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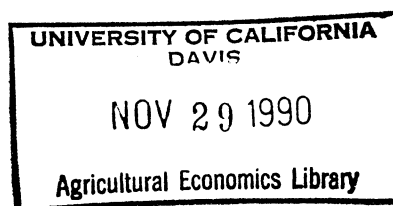
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A NOTE ON THE
INCOME EFFECTS OF P.L. 480 FOOD AID



Food aid

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1. Introduction

Schultz (1960) was among the first to suggest that P.L. 480 imports might depress food prices and dampen producer incentives in recipient countries. His seminal paper sparked a debate on the "disincentive effects" of food aid that continues today (see Isenman and Singer (1977) for a review). Schultz's central observation was that P.L. 480 imports cause an outward shift in the recipient country's supply curve for food, and hence might lead to a drop in the equilibrium price of food.

Several other authors, however, have argued that the price depressing effect identified by Schultz will be offset by a concurrent "income effect"¹ (Rogers et al. (1972); Bezuneh and Deaton (1981); Srivastava et al. (1975)). Food aid imports, these authors argue, contribute resources to the economy of the recipient country, and therefore boost aggregate income. This increase in income causes an outward shift in the demand curve for food, and the drop in price resulting from the outward shift in the supply curve will therefore be partially or totally negated.

The authors that make this argument, however, simply assume that food aid imports increase domestic income, without specifying precisely the ways in which P.L. 480 receipts affect income. The purpose of this paper is to analyze more closely the relationship between aggregate income and food aid imports, and to assess the implications of this relationship for the net effect of P.L. 480 receipts on domestic food prices and producer incentives.

¹The term "income effect", as used in this paper, is not to be confused with the Slutsky decomposition income effect. The Slutsky income effect is reflected in the slope of the Marshallian demand curve; the income effect defined in this paper refers to changes in food price caused by shifting of the Marshallian demand curve that occurs as aggregate income changes.

Previous studies (Fisher (1963), Seevers (1968)) have assessed the price impacts of food aid by performing comparative statics on a market clearing identity, equating domestic demand with domestic supply plus food aid imports. To study the income effects explicitly, I add to the model a second equation, representing the ways in which receipts of P.L. 480 aid affect income. I consider two principal channels through which income depends on food aid. First, the market value of the food aid imported constitutes one component of aggregate income. Second, the quantity of food aid received has an impact on the incomes of domestic food producers. Any change in food price induced by P.L. 480 imports leads to a change in domestic output (assuming supply is not perfectly inelastic); these changes in price and quantity in turn affect farm profits.

Comparative static analysis of my two-equation model yields results that directly contradict the assumption that P.L. 480 imports increase domestic income. I show that, as long as the demand for food is less than unitary elastic, aggregate income falls as food aid imports are increased. This result has an intuitive interpretation. If demand is inelastic, increasing the quantity of food supplied decreases the total market value of that food. Hence, the portion of income made up of the market value of the food aid received falls as P.L. 480 imports rise. The second component of aggregate income, farmers' incomes, also decreases as P.L. 480 aid increases. Falling food prices lead to a drop in domestic output and a reduction in farm profits.

These results indicate that the income effect of food aid causes a contraction in aggregate income, leading to an inward shift in the demand curve, rather than the outward shift assumed in previous studies. The income effect thus exacerbates the drop in food

prices associated with P.L. 480 aid, rather than offsetting it as previously asserted.

The conclusions that I draw from this exercise are intentionally limited in scope. In particular, I refrain from making any welfare statements. The welfare loss due to depressed prices and domestic production might well be outweighed by the welfare gains from increased consumption. My point is simply that it is wrong to assume a priori that the price depressing effects of food aid are likely to be small because of an offsetting expansion in income and demand. Such an assumption would lead to the conclusion that Schultz's cautionary observations can safely be ignored. This paper shows that, on the contrary, income effects might actually exacerbate the disincentive effects identified by Schultz. I leave the net welfare effects of P.L. 480 programs as a question open for debate, but I hope to have shown that that debate should be taken seriously, rather than assumed away because of some undefined income effects.

2. The Model

My model of a country receiving food aid consists of two equations, a market clearing condition, and an expression showing how income depends on food aid receipts, domestic food production, and the price of food.

