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FOOD AID IMPACTS ON COMMERCIAL TRADE: A REVIEW OF THE EVIDENCE

**Prepared for the Office of Program, Policy, and Management of the Bureau for
Food for Peace and Voluntary Assistance of the Agency for International
Development**

by

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October 1990

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EXECUTIVE SUMMARY

Despite more than 35 years of experience with U.S. food aid under PL 480 and literally thousands of studies, articles, and reports, the nature of food aid's impacts on commercial trade and development remains unclear.

This study reviews 24 studies that used quantitative analytic methods to explore food aid impacts on the recipient country's commercial trade. These studies were identified as the result of an intensive review of the literature and discussions with knowledgeable individuals in academia and government. While this study does not include every quantitative analysis carried out on this issue (and indeed a handful of studies were identified but could not be obtained for review),¹ we believe that it effectively covers the published literature on these issues. It is noteworthy that no quantitative studies were identified that attempted to confirm analytically the relationship between food aid and commercial trade in the Asian cases frequently cited as evidence of such a relationship (Korea and Taiwan). A second major gap in this literature is the failure to distinguish adequately among project, program, and emergency aid in measuring impacts.

Seventeen of the studies attempted to quantify the relationship between food aid and commercial imports, while the remaining studies used quantitative analysis of other variables to draw conclusions regarding impacts on commercial trade. With the exception of four studies on India and one on Colombia, all of the studies identified were published between 1980 and 1989. Because several of the studies conducted alternative analyses of the same data or reported analyses from several countries, estimates from a total of seventeen single-country and three multi-country studies were obtained from the literature (excluding studies that reported coefficients on food aid that were not statistically significant).

The balance of empirical evidence generated by these studies confirms that, in at least some cases, food aid partially displaces commercial imports in the short term. This finding is generally supported by a plurality of the

1. Please refer to Part 3 of the bibliography for a list of studies identified, including those that could not be obtained within the study period.

studies based on analysis of data on a country-by-country basis. Six of the 17 single-country analyses that directly measured this relationship² found that each ton of food aid displaces between 300 and 900 kilograms of commercial imports in the short term, and five found smaller displacement impacts.³ These findings were not unanimous, however: the three studies that pooled data from several countries found a positive relation between food aid and commercial imports in the short term, as did six of the country studies.⁴

The findings appear to cluster in two groups. In the first group are countries where food aid accounts for a relatively minor share of total availability (e.g., India and Brazil). Studies for these countries generally found substantial displacement of commercial imports. A second group consists of countries where food aid is a major source of both imports and total grain availability (primarily African countries). Studies for this second group tend to find a minor impact on commercial imports, either positive or negative, possibly suggesting that the income effect (increasing total imports) is outweighing the price effect (discouraging commercial imports). This conclusion is appealing intuitively but should not be considered definitive. The wide variation in the coefficients estimated and the low degree of statistical significance in many of the analyses (not included among the seventeen) suggest that coefficient estimates are sensitive to model specification.

A second major conclusion supported by the literature is that the short-term impact of food aid on commercial imports depends both on the design of the program and on the structure of the food market in the recipient country, both of which are in turn greatly influenced by the domestic policy environment in the recipient country. In particular, programs that direct food aid through channels that do not directly compete with the commercial market are less likely to displace commercial imports than are food aid programs that more closely resemble commercial imports in their design and operation. Because programs operating outside of commercial channels generally provide food at a below-market price, they have the potential to increase demand through income transfer effects, as well as through simple price effects (with the size of these impacts depending on the elasticities involved). This impact is directly related to the use of below-market-price channels, an approach that is being phased out in a number of

2. Clay's two for Sri Lanka estimates, Hall's estimates for Brazil and Colombia, one of Maxwell's estimates for Ethiopia, and Mann's estimate for India.

3. Bolling's estimates for Jamaica and Trinidad, Rogers's estimate for India (also reported in Srivastava), Shapouri and Rosen's estimate for the Sudan, and Rosen's estimate for Madagascar.

4. Maxwell's second estimate for Ethiopia; Rosen's estimate for the Sudan; Shapouri and Rosen's estimates for Liberia, Senegal, and Mali; and Bezuneh's estimate for Tunisia.

countries and one, moreover, that is less likely to translate into increased commercial sales over the longer term (due to the inability of the recipient to continue the program without concessional financing). Given the importance of the demand side of the food system, models that incorporate market duality where it exists, tend to perform better than those that look only at the supply side.

