



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

The Relationship between Food Aid and Food Trade: Theoretical Analysis and Quantitative Results

*Roland Herrmann, Carlo Prinz, and Patricia Schenck*¹

Abstract: This paper clarifies linkages between food aid and food trade, both theoretically and empirically. A theoretical model first shows that domestic policy is crucial for the trade effects of food aid. Food trade may fall, remain constant, or even rise due to increased food aid. The important issue is whether the recipient country's government spends the counterpart funds to subsidize demand or supply. Estimated cereal import demand functions for Botswana, Egypt, Morocco, Peru, and Sudan indicate very different reactions of food imports to food aid across countries. The paper also investigates from the donor's point of view how a country's food import position affects the amount of food aid it receives. A cross-country analysis of the allocations of the EC's food aid reveals that per-capita food aid is higher the lower the per-capita income of a recipient country, the worse its balance-of-payments situation, and the more it depends on food imports.

Introduction

Although there is an extensive economic literature on the pros and cons of food aid (Dearden and Ackroyd, 1989; Srinivasan, 1989; Lachmann, 1988; Clay and Singer, 1985; and Isenman and Singer, 1977), analytical and quantitative studies on many aspects of food aid are lacking. This holds true, for example, for the relationship between food aid and food trade. This paper aims to elaborate important linkages between food aid and food trade, both theoretically and quantitatively. Two questions are examined: how the food trade of recipient countries responds to food aid and whether the distribution of food aid by donors is responsive to the food-deficit situation of potential recipients, and, if so, to what extent.

Impact of Food Aid on Food Trade

Theoretical Analysis

If the answer to the question, "Does food aid lead to less food imports and, thus, contribute to a solution of balance-of-payments problems in developing countries?" is yes, the next question is, "To what extent does food aid reduce food imports?" In order to tackle these questions, a stylized model of the market for a food staple in a developing country is used. The analysis is comparative statics and hence concentrates on the direct and short-run rather than on the indirect and long-run effects of food aid on food trade.

Despite the stylized nature of the model, it contains a structure sufficient to draw some important theoretical conclusions on the impact of food aid on food trade. In particular, it incorporates one essential feature of food aid policy—the use of counterpart funds in the recipient countries. Counterpart funds arise when food aid is given in the form of bulk supply. In quantitative terms, bulk supply is the dominant type of food aid, whereas emergency food aid, project aid, and triangular transactions are less important (FAO (a)). Under bulk supply, food deliveries flow to the recipient country and are sold by the government through the normal marketing channels. Counterpart funds are equal to the quantity sold multiplied by the domestic market price. The government may use the counterpart funds in either the food or the non-food sectors of the economy. It can be shown that the trade impact of food aid depends crucially on the use of these counterpart funds. This implies that domestic policy in the recipient country is important for the trade effect of food aid.

The argument can be shown within a theoretical model. The benchmark situation without food aid is characterized by the following equations:

$$(1) S^{PR} = a + bp$$

$$(2) S^{GO} = 0$$

$$(3) D^{PR} = c + dp$$

$$(4) p = e + fp_w$$

$$(5) p_w = \bar{p}_w$$

$$(6) S = S^{PR} + S^{GO} + M$$

$$(7) S = D^{PR}$$

Food supply (S) in this country is composed of private supply (S^{PR}), supply by the government (S^{GO}), and imports (M). Supply by the government is zero in the non-food-aid case. Food demand in the country consists only of private demand (D^{PR}). As Equations (1) and (3) show, private food supply and private food demand are a function of the price on the domestic market (p). The domestic food price is a function of the world food price (p_w). Equation (4) characterizes a price transmission equation often used in agricultural policy analysis. Differences between the domestic and the world price may be due to transport costs and national food price policies. Equation (5) describes the small-country case; changes in quantities traded by the respective country do not alter the world price. a , b , c , d , e , and f are coefficients of the model. The theoretical expectations on the signs are: $a > 0$, $b > 0$, $c > 0$, $d < 0$, $e > 0$, and $f > 0$.

