP_t - \frac{Q_t}{\partial P_x} dP_x \\
(iv) & \quad dY = dA + \frac{\partial \Pi}{\partial P^*_1} \cdot dP^*_t + \frac{\partial \Pi}{\partial P_t} \cdot dP_t + \frac{\partial \Pi}{\partial P_x} \cdot dP_x
\end{align*}

Noting that

\begin{align*}
(v) & \quad dP_t = \frac{\partial P_t}{\partial A} \cdot dA
\end{align*}

substitute (v) into (iv) and rearrange terms

\begin{align*}
(vi) & \quad dY = dA + \frac{\partial \Pi}{\partial P^*_1} \cdot dP^*_t + \frac{\partial \Pi}{\partial P_t} \cdot dP_t + \frac{\partial \Pi}{\partial P_x} \cdot dP_x \\
(vii) & \quad = (1 + \frac{\partial \Pi}{\partial P_t} \cdot \frac{\partial P_t}{\partial A}) dA + \frac{\partial \Pi}{\partial P^*_1} \cdot dP^*_t + \frac{\partial \Pi}{\partial P_x} \cdot dP_x
\end{align*}

Now substitute (vii) into (iii) and rearrange terms

\begin{align*}
(viii) & \quad \frac{\partial C_t}{\partial P^*_1} \cdot dP^*_t + \frac{\partial C_t}{\partial P_t} \cdot dP_t + \frac{\partial C_t}{\partial Y} \cdot (1 + \frac{\partial \Pi}{\partial P_t} \cdot \frac{\partial P_t}{\partial A}) dA + \frac{\partial \Pi}{\partial P^*_1} \cdot dP^*_t + \frac{\partial \Pi}{\partial P_x} \cdot dP_x \\
(ix) & \quad \{\frac{\partial C_t}{\partial P^*_1} + \frac{\partial C_t}{\partial Y} \cdot \frac{\partial \Pi}{\partial P_t} + \frac{\partial Q_t}{\partial P^*_1} \} dP^*_t = -\{\frac{\partial C_t}{\partial P_t} \cdot \frac{\partial P_t}{\partial A} + \frac{\partial C_t}{\partial Y} \cdot \frac{\partial \Pi}{\partial P^*_1} \} dA
\end{align*}

Divide through both sides to get

\[
\frac{dP^*_t}{dA} = - \frac{\Omega + \Sigma}{\frac{\partial Q_t}{\partial P^*_1} + \frac{\partial C_t}{\partial P^*_1} + \frac{\partial C_t}{\partial Y} \cdot \frac{\partial \Pi}{\partial P^*_1}}
\]
where \( \Omega = \frac{\partial P_f}{\partial A} \left[ \frac{\partial C_i}{\partial P_f} + \frac{\partial Q_i}{\partial P_f} + \frac{\partial C_i}{\partial Y} \right] \frac{\partial \Pi}{\partial P_f} \)  

(13)

\[
\Sigma = \frac{\partial C_i}{\partial Y} \left[ 1 + \frac{\partial \Pi}{\partial P_x} \frac{dP_x}{dA} \right]
\]

(14)