The market clearing equation is simply

$$(1) \quad S(P) + A = D(P, Y)$$

where A is the quantity of food aid received, P is the domestic price of food, $S(P)$ is the

domestic supply curve, Y is aggregate income, and $D(P, Y)$ is a Marshallian demand curve.

The dependence of income on food aid receipts and related variables is given by the equation

$$(2) \quad Y = \bar{Y} + PA + PS(P).$$

\bar{Y} is simply the sum of any parts of aggregate income not affected by the level of food aid imports. PA is the market value of the food aid imported.² $PS(P)$ is the total revenue that farmers earn by selling their output. Assuming that the only variable input to production is farmers' own labor and that the reservation wage is zero³, total farm revenue will be equal to farm profits, and hence $PS(P)$ will be part of aggregate income.

3. Supply and Income Effects

The ways in which P.L. 480 imports affect food prices in recipient countries can be evaluated simply by performing comparative statics on equations (1) and (2).

Totally differentiating (1), and solving for the elasticity of food price with respect to

²Aggregate income is increased by exactly the market value of the food aid received under any of three scenarios: (1) food is distributed directly to individual households, who are then free to resell it, (2) food is given to the recipient government, which sells it domestically and uses the revenue to finance goods and services that private individuals would otherwise have paid for, or (3) the government is given the food, resells it domestically, and reduces taxes by an amount equal to the revenues thus raised.

³These assumptions are consistent with a positive supply elasticity (which I assume) if either (1) the production function is constant returns to scale but farmers' marginal disutility from labor is increasing, or (2) the marginal disutility of labor is constant, but the marginal productivity of labor is decreasing.

food aid, defined as $E(P,A) = (dP/dA)(D/P)$, yields

$$(3) \quad E(P,A) = \frac{E(D,Y)E^T(Y,A) - 1}{(S/D)E(S,P) - E(D,P)}$$

where $E(S,P) = (\partial S/\partial P)(P/S)$, $E(D,P) = (\partial D/\partial P)(P/D)$ and $E(D,Y) = (\partial D/\partial Y)(Y/D)$ are the usual supply, demand and income elasticities; and $E^T(Y,A) = (dY/dA)(D/Y)$ is the total elasticity of income with respect to food aid. By specifying how much the price of food changes as P.L. 480 commodities are imported, $E(P,A)$ gives a measure of the disincentive effect of food aid.⁴

$E(P,A)$ can be decomposed into two effects: $E(P,A) = \gamma + \psi$, where $\gamma = (-1)/[(S/D)E(S,P) - E(D,P)]$ and $\psi = [E(D,Y)E^T(Y,A)]/[(S/D)E(S,P) - E(D,P)]$.

I will refer to γ as the supply effect. It shows how much price changes in response to food aid imports, assuming that the demand curve remains fixed [$E(D,Y)E^T(Y,A) = 0$]. Graphically, γ represents an outward shift in the supply curve (see figure 1). Importing a quantity A of food aid shifts the supply curve from S to $S+A$. Given the fixed demand curve D , equilibrium price drops from P^0 to P^1 .

The first result follows straightforwardly from this graphical analysis and from the definition of γ .

Result 1 Assuming $E(S,P) > 0$ and $E(D,P) < 0$, we have $\gamma < 0$.

⁴A related question is the extent to which domestic food production decreases in response to food aid imports. Once $E(P,A)$ has been evaluated, however, the elasticity of supply with respect to food aid can be expressed simply as $E(S,A) = E(S,P)E(P,A)$.

