Food Aid and Food Security: A Cautionary Note

Daphne Taylor and Derek Byerlee

Economics Program, International Maize and Wheat Improvement Center (CIMMYT), 06600 Mexico D.F., Mexico.

Received 3 August 1990, accepted 5 March 1991

A simple model is presented to examine the effects of instability in global food aid supplies on foreign exchange expenditures and food availability in recipient countries. When global food prices rise, food aid recipients are doubly affected through decreased availability of food aid, and through higher costs of additional commercial imports needed to make up the shortfall. Empirical estimates of key parameters of the model suggest that countries with a high dependence on food aid may place their food security at risk.

Suit un modèle simple qui permet d'analyser les conséquences de l'instabilité des approvisionnements destinés à l'aide alimentaire sur les dépenses en devises étrangères et l'offre d'aliments dans les pays bénéficiaires. Lorsque le prix mondial des aliments augmente, les bénéficiaires de l'aide alimentaire subissent le contrecoup à la fois d'une aide alimentaire réduite et du coût plus élevé des produits importés pour répondre à la pénurie. Une estimation empirique des principaux paramètres du modèle suggère que les pays qui dépendent fortement de l'aide alimentaire compromettent leur sécurité alimentaire.

INTRODUCTION

With the slowdown of official development aid in recent years, especially from the United States, there has been a call for increased food aid as a way of augmenting development assistance, supporting structural adjustment programs and promoting food security (Singer 1989; Mellor 1988; Dearden and Ackroyd 1989; USAID 1988; USAID 1989). Although the importance of food aid has decreased for much of Asia and remains low in Latin America, food aid to sub-Saharan Africa has increased rapidly. From the early 1970s to the mid-1980s, the food aid reliance ratio — that is, the quantity of cereal food aid expressed as a percentage of the quantity of all cereal imports — increased from 17% to 42% in sub-Saharan Africa (Figure 1).[1]

This paper examines one dimension of the complex link between food aid and food security — specifically, the threat posed to food security at the national level by instability in global food aid supplies. There appears to be a strong negative relationship between cereal food aid supplies and market prices for grain (Figure 2).[2] When world wheat prices soared by 93% in 1973–74, wheat food aid shipments fell from 6 million to 3 million tonnes. Likewise in 1990, as world wheat prices rise, wheat food aid shipments are expected to decline to 6 million

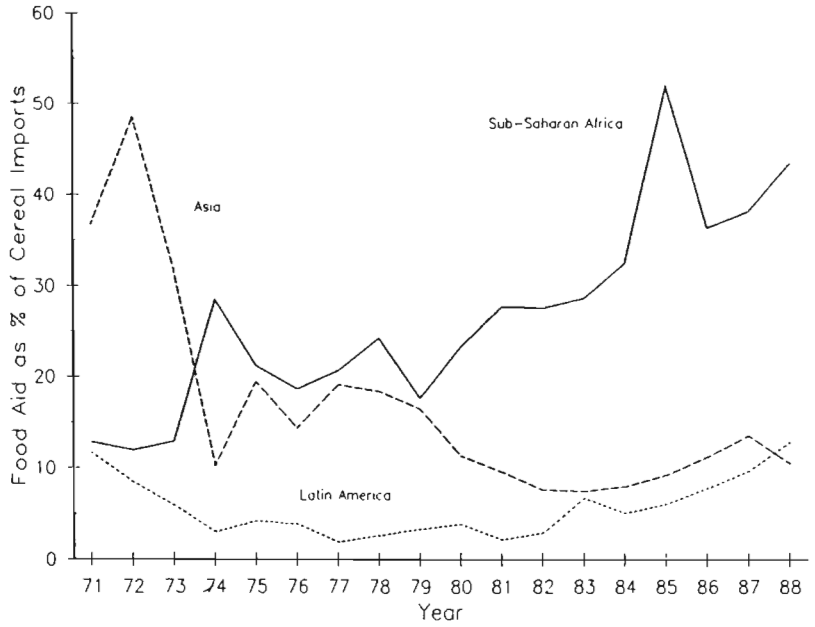

Figure 1. Cereal food aid as a percentage of cereal imports
Source: FAO.

tonnes (IWC 1989). Similar countercyclical swings in food aid are apparent throughout the 1980s.[3]

Despite efforts by the Food Aid Convention[4] to fix food aid requirements in quantity terms, the variability in global food aid quantities has been greater than the variability in the value of global food aid supplies (17% compared with 11%).[5] This would suggest that most donors (the European Community is the major exception) establish food aid targets in value terms, so any increase in grain prices leads to a corresponding decline in food aid quantities.