Food imports are included in Equation (6), which can be rewritten after including (7) as:

$$(8) M = D^{PR} - S^{PR} - S^{GO}$$

After introducing (1), (2), and (3) into (8), food imports in the non-food-aid situation can be written as:

$$(9) M_0 = c + dp - a - bp$$

Equations (4) to (8) remain valid in the model for the food-aid situation. Equations (1)–(3), however, are replaced by:

$$(1') S^{PR} = a + bp + h(\beta p \bar{F}\bar{A})$$

$$(2') S^{GO} = \bar{F}\bar{A}$$

$$(3') D^{PR} = c + dp + g(\alpha p \bar{F}\bar{A})$$

Equation (2') indicates that an exogenously given amount of food aid ($\bar{F}\bar{A}$) will be sold by the government on the domestic market. This yields counterpart funds in the magnitude of ($p\bar{F}\bar{A}$). Counterpart funds will now be used partly to stimulate food demand and partly to stimulate food supply. We posit in Equation (3') that a share of these counterpart funds is given to the population that demands food, whereby $0 \leq \alpha \leq 1$. Basically, this leads to an income effect. The coefficient g (> 0) indicates how food demand increases when income rises by one monetary unit. In Equation (1'), it is assumed that a certain share of the counterpart funds is used for stimulating technical progress in domestic food production. β ranges between 0 and 1. The additional assumption $(\alpha + \beta) \leq 1$ guarantees that counterpart funds can also be partly spent in the non-food sector. h indicates the responsiveness of domestic food production to an additional monetary unit spent on technical change in agriculture. The theoretical expectation is that $h > 0$.

In the system of Equations (1')–(3') and (4)–(8), food imports can be derived as:

$$(10) M^* = c + dp + g(\alpha p \bar{F}\bar{A}) - a - bp - h(\beta p \bar{F}\bar{A}) - \bar{F}\bar{A}$$

A comparison of (9) and (10) yields the impact of food aid on food imports:

$$(11) \Delta M = M^* - M = g(\alpha p \bar{F}\bar{A}) - h(\beta p \bar{F}\bar{A}) - \bar{F}\bar{A} > \text{ or } \leq 0$$

Equation (11) shows the very general result that food imports may be lowered or raised by food aid when the use of counterpart funds in the food sector is captured by the model. A one-to-one substitution of food imports by food aid ($\Delta M = -\bar{F}\bar{A}$) is a special case when counterpart funds are not spent in the food market ($\alpha=0, \beta=0$). When counterpart funds are only used for stimulating food production ($\beta>0, \alpha=0$) (e.g., by fostering technical change in agriculture or by subsidizing inputs), an additional amount of food imports will be replaced by domestic production. In that case, increasing food aid by one ton leads to decreasing imports by more than one ton. The economic explanation is straightforward: food imports are directly substituted by food aid. The use of counterpart funds for shifting domestic production to the right will further reduce food imports. When counterpart funds are only used to subsidize demand ($\alpha>0, \beta=0$) (e.g., by transferring income to the poor), additional food imports will occur. In that case, an increase in food aid of one ton will lower food imports by less than one ton. Food imports may even rise when the shift in the food demand curve due to food subsidization overcompensates for the increased availability of food as a consequence of food aid. When counterpart funds are used to subsidize demand and supply ($\alpha>0, \beta>0$), the direction and size of the impact of food aid on food imports depend upon the relative shifts of the demand and supply curves. It can be derived that food aid is more likely to lead to a substitution of food imports:² the lower the share of counterpart funds used to subsidize demand, the lower will be α ; the weaker the response of the population to increasing incentives for food demand, the lower will be g ; the higher the share of counterpart funds used to subsidize supply, the higher will be β ; and the stronger the response of food producers to increasing incentives for food production, the higher will be h .

When the supply shift is larger than the demand shift, food aid will lead to a stronger substitution of food imports: the higher the amount of food aid, the larger will be $\bar{F}\bar{A}$; and the higher will be the domestic price of food.