The findings of the single-country analyses on short-term trade impacts are contradicted by the three multi-country studies, however. The studies that combined data from several countries, rather than analyzing each or several countries separately, generally found a positive relationship between food aid and commercial imports. Although further analysis is needed to explain this result in light of the country work, it appears that this result captures inter-country differences in food self-sufficiency (overall import needs) rather than any connection between food aid and commercial trade as such. In other words, looking across countries, large quantities of food aid and large commercial imports tend to occur in the same countries: those with a large food deficit are more likely both to import greater quantities commercially and to receive large amounts of food aid.

Food aid's long-term impact on commercial trade development, including its effectiveness as a tool for expanding U.S. markets for agricultural commodities, remains unexplored territory. No studies were found that attempted to link food aid to import levels more than three years later or to match food aid donations with increased sales or donor market share (short-term or long-term). Thus, the studies available are silent on such vital issues as whether food aid "graduates" are more or less likely to import commercially, whether food aid recipients are more likely to become better commercial customers for the donor country (in terms of absolute levels or market share), whether food aid has a measurable impact on the commodity mix imported over time, or whether food aid recipients are more or less likely to increase their reliance on external trade rather than domestic production for their basic food supply. A possible explanation for the lack of analysis on this issue might be that academic interest regarding food aid has focused on possible production disincentives, rather than trade, while analysts interested in trade impacts have preferred to focus on pure trade interventions, such as the Export Enhancement Program, but this is only speculation.

Several recent studies provide a sound methodological basis for expanding the analysis of food aid's effects on commercial trade over the long term (particularly Lavy's two studies using pooled data and Rosen's study using single-country analysis, all of which use African data only). Using a similar approach, it would be a straightforward exercise to determine whether food aid recipients have turned into better customers than non-recipients, taking into consideration economic growth and other factors. It would clearly be more difficult to reach a definitive conclusion on food aid's role as a causal factor in the evolution of trade.

The quantitative studies carried out to date underscore the need to examine the experience across a wide range of countries, to look beyond the idiosyncracies of any single country's experience and derive conclusions of general validity. An analysis designed to produce such conclusions should, therefore, use data from a cross-section of major recipients of food aid, both current and past, incorporating information on trade, production, and, if possible, non-commercial food distribution channels for food aid and related commodities to draw a more complete and reliable picture of food aid-trade relationships.

INTRODUCTION: BACKGROUND AND SCOPE OF THE STUDY

The legislation governing U.S. food aid emphasizes both trade promotion and development assistance as objectives of the food aid program, while recognizing the need to avoid negative effects on either the recipient country's agriculture or commercial trade. Despite more than three decades of experience with food aid, the program's impacts on the recipient country and on international trade — both positive and negative — remain controversial and have been a continuing focus of attention both among academics and within the development community.

This attention has led to the development of an extremely large and diverse literature on food aid. The current literature on food aid runs to literally thousands of entries: indeed, it would be possible to assemble a fairly lengthy bibliography composed entirely of bibliographies on food aid. There have been numerous reviews of food aid literature, including the synthesis of over 80 A.I.D. evaluations of program food aid completed in 1989 by the authors of this report. Despite this interest, there have been few systematic or broad-based attempts to assess food aid's impacts on commercial trade, whether in the short-term or the long-term. Because food aid's impact on commercial trade is a continuing focus of controversy, most reviews of the literature touch on this issue to a greater or lesser degree (see, for example, Maxwell 1983, Clay and Singer 1985, and the Nathan Associates 1989 review of A.I.D.'s food aid evaluations), but the broad scope of these studies prevents them from dealing with this issue systematically.

This paper constitutes a first attempt to fill this gap. It focuses particularly on quantitative assessments of food aid's impacts with the aim of weighing the evidence, or the lack thereof, regarding food aid's impacts on commercial trade. This focus is appropriate for three reasons. First, the general literature has already been reviewed by a number of authors, as noted. These authors have done an excellent job of summarizing the arguments made both for and against food aid's having an impact on commercial trade. There is little point in repeating the points they have made.

Second, the quantitative evidence deserves special attention, not only to weigh the evidence thoroughly but also to separate the wheat from the chaff.

