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Does Food Aid Really Discourage Food Production?

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Food aid has long been criticised as a potential disincentive to recipient country agricultural production. Schultz (1960) 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 output price disincentives of this sort seems widely accepted in the literature [see reviews by Maxwell and Singer, 1979; Ruttan, 1993 and Barrett (forthcoming)], although analysts as far back as Fisher (1963) have wondered whether the potential income effects on food demand might mitigate or even offset these Schultzian disincentive effects.

However, the analytical food aid literature still relies on implausible Arrow-Debreu models, even though the structural deficiencies of recipient country markets are a central reason why they receive food aid. This is true as well for much of the recent empirical literature based on computable general equilibrium or multi-market modelling (e.g., Dorosh *et al.*, 1995). Moreover, given that the literature on agricultural production in poor countries generally pays great attention to factor markets – not just to product markets – we find it puzzling that the literature on food aid generally ignores factor market (dis)incentives created by food aid shipments. This paper therefore revisits the issue of the incentives to food production in food aid recipient economies by employing a simple representative agent model that accommodates incomplete or imperfect markets, thereby enabling identification of potential indirect effects through factor markets. The net effect is that food aid generates ambiguous incentives for food producers in recipient economies.

I

A NON-SEPARABLE REPRESENTATIVE HOUSEHOLD MODEL OF THE RECIPIENT ECONOMY

This paper uses a non-separable household model to analyse the impacts of exogenous food aid shocks on recipient economy food production volumes. Before presenting the model, let us briefly explain our model selection strategy. Food aid is a macro-economic phenomenon, while output response is an inherently micro-economic one. General equilibrium modelling is commonly used to integrate macro-economic and micro-economic concerns by endogenising non-tradables' prices. In this paper we nonetheless adopt a non-separable household modelling approach combined with sensitivity analysis on two grounds. First, the non-separable household model incorporates quasi-general equilibrium

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conditions that capture the most important (labour and food markets) effects of interest. Second, the principle of parsimony applies; ours is the simplest model which generates results invariant to the introduction of greater complexity into the model. If the objective was to derive specific estimates of food aid's net effects in a particular setting, one could empirically implement our non-separable household model by nesting it in computable general equilibrium simulations that take into account the structural features we emphasise, following Janvry *et al.* (1992). Our objective in this paper is, however, more modest: to establish the analytical ambiguity of food aid's incentive effects on recipient country food production and hence the need for empirical analysis that carefully traces food aid's effects on production incentives through all factor and product markets.

Almost a quarter of the world's population belongs to peasant households in low- and middle-income countries. Recent advances in the theory of household decision-making emphasise complex relationships between consumption, labour allocation, and production decisions in peasant households that consume a significant proportion of their own output (Singh *et al.*, 1986; Janvry *et al.*, 1991). These households are commonly found in villages where poor transportation and communications infrastructure – and hence high transactions costs – and low disposable incomes constrain market participation. Selective labour and financial market failures are consequently common to many households, although not universal to all households. When such market failures occur, household utility maximisation no longer reduces production decisions to familiar profit-maximisation choice rules. Rather, consumption, labour allocation, and production decisions become inextricable; these models are therefore often called "non-separable" household models. Non-separable models accommodate selective market failures, e.g., for labour and/or finance, that condition producers' response to external shocks, such as the delivery of food aid. Given the weakness of markets in food aid recipient economies, a non-separable representative household model could be useful in assessing analytically the effects of food aid on producer incentives.

Following Janvry *et al.* (1991), we therefore consider a representative household that owns a plot of land and produces agricultural commodities. Those factors and products that are tradable in the market are said to belong to the set T, those that are non-tradable due to excessive transactions costs, risk, or other reasons belong to the set N. Production of these crops employs labour (Q_l) and a purchased input (Q_x) on a fixed amount of land (D) to produce cash crops (Q_c) and food (Q_f). The household maximises 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:

$$\text{Max } U(\mathbf{C}) \qquad \ldots (1)$$
$$\mathbf{C, Q}$$
$$\text{Subject to } Z(\mathbf{Q/D}) = 0 \qquad \ldots (2)$$
$$\mathbf{P_c}' \mathbf{C_t} \leq \mathbf{P_q}' \mathbf{Q_t} + M \qquad \forall t \in T \qquad \ldots (3)$$
$$\mathbf{C_n} \leq \mathbf{Q_n} + \mathbf{W_n} \qquad \forall n \in N \qquad \ldots (4)$$