Empirical Results on the Impact of Food Aid on Food Trade

Import demand functions are estimated for five LDCs that receive significant amounts of food aid: Botswana, Egypt, Peru, Sudan, and Morocco. The objective is to quantify the actual impact of food aid on food imports. The computations refer either to cereals or wheat, as cereals are the main food aid products with regard to delivered quantities (FAO (a)). The estimations are based on the same theoretical import demand model. The hypothesis is that net cereal imports (M) depend upon the national import price of cereals (p_w), a domestic income variable (Y) measured by GDP data, domestic cereal production (PR), and cereal food aid (FA):

$$(12) M = f(p_w, Y, PR, FA)$$

Table 1 shows the empirical results on the food aid-food trade linkage in the five countries. Coefficients of linear models, which are in line with the theoretical framework shown above, are presented, as well as those of log-linear models.

From Table 1, it can be derived that the impact of food aid on food imports follows no uniform pattern across the countries. For Peru and Botswana, the estimated coefficients indicate that commercial imports are substituted by food aid. This effect is commonly expected. The strongest degree of substitution exists in Botswana: increasing food aid deliveries by one ton causes a decline in commercial imports of nearly two tons. The empirical results

show for Egypt, Sudan, and Morocco, however, a positive impact of food aid on food imports. In the case of the linear models, the positive coefficients are statistically significant at the 95-percent level for all three countries. A rise of 1 kg in food aid per capita leads to an increase in imports per capita of 0.47–1.03 kg. The estimated coefficients of > -1 lend support to the hypothesis that counterpart funds are primarily used to subsidize food demand in developing countries. Only in Botswana, where a more than one-to-one substitution between food aid and food trade was measured, are counterpart funds likely to be used for production subsidies. The regression coefficients of the log-linear models again suggest that a positive impact of food aid on food trade occurs in several countries.

Table 1—Estimated Reactions of New Cereal Imports to Variations in Cereal Food Aid, Selected Developing Countries, 1971–87^a

Country	Linear Models (1)	Log-Linear Models (2)
Botswana	-1.9854* FA_{t-1} (-2.40)	0.2087 FA_{t-1} (1.37)
Egypt	1.0343* FA/C_t (2.39)	0.3820** FA/C_t (3.83)
Morocco ^b	0.9651* FA/C_t (2.35)	0.0749 FA/C_t (1.24)
Peru	-0.8631* FA/C_t (-2.28)	-0.0609* FA/C_t (-2.24)
Sudan ^b	0.04697* FA/C_t (2.85)	0.2662** FA_t (4.46)

^aThe levels of statistical significance of the estimated coefficients are indicated by * for 95 percent and ** for 99 percent. The values in parentheses are *t*-values. In most cases, the food aid variable was measured in per-capita values (FA/C). The indices *t* and *t-1* are the two periods considered.

^bReferring to wheat food aid.

Sources: Authors' computations with data from FAO (1987), FAO (a), FAO (b), FAO (c), FAO (d), International Monetary Fund, and World Bank.

The Influence of Food Import Dependence on the International Allocation of Food Aid: A Quantitative Analysis of EC Food Aid Policy

So far, food aid has been treated as an exogenous variable from the individual recipient country's point of view. We now analyse how the country's food imports are affected by changes in food aid. In the following analysis, food aid is treated as an endogenous variable on which the donor country decides according to certain criteria. Determinants of the international allocation of food aid are then elaborated for EC food aid policy. EC food aid consists of bilateral member and Community action in which the latter's share is roughly 60 percent (FAO (a), 1989). As well as officially declared criteria for the distribution of food aid, we test whether food import dependence affects the amount of EC food aid a country receives. The officially postulated criteria for EC food aid are: fundamental food requirements, per-capita income, the balance-of-payments situation (European Communities, 1982), and the economic and social effects, as well as the cost of the proposed measure (European Communities, 1986).