Given the diversity of experience with food aid worldwide, it is possible to identify a subset of quantitative studies that support almost any point. Only by a thorough and systematic review of the studies is it possible to arrive at an unbiased conclusion regarding the evidence. The food aid literature is replete with writings aimed at making a case for or against food aid, many of which offer only a limited factual basis for the arguments made. One finds the same quantitative studies referenced repeatedly, moreover, often without a full presentation of the model used or the findings.

Finally, a review of the quantitative literature is necessary to assess whether the question of food aid's impact on commercial imports has been answered or whether important gaps remain in our understanding of this question, requiring further study. To serve this purpose, the review must examine not only the findings reached but also the methodologies used, as the basis for extending or updating the work already done.

Given the decision to focus on the quantitative evidence, it is necessary to ask, what is included in the universe of quantitative studies? This question is not as easy to answer as it might first appear. If we imagine a continuum with wholly non-quantitative studies on one end (nary a number in view) and studies based on multiple equation systems on the other, then it is clear that a very large number of studies occupy the middle ground. Nearly all food aid studies provide some data, even if it is only a table showing food aid levels over time. To term this entire literature quantitative would clearly distort the meaning of the word. We have used two basic criteria in deciding whether to include or exclude a given study:

- Studies that used an identifiable quantitative analytic technique to attempt to measure or verify the relationship between food aid and another variable (commercial imports, production, consumption, etc.) have been included. Given the nature of the question being studied, it is not surprising that most of the studies identified used econometric techniques, but several studies used other techniques, ranging from correlation analysis to input-output analysis.
- Studies that did not base their analysis on actual historical data at the country or multi-country level were excluded. In other words, studies that projected impact on commercial trade from a theoretical model of international or national behavior were not included. (Several studies included both a theoretical analysis and an historical analysis based on one or more country experiences; these were included.)

Our criteria generally excluded studies where the analysis was limited to a non-rigorous interpretation of the data,⁵ for two reasons. First, because the validity of such analyses depends largely on the skill and judgment of the author, the quality and utility of such studies is highly variable and difficult to assess second-hand. Second, the very large quantity of such studies — literally hundreds of food aid studies consider commercial imports and attempt to discern the relation between the two to a greater or lesser degree — made it impossible to include this entire literature with the resources available.

The study also excluded studies based on theoretical models of international trade or country-level behavior, rather than analysis of historical behavior. Although such studies are useful in improving understanding of trade issues, they cannot by definition be used to prove or disprove the connection that may exist between food aid and commercial trade. Readers interested in exploring this literature are referred to a recent study by Seitzinger and Paarlberg, which reviews this literature in detail. The overall conclusion of this literature is that subsidies to international trade, including food aid, are likely to increase total imports, but by less than the amount of subsidized food provided. In other words, food aid may be expected to partially displace commercial imports, with the degree of displacement depending on the price elasticity of demand for the commodity and how this elasticity is affected by program design (particularly the degree of subsidization).

Finally, this study does not encompass the large and growing literature that seeks to draw a connection between foreign aid (as distinct from food aid) and increased import demand caused by economic growth and development. This literature is excluded because it touches on food aid only peripherally and because the studies that have appeared to date, almost without exception, do not incorporate quantitative analyses (or, if they do, do not separate food aid from other aid). A recent discussion of the pros and cons of foreign aid, with a strong focus on food aid and agricultural exports, may be found in *How U.S. Food Aid Programs Help American Agricultural Exports*, published by the International Trade and Development Education Foundation in 1988.

In sum, this paper focuses primarily on studies that have sought to measure or verify the relationship between food aid and commercial imports based on rigorous analysis of historical data. The paper begins with a brief review of the main issues surrounding food aid's impacts on international trade. It then reviews the formal analytic literature on these issues,

5. Such a study might present, for example, a table or graph showing food aid and commercial imports over time as the basis for a discussion of their relationship, but it would not attempt to measure this relationship or confirm it analytically by controlling for other variables.

compares the models used in the analysis, and synthesizes the findings reported in this literature. Based on this review, the report concludes with an assessment of which questions remain unanswered, and it suggests future directions for analysis. The report includes an annex providing detailed annotations on each of the studies synthesized.