The inverse relationship between world market prices and food aid supplies has two important negative implications for food aid recipients. When world grain prices rise, not only does the cost of current commercial imports increase, but also the quantity of food aid decreases, requiring additional commercial imports (at higher prices) if food supplies are to be maintained. This particular aspect of food aid dependence has received little attention in recent food aid literature (von Braun and Huddleston 1988 is a notable exception).

In 1981, in an attempt to minimize the effects on developing countries of surges in cereal import bills on foreign exchange expenditures, the International Monetary Fund (IMF) extended its compensatory financing facility to include

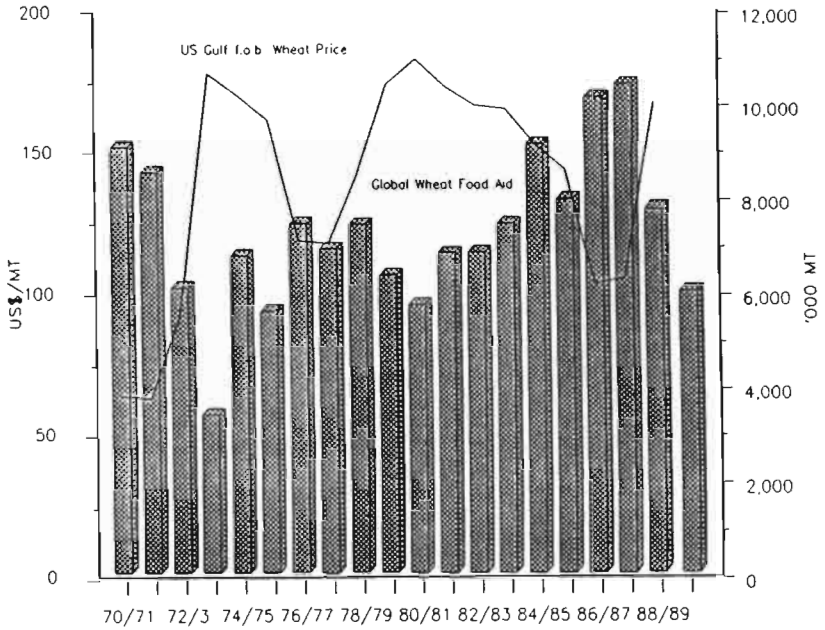

Figure 2. Global wheat food aid shipments and nominal wheat prices, 1970–90
Note: The U.S. Gulf FOB wheat price refers to No. 2 Hard Winter Wheat (IWC 1987). Global wheat food aid shipments were taken from FAO, *Food Aid in Figures*. The 1990 shipment is an estimate (IWC 1989).

fluctuations in the cost of cereal imports (IMF 1981). The facility was initially operative for four years and was extended for an additional four years in 1985. Although to date this facility has been only modestly used, and as such has not been fully tested, the analysis presented in this paper clearly suggests the continued need for such a food security mechanism.

Below we develop a simple country-level model to analyze the implications of instability in food aid supplies on foreign exchange expenditures and food supply availability. We then discuss empirical evidence on parameters of the model for wheat and draw out the implications of the model for food security.

THE MODEL

The model will be specified for two scenarios — with and without a foreign exchange constraint for food imports. In both cases, food aid is treated as a substitute for commercial imports; that is, it is assumed that food aid is "non-additional" to commercial imports and hence a balance of payment support. Since non-project, non-emergency food aid represents more than half the total volume

of cereal food aid supplied, it can be assumed that the bulk of food aid supplies is provided for balance of payment support purposes (FAO). This is also supported by various studies of the relationship between food aid and commercial imports (Maxwell and Singer 1979; Abbott 1979; Byerlee 1983).

For an individual country:

$$M = C + A \tag{1}$$

where

M = total food imports;
C = current commercial food imports; and
A = food aid supplies.