As this paper covers the 1983–85 period and the last criterion was added by the EC Commission in 1986, the cross-country analysis that follows concentrates on the first three criteria. Computations using the variable "fundamental food requirements"—measured by the

daily per-capita calorie supply as a percentage of the daily calorie requirements—resulted in no statistically significant coefficients. This variable was therefore dropped from later regressions. Two additional variables are included that capture the recipient country's dependence on food imports.

The following alternative equations are estimated:

$$(13) FA_i = f(GNP_i, CAB_i, CIMP_i)$$

$$(14) FA_i = f(GNP_i, CAB_i, SSR_i)$$

FA is the amount of EC cereal food aid per capita committed to the recipient country *i*. *GNP* is the gross national product per capita and is used as a measure of per-capita income in the recipient country *i*. *CAB* represents the current-account balance and captures the balance-of-payments situation in country *i*. *CIMP* stands for cereal imports per capita in country *i*. *SSR* is the self-sufficiency ratio for cereals in country *i* and is computed as domestic cereal production divided by the sum of domestic cereal production and cereal imports. In general, the independent variables are lagged 2 years, because, it is argued, the allocation decision of the EC bureaucracy is likely to be based on the most recent data set available. Comparisons with cross-country data included in the World Bank's *World Development Report* show a time-lag for the relevant data of 2–3 years.

The empirical results are presented in Table 2. They confirm the importance of the postulated allocation criteria, *GNP* and *CAB*. There is a negative influence of per-capita income and the balance-of-payments situation on the amount of food aid a country receives. This influence is significant at least at the 95-percent level in all model specifications. The estimated reaction to a \$100 change in *GNP* is 400–900 g of food aid per capita. A deterioration of the current-account balance by \$10 per capita raises the deliveries of EC food aid 300–900 g per capita.

Besides the strong impacts of *GNP* and *CAB*, the donations of food aid to a country are significantly negatively related to the country's self-sufficiency ratio in all equations and significantly positively influenced by cereal imports in all equations except in that for 1984. The regression coefficient indicates that an increase of one percentage point in the self-sufficiency ratio leads to a reduction in EC food aid of 75–100 g per capita. On the other hand, each additional kg of cereal imports per capita increases food aid by roughly 30 g per capita. The corrected coefficients of determination of the models are rather high: 50–82 percent of the variance in EC food aid shipments can be explained in all periods under consideration. These values of R^2 are noteworthy, given a cross-country analysis.

Summary and Conclusion

The linkages between food aid and food trade play a central role in the economics of food aid. It was the objective of this paper to study these linkages theoretically and in a quantitative analysis. The theoretical analysis revealed that domestic policy is crucial for the trade effects of food aid. Food trade may fall, remain constant, or even rise due to increased food aid. The important issue is whether the recipient country's government spends the counterpart funds on subsidizing demand or supply. Estimated cereal import demand functions for Botswana, Egypt, Morocco, Peru, and Sudan indicated very different reactions of food imports to changes in food aid. Positive as well as negative linkages were found. From a donor's point of view, the allocation of food aid is not exogenous, as it is for the recipient country, but depends on certain decision criteria. EC food aid in cereals was shown to depend heavily on two officially postulated allocation criteria, the income and the balance-of-payments situation. Moreover, the larger the amount of food aid a country receives from the EC, the more the country depends on food imports.

Table 2—Determinants of the International Allocation of the EC's Food Aid, 1983–85^a