Although the study focuses on commercial trade impacts, the discussion will from time to time discuss impacts on consumption and production in the recipient country as well. These issues are germane to a review of the literature on trade impacts for three reasons. First, commercial imports, food aid, and local production constitute closely related elements of the food supply system. Together with consumption and income on the demand side, they jointly determine how much will be consumed and from what sources. When a change takes place in the economic environment in a given country, such as a sharp downturn in local production, it affects income levels and availability of foreign exchange, and therefore affects international trade and food aid as well. Second, much of the literature on food aid is designed to address both trade and other issues. It is difficult to discuss this literature fully without considering both trade and non-trade issues. Finally, interest in production and consumption impacts of food aid remains strong, particularly with regard to possible disincentive effects. A review of these issues is therefore an appropriate element of this study. For these reasons, we have included all of the quantitative studies of food aid located by the team in the overall bibliography, and we have provided a review of the findings regarding production in Annex 3 to this report.

The study's authors are indebted to many of the authors cited in the bibliography, who generously provided copies of unpublished studies and helped to identify additional sources. The support and assistance of the Office of Program, Policy, and Evaluation in A.I.D.'s Bureau for Food for Peace and Voluntary Assistance is also acknowledged with gratitude.

FOOD AID IMPACTS ON COMMERCIAL TRADE: WHAT ARE THE ISSUES?

Questions have been raised regarding food aid's impacts on the donor, on the recipient, and on world markets since the inception of surplus disposal programs in the interwar period. The initiation of serious analytic efforts to assess food aid's impacts can be traced to Schultz's seminal article in 1960 (see the annotated bibliography in Annex 1). The academic response to the questions raised by Schultz and others was initially muted by the lack of readily available data and analytic techniques with which to assess the impacts hypothesized. As developments in computerized analysis removed this constraint, there was a spate of studies attempting to measure food aid's impacts in quantitative terms.

Much of this formal analytic literature focuses on food aid's impacts on the domestic economy of the recipient country, particularly the potential for disincentive effects on production. Analysis of food aid impacts on commercial trade has largely been carried out in the context of efforts to understand the food economy in order to determine impacts on local production. In addition, a substantial literature has developed to explore the determinants of food aid itself. Much of this literature — but by no means all — sets out to prove that food aid is not determined solely by need (which should be self-evident to all but the most naive observer).

Despite the importance of market development as a primary rationale for U.S. food aid programs, relatively few analyses have been carried out to measure or document impacts on commercial trade, whether short-term or long-term. No studies at all could be identified that examined food aid's impact on the agricultural exports of the recipient country, either long-term or short-term. Given the complete absence of rigorous analysis on possible recipient country export impacts, this report will focus entirely on analysis of food aid impacts on recipient country imports, and in particular on the degree to which food aid substitutes for commercial imports that would have taken place in any case (often referred to in the literature as the additionality question).

Given the paucity of studies on this issue, it is necessary to develop a framework to discuss the issues surrounding food aid's potential impact on

commercial trade and market development. The literature on food aid and commercial trade suggests a number of alternative mechanisms through which food aid may affect commercial import levels. These impacts can be divided into short-term and long-term impacts:

Short-term Impacts

- ***Direct displacement of commercial imports:*** Food aid may replace commercial imports that would otherwise have taken place, particularly where the central government exercises substantial control over imports.⁶
- ***Increased effective demand through macro-level income transfers:*** Food aid provides a direct resource transfer to the recipient, and thus may encourage the country to expand its purchases of all goods, including imported food. Given that the income elasticity for food is generally below one, this expansion would generally result in some substitution of food aid for commercial imports.
- ***Relief of a balance of payments constraint:*** Food aid helps a country to finance its foreign exchange requirements, enabling it to implement a level of imports that might not have been feasible otherwise (this impact would presumably imply a reduction in commercial imports, but not a one-for-one replacement with food aid, due to the country's presumably positive propensity to spend the additional foreign exchange on food as well as non-food items).
- ***Short-term income transfers at the micro level:*** Food aid programs may be used to transfer income to population groups with a high propensity to raise food consumption and expenditures on food, leading to increased demand for food in the recipient country as a whole.
- ***Short-term price effects:*** Food aid may be used to subsidize domestic consumption of foodstuffs, leading to increased demand and, depending on how macroeconomic policy measures affect the commodity market, to increased imports.

6. This displacement may or may not be on a ton-for-ton basis, and therefore total imports may increase even if there is some displacement. To the extent that food aid replaces commercial imports from another source, moreover, total exports by the donor country may even increase.