where boldface type denotes a vector, $\mathbf{P}_c$ is the subvector of prices associated with tradable consumption goods, $\mathbf{C}_t$ is the subvector of consumption volumes for tradable goods, $\mathbf{P}_q$ is the subvector of prices associated with tradable production netputs, $\mathbf{Q}_t$ is the subvector of tradable production netput volumes, M represents exogenous income transfers, and $\mathbf{W}_n$ is the vector of non-tradable endowments (in particular, time). Food aid may comprise part of transfers when food is tradable, i.e., $M = AP_f + B$ when $f \in T$, where A represents food aid volumes and B represents non-food monetary transfers. If food is a non-tradable good, then M=B and food aid comprises the food endowment of the representative household, i.e., $W_f = A$. Assuming $U' > 0$, constraints (3) and (4) will bind. The Lagrangian to this problem may be written as:

$$L = U(\mathbf{C}) + \psi Z(\mathbf{Q}) + \lambda(\mathbf{P}_q \mathbf{Q}_t - \mathbf{P}_c \mathbf{C}_t + M) + \omega'(\mathbf{W} - \mathbf{Q} - \mathbf{C}) \quad \ldots (5)$$

where ψ represents the marginal utility of technology improvement, λ is the marginal utility of income, and ω can be regarded as the vector of marginal utilities of an extra unit of each non-tradable good. This formulation accommodates transactions costs that drive a wedge between the purchase and sale prices of tradables, food that is either tradable or non-tradable, multi-output technologies, etc., and implicitly reflects the absence of markets in land and finance. It is very generally applicable to low-income agrarian economies.

We treat labour as non-tradable because in the recipient economies of interest, the vast majority of labour is engaged on the worker's own farm at a shadow wage that differs from any market wage (Janvry *et al.*, 1991; Fafchamps, 1993; Jacoby, 1993; Skoufias, 1994). Given that food can be reasonably classified as either tradable or non-tradable in many low-income agrarian economies (Barrett and Carter, 1999), we consider both cases: nontradable and tradable food. Since commercial inputs to food production and cash crops are almost always tradable, we treat them as belonging to the set T. Representing the shadow price of non-tradables as $P_n^* = \omega_n/\lambda$, and the price of tradable goods as $P_i^* = P_i$, we then have the standard first-order conditions for constrained utility maximisation.

$$U_i = \lambda P_i^* \qquad \forall C_i \qquad \ldots (6)$$

$$\psi Z_j = -\lambda P_j^* \qquad \forall Q_j \qquad \ldots (7)$$

$$Z(Q/D) = 0 \qquad \ldots (8)$$

$$\mathbf{P}_c' \mathbf{C}_t = \mathbf{P}_q' \mathbf{Q}_t + M \qquad \forall t \in T \qquad \ldots (9)$$

$$\mathbf{C}_n = \mathbf{Q}_n + \mathbf{W}_n \qquad \forall n \in N \qquad \ldots (10)$$

Algebraic manipulation of these conditions yields a generalised profit function, $\pi^*(\mathbf{P}_q^*) = \mathbf{P}_q^{*\prime}\mathbf{Q}$, a system of factor demand and output supply functions, $\mathbf{Q} = Q(\mathbf{P}_q^*)$, an expression for household full income, $Y^* = \pi^* + P_l^* W_l + P_f^* A + B$, and a system of demand equations, $\mathbf{C} = C(\mathbf{P}_c^*, Y^*)$. One can also derive an equation for the endogenous shadow value of non-tradables, $\mathbf{P}_n^* = P_n^*(\mathbf{P}_{-n}^*, A, B)$, where $\mathbf{P}_{-n}^*$ is the shadow price vector, $\mathbf{P}^*$, excluding $\mathbf{P}_n^*$. The incentive effects of food aid come through its influence on Y^* (via M in the case of tradable food, via W_f in the case of non-tradable food) and on the price vector, $\mathbf{P}^*$.