Scenario One: Without a Foreign Exchange Constraint

In the first scenario, foreign exchange outlays for food imports are not considered a constraint, so that:

$$F = P(M - A) \tag{2}$$

where

F = foreign exchange outlays for food imports,[6] and
P = price of imported food.

Differentiating Eq. 2 yields:

$$\frac{(\delta F)}{(\delta P)} = (M - A) + P\left(\frac{(\delta M)}{(\delta P)}\right) - P\left(\frac{(\delta A)}{(\delta P)}\right) \tag{3}$$

and

$$\epsilon_F = \left(\frac{(P \cdot \delta F)}{(F \cdot \delta P)}\right) = \frac{(P(M - A))}{F} + \frac{(P^2 \cdot \delta M)}{(F \cdot \delta P)} - \frac{(P^2 \cdot \delta A)}{(F \cdot \delta P)} \tag{4}$$

Substituting from Eq. 2 and simplifying produces:

$$\epsilon_F = 1 + \frac{(\epsilon_M - r\epsilon_A)}{(1 - r)} \tag{5}$$

where

ϵ_F = elasticity of a country's foreign exchange expenditures for food with respect to world food prices;
ϵ_M = elasticity of a country's total food imports with respect to world food prices;
ϵ_A = elasticity of a country's food aid supply with respect to world food prices; and
r = the food aid reliance ratio A/M.

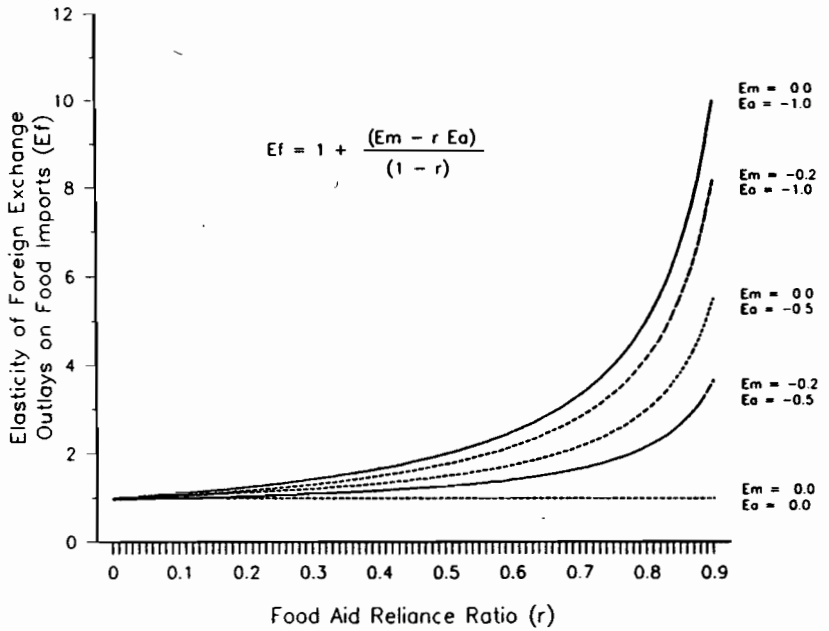

Figure 3. Elasticity of foreign exchange outlays under different assumptions for model parameters

Eq. 5 leads to the observation that the elasticity of foreign exchange outlays for food with respect to world food prices will be high if three conditions hold: total food imports are relatively inelastic with respect to world prices; the food aid reliance ratio is high; and food aid supplies are relatively elastic with respect to world prices.

For a non-recipient country ($r = 0$), Eq. 5 reduces to $\epsilon_F = 1 + \epsilon_M$. Since it is expected that $-1 < \epsilon_M < 0$, ϵ_F will be less than unity and thus inelastic with respect to world prices. On the other hand, for a food aid recipient country, where *a priori* expectations assume $\epsilon_M < 0$ and $\epsilon_A < 0$, a sufficient condition for ϵ_F to be greater than unity and thus elastic with respect to world prices is $|\epsilon_M| < |r\epsilon_A|$. Since the demand for basic food products is generally inelastic and because many governments attempt to insulate domestic consumers from short-run fluctuations in world prices, ϵ_M is often close to zero. In addition, it is likely that at least at the global level, ϵ_A is close to unity if food aid supplies are determined by a fixed budget constraint $\bar{K} = PA$.[7] Under these circumstance and with a high value of r, the value of ϵ_F is quite high (two or more under plausible assumptions). Figure 3 shows this relationship for various combinations of ϵ_M, ϵ_A and r.