Long-term Impacts

- ***Development of commercial ties:*** Food aid programs may strengthen trade linkages between importers (public or private) in the recipient country and U.S. suppliers, encouraging these importers to turn to U.S. suppliers for commercial imports in the future. Alternatively, food aid may actually disrupt or hinder development of these linkages, either by replacing commercial transactions with government-to-government food aid programming or by damaging the reputation of U.S. commodities and suppliers. The latter effect may occur if, for example, the food aid commodities delivered are of low quality or if program procedures are unnecessarily cumbersome.
- ***Changes in taste preferences:*** Food aid may encourage the local population to develop a taste for the commodities provided through the program. This change can take place through a variety of mechanisms, including introduction of commodities that have not traditionally been part of the diet (e.g., wheat, and, more recently, maize, in the case of Bangladesh); increased availability of a well-known commodity at a reduced price, leading to expanded use in the diet (e.g., rice in West Africa); or through introduction of new varieties of an established commodity (e.g., red sorghum in West Africa).
- ***Agricultural development:*** Food aid resources may have a positive or negative impact on the recipient country's agricultural system, altering domestic production of similar commodities or affecting the aggregate production in the sector as a whole. These effects may lead in turn to changes in import patterns and increased or decreased opportunities to market U.S. agricultural products.
- ***International relations:*** Food aid may help to cement relations between the U.S. and recipient countries, helping to promote U.S. trade across the board. On a more pragmatic level, food aid may be used as a bargaining chip in trade discussions, encouraging the recipient government to direct a greater share of its commercial purchases to U.S. suppliers.
- ***Income growth and diversification:*** Food aid may contribute to national development, leading to rising income levels, rising consumption, and expanded demand for food, which may in turn fuel increased commercial imports.

The extent to which these various impacts arise in a given situation depends on the local market structure and the nature of the food aid program. Clearly, each of these impacts is more likely to occur in some program designs than in others. A number of large food aid programs have historically been based on distribution of the commodity to low-income consumers through government channels at a highly subsidized price. This type of program is unlikely to lead to long-term income growth or to development of commercial trade linkages; nor is it likely to displace commercial imports over the short-term to the extent that the food is channeled to consumers who increase their consumption by the full amount received.

Differences in food aid program design, and consequently in the mechanisms governing import impacts which correspond only loosely to the formal distinction between project and program food aid. Program food aid may be distributed through governmental channels that effectively target low-income consumers, reducing the trade impact, or it may flow directly into market channels. Similarly, project food aid may be distributed to low-income consumers or it may be sold to generate revenues to support the program. In both cases, the potential impact on trade depends on the extent to which distribution of the food aid commodity departs from an open-market pattern, that is, on the extent to which food aid is distributed through separate channels that do not compete with food being sold in the marketplace.

In any case, the distinction between program and project food aid is poorly recognized in the literature on food aid impacts. As further discussed below, some of the studies reviewed identified the programs analyzed as Title I programs, historically the most common form of U.S. program food aid. Most of the studies, however, either combined all food aid together or failed to make clear the nature of the food aid programs involved.

STUDY METHODOLOGY AND HYPOTHESES REVIEWED

The literature on food aid impacts falls well short of addressing the full range of issues identified in the previous section. On the contrary, only a few of the available studies discussing food aid's trade impacts go beyond measurement of the impact to consider the factors underlying the impact or the interaction between food aid program design and impact on commercial trade. No study was identified that attempted to examine long-term impacts (the longest lag examined between food aid input and changes in any dependent variable being three years). For this reason, a limited set of hypotheses was formulated for use in reviewing the literature:

- Food aid increases total imports of the programmed commodity in the short run.
- Food aid increases the value of commercial imports of the programmed commodity in the short run.
- Food aid increases the quantity of commercial imports of the programmed commodity in the short run.

To assemble the information available regarding these hypotheses, the team reviewed the literature to identify analyses that attempted to quantify the relationships between food aid and the food economy of the recipient country. Some of the studies identified focused on trade, but many dealt with trade impacts only incidentally.

For each quantitative study identified, the team prepared a detailed annotation summarizing impacts on trade and production. The quantitative results were summarized in three tables, presented below:

- Table 1 describes the studies reviewed in terms of the countries and time period covered, the methodology used, and the type of food aid program concerned.