The representative agent model just described offers a parsimonious way to capture the incentive effects of food aid. If the economy is made up of N such households, the cash

budget constraint represented by relation (3), summed across households, becomes the economy's balance of payments constraint. The price of tradables are simply the product of the world price and the exchange rate, $P_i = eP_{wi}$ for all $i \in T$. Since marginal rates of substitution and transformation are equated within the household, yielding shadow (i.e., autarkic) prices, the non-separability of the model *de facto* internalises the general equilibrium effects across factor, labour and product markets.[1]

II

THE OPPOSING EFFECTS OF FOOD AID ON PEASANT PRODUCER HOUSEHOLDS

The precise effects of food aid on production incentives depend on several factors, to which we now turn. If food is non-tradable, then food aid clearly has Schultzian (negative) effects on food prices, because it relaxes the availability constraint (4), thereby lowering ω_f and thus P_f^*, the shadow price of food. If food is tradable, then the recipient economy is a price taker on the international market ($P_f^* = P_f = eP_{wf}$). Nonetheless, food aid may impact recipient economy food prices through real exchange rate appreciation induced by the balance of payments effects caused by the substitution of food aid for commercial food imports. Despite the rhetoric of the international food aid convention, which requires maintenance of 'usual marketing requirements' (UMRs) so that food aid is purely 'additional' to commercial trade flows, the empirical literature on food aid clearly shows that the additionality principle is commonly violated [Maxwell and Singer, 1979; Braun and Huddleston, 1988; Barrett *et al.*, 1999; Barrett (forthcoming)]. Food aid typically reduces recipients' commercial food imports substantially, thereby relaxing balance of payments constraints. If that relaxation is considerable, it could induce real exchange rate appreciation (*i.e.*, a fall in e), thereby reducing the price of tradables. The last option is that food aid has no effect on the real exchange rate and food is tradable, in which case there will be no product price effect. Food aid should thus have non-positive price effects on recipient economy food prices, irrespective of whether food is tradable or non-tradable.

Since the violation of additionality may induce exchange rate appreciation, leading to non-positive effects on all tradables' prices, there may then be factor market effects as well as output market effects. Since most low-income agrarian nations import a substantial portion of commercial agricultural inputs (e.g., inorganic fertiliser, machinery), relaxing the balance of payments constraint – the macro-economic analog to the representative household's budget constraint – may stimulate food production in recipient economies. Just as food aid leads to non-positive changes in the domestic market price of food, P_f^*, so too does it lead to non-positive changes in the price of tradable inputs, P_x^*. This is the root of the inherently ambiguous producer incentive effects of food aid. Factor and product market incentives move in opposing directions, so the impact of food aid on producer incentives and output volumes turns on the relative magnitudes of these effects; it is an inherently empirical question.

We can formalise this argument using the simple model of Section I. The representative household's food output response to an increase in food aid is

$$\frac{dQ_f}{dA} = \frac{\partial Q_f}{\partial P_f^*} \cdot \frac{dP_f^*}{dA} + \frac{\partial Q_f}{\partial P_I^*} \cdot \frac{dP_I^*}{dA} + \frac{\partial Q_f}{\partial P_x^*} \cdot \frac{dP_x^*}{dA} \quad \ldots.(11)$$

The first term on the right-hand side of (11) is the Schultzian partial equilibrium supply response. This is non-positive because $\partial Q_f/\partial P_f^* > 0$, from the output supply function, and $dP_f^*/dA \leq 0$ by the arguments of the preceding paragraph (with a strong inequality obtaining if food is non-tradable, $dP_f^*/dA = d(\omega_f/\lambda)/dA < 0$). Now two factor market effects must be considered. The third term will be non-negative. It is positive if food aid relaxes the balance of payments constraint, prompting exchange rate appreciation, $dP_x^*/dA = P_{wx} \cdot de/dA < 0$, and permitting additional intermediate imports at reduced domestic price. It is zero if there are no exchange rate effects (since then $dP_x^*/dA=0$). 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 labour allocation incentive effects of food aid shown in the second term of (11).[2]