Furthermore, for two countries with the same ϵ_M, one a food aid recipient and the other a non-recipient, ϵ_F will be more elastic for the food aid recipient, provided that $|\epsilon_M| < |\epsilon_A|$. Since it is already noted that ϵ_A is likely to be close to unity and ϵ_M close to zero, this condition is likely to hold.

The analysis suggests that changes in world food prices could cause food aid recipients to experience sharp fluctuations in the demand for foreign exchange needed to finance commercial food imports. This effect is magnified for countries that have high food aid reliance ratios.

Scenario Two: With a Foreign Exchange Constraint

A second scenario is to treat individual countries' foreign exchange allocations to commercial food imports as fixed at $\bar{F}$ and to examine the impact of an increase in world prices on food imports.

In the absence of food aid and under the assumption of a fixed foreign exchange allocation to finance commercial food imports, the elasticity of food imports with respect to world prices is unity, $\epsilon_M = -1$.[8] With food aid supplying part of food imports ($r > 0$), ϵ_M can be calculated using Eq. 5 and replacing ϵ_F with zero:

$$0 = 1 + \frac{(\epsilon_M - r\epsilon_A)}{(1 - r)} \tag{6}$$

Rearranging:

$$\epsilon_M = -1 + r(\epsilon_A + 1) \tag{7}$$

This equation merely confirms intuition: when ϵ_A is close to unity, countries that receive food aid and allocate fixed foreign exchange budgets to food imports enjoy no special advantage in food security over countries that depend entirely on commercial imports.

However, for countries that receive a disproportionate share of any cut in food aid such that ϵ_A is greater than unity, total food imports in the food aid recipient country are more influenced by changes in world prices than in countries that do not receive food aid.

Whether it is appropriate to assume flexible or fixed foreign exchange outlays depends on the country under study. However, many countries appear to follow a "food first" strategy in allocating foreign exchange, and hence Scenario One may be a better representation of the effects. However, implicit in this scenario is that costs of additional food imports are reflected in a cut in non-food imports or in a widening balance of payments deficit. These effects are likely to have broader macroeconomic implications for economic growth and exchange rate stability.

EMPIRICAL EVIDENCE ON PARAMETERS FOR THE MODEL

Whichever of the two scenarios is assumed, there are two critical parameters for the model. These are the food aid reliance ratio, r, and the elasticity of food aid supplies with respect to world prices, ϵ_A. In Scenario One, where there is no foreign exchange constraint, a third important parameter is the elasticity of food imports with respect to world prices, ϵ_M. Since wheat accounts for approximately 80% of all cereal food aid supplies, the following sections will outline plausible ranges for these parameters in the case of wheat. For illustrative purposes, the elasticity of foreign exchange expenditures for wheat with respect to world wheat prices are calculated for a selected group of food aid recipient countries. Caution, however, should be used when examining these estimates because the model does not explicitly account for substitution between cereals.

Wheat Food Aid Reliance Ratios

Table 1 presents food aid reliance ratios for wheat (wheat food aid as a proportion of total wheat imports) for 52 recipient countries. For the 1980–88 period, the average reliance ratio is above 0.70 for 15 countries, and between 0.31 and 0.70 for a further 19 countries. Of these 34 countries that are highly reliant on food aid for their wheat imports, 20 are located in sub-Saharan Africa. In some of these countries, food aid is given primarily for emergency relief, but for most, food aid is provided as part of the development assistance program and balance of payment support.

Estimates of Wheat Food Aid Supply Elasticities

For an individual country, the elasticity of food aid receipts with respect to world prices can be estimated from the elasticity of global food aid supplies with respect to world prices and the extent to which the allocation of food aid for that country changes with changing global supplies of food aid.