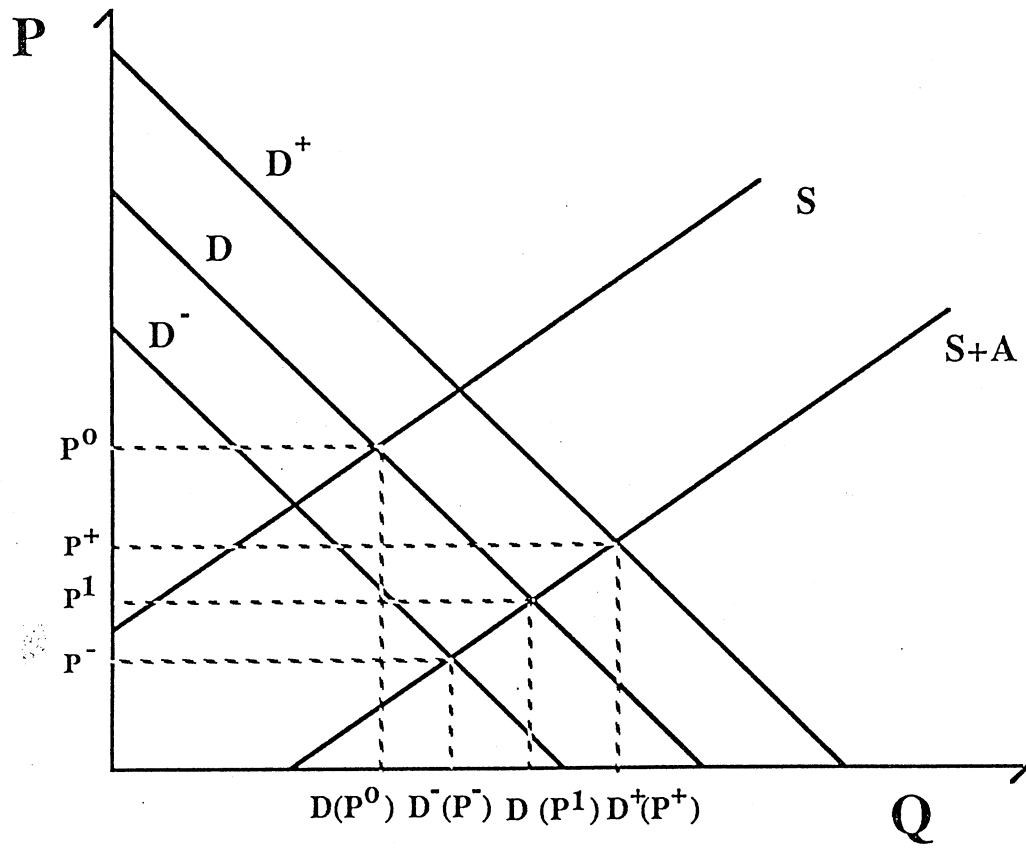


Figure 1

This result is simply a formalization of Schultz's observation that an outward shift in the supply curve induced by food aid imports will lead to a drop in domestic food prices.⁵ The question addressed in this paper is whether the concurrent income effect will offset or exacerbate this price depressing supply effect. Formally, this question reduces to evaluating the sign of ψ .

Assuming that food is a normal good [$E(D,Y) > 0$], ψ will agree in sign with $E^T(Y,A)$ (see the definition of ψ). For $E^T(Y,A) > 0$, ψ reflects an increase in aggregate income due to P.L. 480 aid, and an outward shift in the demand curve from D to D^+ (see figure 1). This increase in demand offsets the price depressing effects of the outward shift in the supply curve, resulting in an equilibrium price $P^+ > P^1$. If, however, $E^T(Y,A) < 0$, then the effects are reversed. The demand curve shifts in to D^- , and price falls to $P^- < P^1$. In such a case, the income effect ψ is negative, and exacerbates the price depressing effect of food aid.

Thus, whether the income effect leads to an expansion or a contraction in income and demand depends on the sign of $E^T(Y,A)$. $E^T(Y,A)$ can be evaluated simply by totally differentiating (2) and solving for dY/dA :

$$(4) \quad dY/dA = P + (dP/dA)A + (dP/dA)S(P) + P(\partial S/\partial P)(dP/dA).$$

⁵Schultz initially suggested that $E(P,A)$ would be equal to the inverse of the demand elasticity. Fisher pointed out, however, that this would be the case only if supply were perfectly inelastic. Totally differentiating the market clearing equation $D(P)=S(P)+A$, Fisher derived the expression $E(P,A)=(-1)/[(S/D)E(S,P)-E(D,P)]$. This is identical to what I have defined as the supply effect, γ . Fisher's expression for $E(P,A)$ failed to capture the income effect, ψ , because he wrote demand as a function of price alone [$D(P)$], rather than as a function of price and income [$D(P,Y)$].

Each term of (4) represents a different channel by which an increase in food aid imports affects aggregate income: P represents the addition to aggregate income of the market value of the commodities received; $(dP/dA)A$ reflects the loss in value of inframarginal units of food aid as further receipts cause price to fall; $P(\partial S/\partial P)(dP/dA)$ shows the value of the marginal reduction in domestic output that occurs as price falls; and $(dP/dA)S(P)$ captures the loss in value of the inframarginal units of domestic output.