Although $\partial Q_f/\partial P_f^*$ 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 expression for household full income, Y^*, then rearranging terms (see the appendix for a derivation). The response of the shadow wage to food aid depends on whether there is an induced fall in P_f^*, on any increase in leisure demand stimulated by the transfer – whether in liquid form for tradable food, as captured in M, or in illiquid form for non-tradable food, as captured in W_f – and on the profit effect of induced reduction in P_x^*. This is shown in expression (12).

$$\frac{dP_f^*}{dA} = -\frac{\Omega + P_f^* \frac{\partial C_f}{\partial Y^*}}{\frac{\partial Q_f}{\partial P_f^*} + \frac{\partial C_f}{\partial P_f^*} + \frac{\partial C_f}{\partial Y}\left(\frac{\partial \pi}{\partial P_f^*} + W_f\right)} \qquad \ldots\ldots(12)$$

$$\text{where} \quad \Omega = \frac{\partial P_f^*}{\partial A}\left[\frac{\partial C_f}{\partial P_f^*} + \frac{\partial Q_f}{\partial P_f^*} + \frac{\partial C_f}{\partial Y^*}\left(A + \frac{\partial \pi}{\partial P_f^*}\right)\right] + \frac{\partial P_x^*}{\partial A}\left[\frac{\partial Q_f}{\partial P_x^*} + \frac{\partial C_f}{\partial Y^*} \cdot \frac{\partial \pi}{\partial P_x^*}\right] \qquad \ldots\ldots(13)$$

The denominator of (12) cannot be unambiguously signed since the bracketed term contains a positive term, W_f, and a negative one, $\partial\pi/\partial P_f^*$. As reflected in (13), the first term in the numerator, Ω, captures the responses of household labour demand and supply to changes (if any) in the output price, P_f^*, and the non-labour input price, P_x^*, induced by increased food aid flows. If food is tradable and food aid has no effect on the real exchange rate, then $\Omega=0$. That is not sufficient, however, for food aid to have no effect on shadow wages. The second term in the numerator of (12) represents the positive profit effect of an additional unit of food aid on leisure consumption. Thus even when food aid has no impact on tradables prices, if labour markets are incomplete – as seems typical of low-income agrarian economies characterised by significant transactions costs – then food aid will have shadow wage effects that are non-zero but of ambiguous sign, reflecting the broader juxtaposition of product market disincentives and factor market incentives to food production. Despite widespread acceptance in the food aid literature, the simple but quite general model presented here demonstrates that negative incentive effects do not necessarily emerge in low-income agrarian economies characterised by incomplete markets – as is typical of food aid recipient

nations. Rather, the incentive effects of food aid are analytically ambiguous, with countervailing factor and product market effects within the tradables sector and ambiguous effects on labour use patterns. This result helps to explain recent empirical findings from dynamic estimation of food aid's effects on recipient country food production (Barrett *et al.*, 1999).

Moreover, a careful study of expressions (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, thereby discouraging agricultural employment at the margin. Conversely, the product market disincentive effects to food production exert downward pressure on the shadow wage, inducing countervailing employment effects at the margin. The economic effects of food aid are fundamentally an empirical question amid the richness of incomplete markets and non-separable household decision-making in poor agrarian economies.

III

CONCLUSION

This brief analytical note revisits the long-standing debate concerning the effects of food aid on food producer incentives in recipient economies. We explore the implications of non-separable household decisions caused by widespread non-participation in labour, land, financial and/or food markets, as is typical of the low-income food aid recipient economies in which this issue is of greatest concern. The classic Schultzian findings do not hold under more general conditions. Rather, the selective market failures that permeate low-income, high-transactions-cost economies significantly complicate analysis of the effects of policy interventions, rendering analytically ambiguous the sign of the key relationships. A natural consequence is the cross-sectional and inter-temporal heterogeneity of output responses to similar food aid disbursement histories, as evident in the literature.

Our model provides analytical support for common empirical findings as yet not theoretically supported. For example, because food aid is not wholly additional (i.e., it partly substitutes 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, 1960; Fisher, 1963) and subsequent modelling efforts 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 emphasise 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.

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APPENDIX

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

(i) $C_l(P^*, Y^*) = W_l - Q_l(P^*)$

(ii) $Y^* = B + P_f^* A + \pi^* + P_l^* W_l$

Next, totally differentiate both expressions.