The elasticity of global wheat food aid supplies with respect to nominal wheat prices is estimated to be -0.5 for the period from 1970 to 1988, while the elasticity for U.S. wheat food aid supplies (60% of global food aid) is -0.8.[9] From a recent USDA study (Shapouri and Missiaen 1990), a price elasticity of -0.6 for U.S. total food aid supply (wheat, rice and maize) is estimated. Similar estimates are provided by other authors (Singer and Diab n.d.; Konandreas 1985).

The critical question is whether these aggregate estimates of ϵ_A at the global level (-0.5 and -0.8) can be taken as plausible ranges of ϵ_A for individual recipient countries.[10] The global ϵ_A value may not be a good proxy for individual country ϵ_A values if food allocations to individual countries are highly influenced by political factors, so that some countries usually receive a fixed quantity of food aid, while others experience high variability in food aid receipts. To determine whether the aggregate estimates of ϵ_A can be taken as plausible ranges of

Table 1. Average wheat food aid reliance ratios for individual countries, 1980–88

Wheat food aid reliance ratios					
$0.10 \leq r \leq 0.30$		$0.31 \leq r \leq 0.70$		$0.71 \leq r \leq 1.00$	
Togo	0.10	Egypt	0.31	Nepal	0.71
Jordan	0.11	Ghana	0.33	Nicaragua	0.72
Indonesia	0.12	Lesotho	0.35	Bangladesh	0.78
Philippines	0.12	Niger	0.35	Tanzania	0.81
Peru	0.13	Guatemala	0.38	Madagascar	0.81
Syria	0.13	Malawi	0.42	Uganda	0.84
Burkina Faso	0.15	Jamaica	0.44	Pakistan	0.89
Vietnam	0.16	Zaire	0.47	Honduras	0.91
Angola	0.18	Burundi	0.49	Mozambique	0.92
Morocco	0.19	Sierra Leone	0.49	Somalia	0.93
Mauritius	0.19	Haiti	0.49	El Salvador	0.94
Tunisia	0.23	Sri Lanka	0.51	Sudan	0.98
Guinea	0.24	Zimbabwe	0.51	Kenya	1.03
Senegal	0.26	Bolivia	0.56	Ethiopia	1.19
Mali	0.28	Zambia	0.56	Afghanistan	3.89
Bhutan	0.29	Rwanda	0.67		
Paraguay	0.30	Costa Rica	0.67		
Dominican Republic	0.30	Chad	0.68		
		Mauritania	0.68		

Note: The wheat food aid reliance ratio is the ratio of wheat food aid to total wheat imports, calculated from FAO data. Wheat-importing developing countries whose populations are less than one million are not included. A food aid reliance ratio greater than 1.00 indicates data problems. In such cases, it may be assumed that wheat food aid shipments are not included in the wheat import statistics for some years.

ϵ_A for individual recipient countries, correlation coefficients are calculated between global and recipient wheat food aid supplies for the period 1970 to 1988 and for 52 countries listed in Table 1.

A high positive correlation coefficient between wheat food aid supply in the recipient country and global wheat food aid supply would suggest that the elasticity of wheat food aid supply in those recipient countries is similar to the elasticity of global wheat food aid supply with respect to world prices. For these countries, a plausible range on ϵ_A would be between -0.5 and -0.8. Table 2 shows the distribution of country-level correlation coefficients, classified according to food aid reliance ratios. Of the 52 countries, 21 have correlation coefficients that are greater than 0.5; of these, 15 have high wheat food aid reliance ratios.

Estimates of Wheat Import Demand Elasticities

Where foreign exchange outlays to finance commercial food imports are not constrained, an additional parameter of interest is the elasticity of food imports

Table 2. Distribution of countries by food aid reliance ratios and correlation between country food aid supply and global food aid supply (number of countries)

Correlation coefficient	Food aid reliance ratio			
	$0.10 \leq r \leq 0.30$	$0.31 \leq r \leq 0.70$	$0.71 \leq r \leq 1.00$	Total
$-1.00 \leq \rho \leq -0.50$	3	0	1	4
$-0.49 \leq \rho \leq 0.49$	9	11	7	27
$0.50 \leq \rho \leq 1.00$	6	8	7	21
Total	18	19	15	52

Note: The correlation coefficient refers to the level of correlation between wheat food aid supply in the recipient country and global wheat food aid supply for the period from 1970 to 1988.

with respect to world prices, ϵ_M. Above we suggest that ϵ_M is low in many developing countries, since the demand for basic food products is generally inelastic, and because most developing countries protect domestic consumers from short-run fluctuations in world prices. Several studies report elasticities for developing-country wheat imports with respect to world prices in the range of -0.1 to -0.2 (Abbott 1979; Jabara 1982; Gekos 1986). For purposes of this analysis, ϵ_M is assumed to be -0.15.