Converting (4) to elasticities yields

$$(5) \quad E^T(Y,A) = (PD/Y) + [(PD/Y) + (PS/Y)E(S,P)]E(P,A).$$

Substituting in the expression for $E(P,A)$ given in (2), and solving for a closed form expression for $E^T(Y,A)$ gives

$$(6) \quad E^T(Y,A) = \frac{-(PD/Y)[1+E(D,P)]}{(S/D)E(S,P)-E(D,P)-E(D,Y)[(PD/Y)+(PS/Y)E(S,P)]}$$

To simplify this expression, I define two further elasticities. Since $(dY/dP) = A + S(P) + P(\partial S/\partial P) = D + P(\partial S/\partial P)$, the total elasticity of income with respect to price can be written as $E^T(Y,P) = (dY/dP)(P/Y) = (PD/Y) + (PS/Y)E(S,P)$. Similarly, since $(dD/dY) = (\partial D/\partial P) + (\partial D/\partial Y)(dY/dP)$, I define $E^T(D,P) = (dD/dP)(P/D) = E(D,P) + E(D,Y)E^T(Y,P)$. Substituting these expressions into the denominator of (6) gives

$$(7) \quad E^T(Y,A) = \frac{-(PD/Y)[1+E(D,P)]}{(S/D)E(S,P)-E^T(D,P)}$$

As long as $E^T(D,P)$ is negative⁶, the denominator of (7) will be positive. $E^T(Y,A)$ will therefore agree in sign with $-[1+E(D,P)]$. Thus, if the Marshallian demand curve is less than unitary elastic [$E(D,P) > -1$], we will have $E^T(Y,A) < 0$. Conversely, $E(D,P) < -1$ implies $E^T(Y,A) > 0$. Since the income effect of food aid, ψ , agrees in sign with $E^T(Y,A)$, we have the following result.

Result 2 Assuming $E^T(D,P) < (S/D)E(S,P)$ (see footnote 6), we have:

$$\psi < 0 \text{ if and only if } E(D,P) > -1.$$

This result is the crux of the paper. It directly contradicts the assumption made in previous studies that P.L. 480 imports lead to an expansion in income and demand that offsets the drop in price due to the supply effect. Result 2 shows that, if demand is less than unitary elastic, the income effect of food aid will lead to a contraction in demand and

⁶The total change in demand resulting from a change in price, $E^T(D,P)$, is made up of two components: $E(D,P)$ and $E(D,Y)E^T(Y,P)$. $E(D,P)$ reflects the change in demand due to a change in price, given a fixed Marshallian demand curve. $E(D,P)$ is negative under the assumption of downward sloping ordinary demand. $E(D,Y)E^T(Y,P)$, however, is positive, and reflects the outward shift in the Marshallian demand curve that occurs as the price of food rises. (An increase in the price of food causes incomes to rise both by increasing the value of the food aid received, and by increasing farmers' profits--see equation (3). Increased income then shifts the demand curve out as long as food is a normal good.)

Starting from an initial price-quantity pair on a Marshallian demand curve, we can trace out the locus of quantities demanded as price varies, taking into account both movements along the Marshallian demand curve [$E(D,P)$], and the shifting of the Marshallian demand curve [$E(D,Y)E^T(Y,P)$]. The assumption that $E^T(D,P) < 0$ is equivalent to the assumption that the resulting "total demand curve" is downward sloping. This condition can be viewed simply as a generalization of the Walrasian stability condition (see Henderson and Quandt 1980, pp. 160-61).

Of course, the condition that $E^T(D,P) < 0$ is sufficient but not necessary for the denominator of (7) to be positive. The necessary and sufficient condition is simply $E^T(D,P) < (S/D)E(S,P)$.

exacerbate the price depressing supply effect.

Most empirical estimates of demand elasticities for food in P.L. 480 recipient countries do in fact show that $0 > E(D,P) > -1$. Sullivan et al. (1989) report own-price demand elasticities for coarse grains, rice, corn and wheat in each of ten countries or regions that receive P.L. 480 aid.⁷ Of these forty cases, the absolute value of the demand elasticity exceeds one in only one instance (wheat in Indonesia). Result 2 thus shows that in most cases the income effect of food aid will be negative.