Dependent Variables	Independent Variables					Test Statistics	
	<i>CONST</i>	<i>GNP</i> _{<i>t</i>-2}	<i>CAB</i> _{<i>t</i>-2}	<i>CIMP</i> _{<i>t</i>-2}	<i>SSR</i> _{<i>t</i>-2}	<i>F</i>	\bar{R}^2
<i>FA 1983</i>	1.6000 (2.86)*	-0.0077 (-4.63)**	-0.0601 (-4.14)**	0.0258 (3.62)**		10.98	0.70
	9.4650 (6.69)**	-0.0072 (-5.80)**	-0.0451 (-3.92)**		-0.0833 (-5.47)**	21.36	0.82
<i>FA 1984</i>	3.0214 (2.94)**	-0.0090 (-3.59)**	-0.0803 (-4.08)**	0.0270 (1.59)		9.74	0.51
	12.1805 (4.07)**	-0.0080 (-3.69)**	-0.0645 (-3.52)**		-0.1016 (-3.10)**	14.69	0.62
<i>FA 1985</i>	2.1020 (2.89)**	-0.0055 (3.86)**	-0.0350 (-2.33)*	0.0358 (3.47)**		9.19	0.54
	8.9939 (4.05)**	-0.0047 (-3.23)**	-0.0340 (-2.13)*		-0.0751 (-3.09)**	7.94	0.50
<i>FA 1983–85</i>	2.3334 (4.51)**	-0.0071 (-6.10)**	-0.0575 (-5.46)**	0.0300 (3.94)**		22.07	0.51
	10.0752 (6.50)**	-0.0065 (-6.01)**	-0.0487 (-4.69)**		-0.0842 (-5.00)**	27.43	0.57

^a*FA* = food aid; *CONST* = constant term; *GNP* = gross national product; *CAB* = current account balance; *CIMP* = cereal imports; *SSR* = self-sufficiency ratio; \bar{R}^2 = corrected coefficient of determination; and *F* = *F*-value. The levels of statistical significance of the estimated coefficients are indicated by * for 95 percent and ** for 99 percent. The values in parentheses are *t*-values. 14 countries are considered for 1983 and 26 and 22 for 1984 and 1985, respectively. The pooled-sample regression considered 62 observations.

Sources: Authors' computations using FAO (b), FAO (c), FAO (d), World Bank, and Commission of the European Communities (1986), pp. 10–11.

Notes

¹Universität Giessen.

²The following results can be derived by differentiating Equation (11) with regard to its determinants: $\delta(\Delta M)/\delta\alpha = gpFA > 0$; $\delta(\Delta M)/\delta g = \alpha pFA > 0$; $\delta(\Delta M)/\delta\beta = -(hpFA) < 0$; $\delta(\Delta M)/\delta h = -(\beta pFA) < 0$; $\delta(\Delta M)/\delta FA = (g\alpha - h\beta)p - 1 < \text{or } \geq 0$; $\delta(\Delta M)/\delta p = g\alpha - h\beta > \text{or } \leq 0$.

References

- Clay, E.J., and Singer, H.W., "Food Aid and Development: Issues and Evidence," World Food Programme, Occasional Paper No. 3, Rome, Italy, 1985.
- Commission of the European Communities, "Nahrungsmittelhilfe der Europäischen Gemeinschaft," *Grünes Europa*, No. 216, 1986.
- Dearden, P.J., and Ackroyd, P.J., "Reassessing the Role of Food Aid," *Food Policy*, Vol. 14, No. 3, 1989, pp. 218–231.
- European Communities, "Verordnung (EWG) Nr. 3331/82 des Rates vom 3 December 1982, über die Nahrungsmittelhilfepolitik und -verwaltung und zur Änderung der Verordnung (EWG) Nr. 2750/75," *Amtsblatt der Europäischen Gemeinschaften*, No. L352, 1982, pp. 1–4.
- European Communities, "Verordnung (EWG) Nr. 3973/86 des Rates vom 22 December 1986, über die Nahrungsmittelhilfepolitik und -verwaltung," *Amtsblatt der Europäischen Gemeinschaften*, No. L370, 1986, pp. 1–4.
- FAO (Food and Agriculture Organization), *World Crop and Livestock Statistics, 1948–85*, Rome, Italy, 1987.
- FAO (a) (Food and Agriculture Organization), *Food Aid in Figures*, Rome, Italy, various years.
- FAO (b) (Food and Agriculture Organization), *Production Yearbook*, Rome, Italy, various years.
- FAO (c) (Food and Agriculture Organization), *The State of Food and Agriculture*, Rome, Italy, various years.
- FAO (d) (Food and Agriculture Organization), *Trade Yearbook*, Rome, Italy, various years.
- International Monetary Fund, *International Financial Statistics: Yearbook*, Washington, D.C., USA, various years.
- Isenman, P.J., and Singer, H.W., "Food Aid: Disincentive Effects and Their Policy Implications," *Economic Development and Cultural Change*, Vol. 25, No. 2, 1977, pp. 205–237.
- Lachmann, W., "Wirtschaftstheoretische Überlegungen zu möglichen Wirkungen der Nahrungsmittelhilfe in Entwicklungsländern," in Körner, H. (Ed.), *Probleme der ländlichen Entwicklung in der Dritten Welt (Schriften des Vereins für Socialpolitik, Neue Folge*, Vol. 173), Berlin, Germany, 1988, pp. 101–122.
- Srinivasan, T.N., "Food Aid: A Cause of Development Failure or an Instrument for Success?," *World Bank Economic Review*, Vol. 3, No. 1, 1989, pp. 39–65.
- World Bank, *World Development Report*, Washington, D.C., USA, various years.