- Table 2 presents additional information on the structure of the models estimated; it is organized in terms of the dependent variables, identifying the independent variables used to explain each one.
- Table 3 presents the findings regarding the direct impact of food aid and other explanatory variables on trade levels.

In order to present a complete picture of the analysis reported, the study team also prepared a table summarizing the studies' findings regarding the relationships linking food aid to production, consumption, and other variables of interest. This summary is presented in Annex 2. It should be noted that several of the estimated equations summarized in this table include commercial imports and/or world prices as explanatory variables, although they do not link these variables to food aid.

OVERVIEW OF THE LITERATURE

Because the purpose of the present study is to review the concrete evidence on food aid's impacts on commercial trade, the review emphasized those studies presenting quantitative analyses of food aid's impacts. The broad literature providing impressionistic or theoretical analyses of food aid impacts was reviewed by the team, and the principal conclusions of this literature are summarized later in this report. Readers interested in a review of the broader literature are referred to Clay and Singer's excellent literature survey, completed in 1985. (Clay and Singer's findings on the commercial trade issue are further discussed below.)

The review covered the full range of literature available in published (and to the degree possible, unpublished) sources that measures the relationship between food aid and commercial imports of food. As further discussed below in the section reviewing the studies' methodologies, nearly all of the quantitative studies identified consisted of single or multi-country econometric studies.

From bibliographic listings and printouts of over 500 entries, the team located and reviewed over 100 documents to identify quantitative analyses for detailed review. This search was supplemented by interviews with many of the leading authorities on food aid, including both academics and practitioners in A.I.D. and USDA to identify additional studies. (A list of individuals contacted is included in Annex 2.) Although many of the studies identified presented quantitative data, use of rigorous quantitative analytic techniques to examine food aid's trade, production, and consumption impacts was surprisingly rare. Only 29 of the studies used such techniques to analyze impacts, of which only 24 examined trade effects. The remainder either did not present data or limited their analysis to qualitative methods or nonrigorous techniques, as discussed above.

This finding confirms the conclusion reached by Elaine Grigsby and Praveen Dixit in their study of U.S. agricultural export programs (1986):

Empirical studies on the impact of export credit sales programs are virtually nonexistent. This is especially true of targeted export credit programs [such as PL 480 Title I]. (page 22)

Although a thorough literature search was conducted, it is inevitable that some quantitative studies escaped the team's attention, either because they do not appear in any bibliography and were not known to the individuals contacted, or because copies could not be obtained. Dissertations (e.g., Grigsby) and unpublished conference papers proved particularly difficult to obtain, given the limited time and resources available. Part 3 of the bibliography presents the working list of studies developed by the team, and it indicates those that could not be obtained by the team. This list includes analytic studies that discussed food aid impacts, but did not include food aid as a variable in the model actually estimated. In some cases, the exclusion of food aid resulted from an analytic focus on other aspects of the food economy, in other cases the rationale for excluding food aid was not always clear in the analysis as reported. In any case, such studies were not generally annotated by the team or included in the analysis below, as it is clearly impossible to discuss the findings regarding food aid impact from analyses that do not include food aid as a variable. (An exception is the Dudley and Sandilands study of Colombia, which was included because it is frequently cited in the literature.)

Detailed bibliographic annotations were completed for 32 documents, including 29 quantitative studies and 3 others included because of their importance to the evolution of the field.⁷ The results from the 24 quantitative studies dealing with trade effects form the basis for the discussion in the remainder of this report. The results of these studies are tabulated and presented in matrix form later in the report.⁸

The group of 24 studies includes 14 single-country quantitative studies, covering 13 countries. (Two of these studies constitute separate reports on the same analysis — Srivastava et al., and Rogers et al.) In addition, five worldwide multi-country studies, three regional multi-country studies (all

7. Four of the quantitative analyses and two of the other analyses do not deal with international trade impacts; these annotations are found in Annex 3.

8. The team was able to obtain nearly all of the studies identified from the bibliography as likely to include quantitative analyses of the issues under study. Several studies could not be obtained by the team in time for inclusion in the review, however, primarily dissertations, journal articles from developing countries, and unpublished papers. While it may be assumed that not all of these studies include quantitative analysis, some are known to contain such analysis (because articles referencing their findings have been reviewed), and additional efforts to obtain these works should be made if a follow-on study is implemented.

focusing on Africa), and two limited multi-country studies (one for Latin America and one for Asia/Near East) were reviewed. Thirteen of these analytical works used single or multiple regression analysis techniques (including vector autoregression), while nine developed systems of simultaneous equations (which were then generally estimated using econometric techniques), two employed comparative statics (including one that used both regression and comparative statics), and one used both correlation analysis and regression.