Estimates of the Model for Wheat in Selected Countries

Using the values discussed for the parameters ϵ_M and ϵ_A, the model is used to estimate ϵ_F for 14 countries, where wheat food aid reliance ratios, r, are high (greater than 0.3) and where wheat food aid receipts are found to be highly correlated with global food aid supplies (greater than 0.5).[11] Table 3 presents estimates for ϵ_F calculated using Eq. 5 (using wheat as a proxy for food).

In Table 3, assuming an import demand elasticity ϵ_M for wheat with respect to world prices of -0.15, ϵ_F is elastic for the complete range of reliance ratios. These high values for ϵ_F under a plausible range of parameter values demonstrate that food aid recipient countries may face large and magnified fluctuations in the demand for foreign exchange as a result of instability in world grain prices. One implication of a high ϵ_F is the large negative impact it may have on non-food imports, which in turn may have detrimental and destabilizing implications for economic growth (Scobie 1981).

Sudan is an extreme example of a country whose demands for foreign exchange and supplies of food are particularly vulnerable to fluctuations in world grain prices, owing to instability in food aid supplies. With a high reliance on food aid, Sudan would experience an enormous increase in demand for foreign exchange in the event of a rise in world prices (i.e., $\epsilon_F > 18$). If in the likely

Table 3. Estimated elasticities of foreign exchange outlays for wheat in selected countries assuming no foreign exchange constraint

Selected countries	Reliance ratio	Correlation coefficient	ϵ_F assuming $\epsilon_A = -0.5$	ϵ_F assuming $\epsilon_A = -0.8$
Egypt	0.31	0.6	1.01	1.14
Guatemala	0.38	0.7	1.06	1.25
Jamaica	0.44	0.8	1.13	1.36
Haiti	0.49	0.6	1.19	1.47
Sierra Leone	0.49	0.6	1.19	1.47
Zimbabwe	0.51	0.6	1.21	1.53
Bolivia	0.56	0.5	1.30	1.68
Costa Rica	0.67	0.5	1.56	2.17
Bangladesh	0.78	0.8	2.09	3.15
Madagascar	0.81	0.8	2.34	3.62
Honduras	0.91	0.7	4.39	7.42
Mozambique	0.92	0.5	4.88	8.33
El Salvador	0.94	0.6	6.33	11.03
Sudan	0.98	0.8	18.00	32.70

Notes: ϵ_F is the elasticity of a country's foreign exchange expenditures for wheat with respect to world wheat prices using the formula $\epsilon_F = 1 + (\epsilon_M - r\epsilon_A)/(1 - r)$. ϵ_M is the elasticity of a country's total wheat imports with respect to world wheat prices and is assumed to be -0.15 across all selected countries. ϵ_A is the elasticity of a country's wheat food aid supply with respect to world wheat prices. The reliance ratio refers to the ratio of wheat food aid to total wheat imports. The correlation coefficient refers to the level of correlation between wheat food aid supply in the recipient country and global wheat food aid supply for the period from 1970 to 1988.

case Sudan cannot afford the required foreign exchange to finance commercial imports, the consequence is a sharp decline in total food imports. In 1988–89, wheat food aid to Sudan did indeed decline dramatically, as did total imports of wheat (Maxwell 1989).

CONCLUSION

This paper explores the effect of instability in global food aid supplies on foreign exchange expenditures and food supply availabilities in recipient countries. Instability in food aid supplies arises from the fact that food aid shipments tend to be fixed in value terms and hence fall when world grain prices increase. A simple model is developed in which food aid supplies are endogenous in order to derive the elasticity of foreign exchange expenditures for food imports and the elasticity for food imports with respect to world prices in food aid recipient countries. For countries in which foreign exchange expenditures for food imports are not constrained, the elasticity of foreign exchange expenditures for food imports has been

shown to be a function of three parameters: the elasticity of total food imports with respect to world prices; the elasticity of food aid receipts with respect to world prices; and the food aid reliance ratio or the proportion of food aid to total food imports.