Discussion Opening—K.N. Ninan (Institute for Social and Economic Change, India)

The paper raises interesting issues that merit a detailed discussion. While technically competent, the economic reasoning behind the relationship hypothesized between food aid and food trade needs to be placed on a sounder footing.

Food aid and food imports can be positively related only superficially when a scarcity situation stimulates both; i.e., when food aid is inadequate, it is supplemented by imports. Also, if aid increases incomes and there is a high income elasticity of demand for food in LDCs, some increase in imports may take place. But a positive association in either case does not

amount to an absence of substitution of imports or at least an avoidance of scarcity. In some economies that do not normally import, deficits in domestic supply may be made up solely through food aid.

In the EC's allocation of food aid, the authors consider food imports as an important variable. The economic logic behind how imports lead to increased food aid needs to be spelt out clearly.

The analysis considers only the linkage between food aid and food trade when, in fact, it would have been more meaningful and useful if trade in general had been considered. If food aid replaces commercial food imports, the foreign exchange so saved could be used for importing non-food or investment goods. If food aid affects the recipient country by inducing a shift from production of food staples to production of exportable cash crops, this, too, could stimulate trade.

On the question of how food trade of recipient countries responds to food aid, the authors' findings revealed that, out of five countries studied, in two (Peru and Botswana), commercial imports were substituted by food aid, while in three (Egypt, Sudan, and Morocco), increased food aid led to increased food imports. However, in Botswana, the log-linear function showed a positive association as against a negative one in the linear function case. Not much light is shed on the factors that explain these diverse results. The authors' argument that, wherever positive associations arose, counterpart funds may have been used to subsidize demand, and, where negative, to subsidize production, is too simplistic and not based on empirical support.

The authors argue that domestic policies are crucial for realizing the trade effects of food aid. This presupposes that only domestic policies matter and not other factors such as food aid distribution arrangements, institutional and structural constraints in the global market, etc. A recent study pertaining to Somalia revealed that food aid resulted in greater import dependency owing to ill-formulated food aid programmes, apart from unsound domestic policies. Moreover, surely donor countries themselves have some control over the use of these counterpart funds, particularly when they advocate policies against subsidies and in favour of private enterprise and a market-friendly approach, etc.—these will surely have some impact on the use of counterpart funds by recipient countries. Hence, external factors, too, are relevant in understanding the linkages between food aid and trade.

The paper considers only the short-run effects of food aid and trade linkages. It would be useful also to know the long-run effects, especially in the light of popular notions about food aid having strong negative effects on the economy of aid receivers, resulting in a "dependency syndrome."

Other issues of interest are: whether food aid displaces commercial imports or domestic agriculture; food aid's effects on consumption, nutrition, and the balance of payments position; food aid's role in inducing structural adjustments and reforms in recipient countries; the costs and benefits (to donors and recipients) of bilateral versus multilateral food aid programmes; the impact of counterpart funds on macroeconomic parameters such as inflation, domestic revenue mobilization, economic development; and above all, the political economy of food aid.

[Other discussion of this paper and the authors' reply appear on page 190.]