This result has an intuitive interpretation. Equation (2) captures two ways in which aggregate income depends on P.L. 480 imports: PA reflects the market value of the food aid received; and PS(P) reflects farm profits, which are affected by food aid imports through their impact on price. By equation (1), these two quantities sum to PD(P,Y), the total value of all food consumed. It is a well known fact that increasing the quantity supplied of some good increases the total value of all of the good consumed if and only if demand for that good is inelastic. Stating this principle in terms of P.L. 480 imports, increasing the quantity of food aid supplied increases the total value of all food in the economy if and only if demand is elastic.⁸ Thus, since aggregate income depends on the value of all food consumed, the income effect of food aid is positive or negative as demand is elastic or inelastic.

⁷Those countries and regions include Mexico, Central America, Latin America (excluding Brazil, Argentina and Venezuela), sub-Saharan Africa (excluding Nigeria), Egypt, India, other South Asia, Indonesia, Philippines, and South-East Asia (excluding Thailand and Malaysia).

⁸The same principle underlies the standard result that a monopolist "never produces on the inelastic portion of the demand curve", although in that case the argument is expressed conversely: when demand is inelastic, decreasing quantity increases total revenue.

Since previous authors have not explicitly defined or formally analyzed the income effects of food aid, it is difficult to specify exactly the grounds upon which they base the argument that an increase in P.L. 480 imports leads to an increase in domestic income. It appears, however, that the assumption of positive income effects has been based on the rough idea that, since food has a positive market value, giving people more of it must make them wealthier. This effect is captured in my model [by the term P in equation (4)]. If this were the only effect of food aid on income, then the income effect would indeed be positive. Previous authors failed to consider, however, two other ways in which P.L. 480 aid affects income: falling food prices due to food aid imports will (i) decrease the value of the food aid already received [captured in my model by the term $(dP/dA)A$ in equation (4)], and (ii) lead to a decline in farm profits [captured by the terms $(dP/dA)S(P) + P(\partial S/\partial P)(dP/dA)$ in equation (4)]. Taking these effects into account, result 2 shows that, as long as demand is inelastic, the income effect will be negative. The income effect of food aid will thus exacerbate the price depressing supply effect and, insofar as food prices represent producer incentives, will compound the disincentive effect first noted by Schultz.

3. Conclusion

This paper has shown that it is wrong to assume that the price-depressing supply effect of food aid will generally be offset by a demand-stimulating income effect. This point is important because making such an assumption could be dangerous: it could lead policy makers to conclude that Schultz's cautionary observation about the price and incentive depressing effects of P.L. 480 aid can be ignored. My results show that the disincentive

problem cannot be assumed away because of an income effect; on the contrary, income effects will generally compound the problem.

The analysis in this paper focuses specifically on the argument, found in Rogers et al., Bezuneh and Deaton, and Srivastava et al., that the income effect of food aid will offset the supply effect. To concentrate attention on that particular issue, I have abstracted from a number of related questions. These include the role of policy, and the effects of food aid outside of the agricultural sector. It is possible that the implementation of appropriate policies in conjunction with a food aid program could minimize the disincentive effect. Hall (1980), for instance, showed that the government of Brazil maintained producer incentives during a period of P.L. 480 imports by using the revenue raised through food aid sales to subsidize producers. Similarly, I have assumed that income in all sectors other than agriculture does not change in response to P.L. 480 receipts. This assumption, of course, may overlook important intersectoral linkages.

The fact that I have abstracted from possible policy interventions and from the role of intersectoral linkages should not suggest that I believe these issues are unimportant. On the contrary, I have tailored the analysis as a response to the argument that, even without policy interventions and without consideration of intersectoral interactions, we can assume that the price depressing effect of food aid will be reduced by an income effect. My purpose in demonstrating that this argument is false is to show that, if food aid programs are to be administered in ways that do not harm the agricultural sectors of the recipient countries, it is essential to search for an appropriate policy environment and to understand the various repercussions that the program will have throughout the economy. The assumption that an

income effect will automatically negate the tendency for P.L. 480 imports to depress food prices would suggest the opposite conclusion, that special care and attention need not be given to the design and implementation of food aid programs.

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