Using likely values for these parameters, it is shown that the elasticity of foreign exchange outlays for food imports with respect to changes in world prices is higher in food aid recipient countries than in countries that do not receive food aid. This is because when world food prices rise, not only do expenditures on commercial food imports increase but also the share of commercial imports in total food imports increases because of a corresponding contraction in food aid supplies. Under quite plausible assumptions, a 1% increase in world cereal prices may lead to more than a doubling in demand for foreign exchange for food imports in food aid recipient countries. Even in countries that allocate a fixed amount of foreign exchange for food imports, food supplies are likely to be no more stable in food aid recipient countries than in countries that do not depend on food aid.

The instability of food aid shipments pose a considerable threat to the food security of highly reliant food aid recipient countries. The international community has recognized this threat and has attempted to lessen the risks faced by those countries through the efforts of the Food Aid Convention and the IMF's compensatory financing facility. Unfortunately, the Food Aid Convention has had limited success in stabilizing need-based food aids levels and use of the IMF's compensatory financing facility has been limited. The elasticities of foreign exchange expenditures for food imports with respect to world prices estimated in this paper clearly suggest the continued need for and perhaps strengthening of such food security mechanisms. In conclusion, these results underline the need for greater stability in food aid availabilities as well as greater recognition of the potential risk faced by developing countries when food aid availabilities fluctuate counter cyclically to world market prices.

NOTES

[1]Most food aid is given in the form of cereals. The term "food aid" and "cereal food aid" are used interchangeably in this paper.

[2]This relationship is illustrated for wheat, which is approximately 80% of all cereal food aid.

[3]When minimum commitments under the Food Aid Convention (see note 4) are subtracted from total cereal food aid supplies, these countercyclical swings are even more apparent. On the other hand, when emergency aid is subtracted from total cereal food aid for the late 1980s, the countercyclical swings are slightly reduced. This would suggest that the increase in food aid supplies in the late 1980s was a result of both increasing emergency assistance and declining prices.

[4]The Food Aid Convention (FAC) is a multilateral agreement among developed countries to contribute a minimum annual level of food aid supplies. Under the 1986 Convention, this commitment amounts to 7.6 million tonnes.

[5]Coefficients of variation for total value and quantity of food aid shipments (cereal and non-cereal shipments) are calculated around linear time trends. Data are taken from the FAO publication *Food Aid in Figures*.

[6]It is assumed that food aid imports are received on a grant basis and do not represent a foreign exchange cost in the recipient country. In countries where the share of food aid in total imports is high, this is usually the case (von Braun and Huddleston 1988).

[7]This formulation assumes that the budget for food aid is determined by world prices, P, rather than the price at which the food aid is purchased. Since nearly all food aid is provided by grain-exporting countries, world prices rather than domestic prices are a better measure of the opportunity cost of providing food aid. Also, although ϵ_4 may be close to unity at the global level, we recognize that for individual countries ϵ_4 may vary substantially, depending on changes in the share of food aid going to individual countries with respect to changes in world prices. This is discussed later in the paper.

[8]Implicit in this scenario is the assumption that some type of rationing system is used to clear the domestic food market whenever production plus imports fail to satisfy effective demand.

[9]These point elasticities are calculated from linear equations of global and U.S. wheat food aid supplies regressed on nominal world wheat prices for the period from 1970 to 1989. In the U.S. equation, $R^2 = 0.58$. In the global equation, $R^2 = 0.36$.

[10]Very few food aid recipient countries are completely dependent on U.S. food aid; similarly, very few are completely independent of U.S. food aid. Thus this range of parameter seems more appropriate than separating U.S. from non-U.S. food aid supplies.

[11]Ethiopia is excluded from this sample because its reliance ratio exceeds one, indicating data problems.

ACKNOWLEDGMENT

The authors would like to thank Simon Maxwell, Michael Morris, Truman Phillips, Hans Singer and Joachim von Braun for their helpful comments. The views expressed in this paper are not necessarily those of CIMMYT.

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