(iii) $\partial C_l/\partial P_l^* \cdot dP_l^* + \partial C_l/\partial P_f^* \cdot dP_f^* + \partial C_l/\partial Y^* \cdot dY^* = -\partial Q_l/\partial P_l^* \cdot dP_l^* - \partial Q_l/\partial P_l^* \cdot dP_l^* - \partial Q_l/\partial P_x^* \cdot dP_x^*$

(iv) $dY^* = P_f^* \cdot dA + A \cdot dP_f^* + \partial\pi/\partial P_l^* \cdot dP_l^* + \partial\pi/\partial P_f^* \cdot dP_f^* + \partial\pi/\partial P_x^* \cdot dP_x^* + W_l \cdot dP_l^*$

Noting that

(v) $dP_f^* = \partial P_f^*/\partial A \cdot dA$

and

(vi) $dP_x^* = \partial P_x^*/\partial A \cdot dA$

Substitute (v) and (vi) into (iv) and rearrange terms.

(vii) $dY^* = (\partial\pi/\partial P_l^* + W_l)dP_l^* + [P_f^* + \partial P_f^*/\partial A(A + \partial\pi/\partial P_f^*) + \partial\pi/\partial P_x^* \cdot \partial P_x^*/\partial A]dA$

Now substitute (v), (vi) and (vii) into (iii).

(viii) $\partial C_l/\partial P_l^* \cdot dP_l^* + \partial C_l/\partial P_f^* \cdot \partial P_f^*/\partial A \cdot dA^* + \partial C_l/\partial Y^* \{(\partial\pi/\partial P_l^* + W_l)dP_l^* + [P_f^* + \partial P_f^*/\partial A(A + \partial\pi/\partial P_f^*) + \partial\pi/\partial P_x^* \cdot \partial P_x^*/\partial A]dA\} = -\partial Q_l/\partial P_l^* \cdot dP_l^* - (\partial Q_l/\partial P_f^* \cdot \partial P_f^*/\partial A + \partial Q_l/\partial P_x^* \cdot \partial P_x^*/\partial A)dA$

Then rearrange terms.

(ix) $\{\partial C_l/\partial P_l^* + \partial C_l/\partial Y^*(\partial\pi/\partial P_l^* + W_l) + \partial Q_l/\partial P_l^*\}dP_l^* = -\{\partial C_l/\partial P_f^* \cdot \partial P_f^*/\partial A + \partial C_l/\partial Y^*[P_f^* + \partial P_f^*/\partial A(A + \partial\pi/\partial P_f^*) + \partial\pi/\partial P_x^* \cdot \partial P_x^*/\partial A] + \partial Q_l/\partial P_f^* \cdot \partial P_f^*/\partial A + \partial Q_l/\partial P_x^* \cdot \partial P_x^*/\partial A\}dA$

Finally, divide through both sides:

$$\frac{dP_l^*}{dA} = -\frac{\Omega + P_f^* \frac{\partial C_l}{\partial Y^*}}{\frac{\partial Q_l}{\partial P_l^*} + \frac{\partial C_l}{\partial P_l^*} + \frac{\partial C_l}{\partial Y}\left(\frac{\partial \pi}{\partial P_l^*} + W_l\right)} \qquad \ldots.(12)$$

where $$\Omega = \frac{\partial P_f^*}{\partial A}\left[\frac{\partial C_l}{\partial P_f^*} + \frac{\partial Q_l}{\partial P_f^*} + \frac{\partial C_l}{\partial Y^*}\left(A + \frac{\partial \pi}{\partial P_f^*}\right)\right] + \frac{\partial P_x^*}{\partial A}\left[\frac{\partial Q_l}{\partial P_x^*} + \frac{\partial C_l}{\partial Y^*} \cdot \frac{\partial \pi}{\partial P_x^*}\right] \qquad \ldots.(13)$$

NOTES

1. Note that a separable household model would fail to capture the general equilibrium effects fully since consumption decisions and exogenous income transfers do not affect production decisions in separable models. A separable representative household model could therefore capture only some of our results.

2. The output elasticity of food may also be affected by cross price effects from related markets that respond independently to food aid inflows. The existence of general equilibrium effects of this sort adds to the claims made here.

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