Many of the studies examined were undertaken in the years following the publication of Schultz's seminal article in 1960, which focused academic attention on possible disconcertive impacts on the recipient country's agricultural sector. Few of these studies used econometric techniques, however, which were still too costly at that time. The earliest studies in the set reviewed date from 1968, coinciding with advances in computer technology that made econometric studies practical for such analysis, and a number of the studies reviewed were completed before 1980. It appears that there has been a revival of interest in the topic, however, with about five of the studies completed since 1987.

The studies are equally divergent with regard to the period covered. Most of the studies cover a period of at least ten years, with one study (Hall, 1980/2) covering a 25-year period. Despite the long time series used, only the two studies by Lavy used lags of more than two years to try to capture long-term impacts. The reasons behind this failure to examine long-term effects remain unclear.

The studies are well distributed geographically. India received the greatest attention, with three studies identified (counting Srivastava et al., and Rogers et al., as a single study). Excluding the 4 worldwide studies (which covered between 33 and 77 countries), 7 studies focused on Asian or Near Eastern countries, 7 on Latin American countries, and 5 on African countries. Interestingly, four of the five studies focusing on Africa were regional studies (covering between 17 and 36 countries each), but only two other multi-country studies were identified in the other regions (Hall, 1980/2, covering Colombia, Peru, and Brazil, and Von Braun, covering Egypt and Bangladesh).

It is interesting to note that no quantitative studies were identified that dealt with the Asian cases most frequently cited in the general literature as PL 480 market-building success stories, that is, South Korea, Taiwan, and Japan. (A qualitative study on Korea was identified (Mason) and is discussed below.)

Table 1 presents basic descriptive information on the 24 studies included in the review.

Table 1. Overview of the Literature

Key: Type of Analysis

1-VAR Single variable regression
 MULTVAR Multiple variable regression
 SIMUL Simultaneous equation system
 VECTOR Vector autoregression
 STATIC Comparative static analysis

Statistical Technique

OLS Ordinary least squares (a regression technique)
 GLS Generalized least squares (a regression technique)
 2SLS, 3SLS Two-stage or three-stage least squares (regression techniques)
 COCH Cochrane - Orcutt (a regression technique)
 INST Instrumental variables estimation (a regression technique)
 CORR Simple correlation analysis

Country or Region	Author	Year Published	Period Covered	Type of Aid	Commodities Studied	Type of Analysis	Statistical Technique	Comments
Brazil	Hall	1980/1	1954-1970	PL480	wheat	SIMUL	OLS 2SLS	System of seven simultaneous equations including supply and demand equations for wheat, corn, rice, and soybeans; examines PL480 impacts on wheat prices, dom. prodn., and comm. imports; same analysis as reported in 1980/2.
Colombia	Dudley & Sandilands	1975	1951-1971	PL480 Title I	wheat	MULTVAR	OLS	Multiple variable equation used to explain fall in domestic production by lagged response to fall in producer prices caused by increased PL480 imports; no direct empirical estimates of PL480 as explanatory variable.
Colombia, Brazil	Hall	1980/2	1950-1975	PL480	wheat & others	SIMUL	OLS 2SLS	System of simultaneous equations testing impact of PL480 imports of wheat on prices, domestic production, and quantity of commercial imports.
Dominican Republic	Bolling	1983/1	1960-80	PL480	all food	MULTVAR	OLS	Analyzed determinants of commercial food imports
Egypt/Bangladesh	von Braun	1982	1976-78	PL480	wheat	STATIC	OLS	Estimates impact based on elasticities estimated econometrically.
Egypt	Scoble	1981	1949-79	PL480	wheat	SIMUL	OLS 2SLS 3SLS	System of 20 import demand equations to estimate the allocation of total import expenditures between wheat and other imports. Used three statistical techniques.
El Salvador	Della Torre & Norton	1988	1971-1986	Title I	all ag imports	MULTVAR	OLS	Three models presented to explain changes over time in level of agricultural imports, real farmgate price levels, & domestic agricultural production.
Ethiopia	Maxwell	1988	1975/76 - 1983/84	food aid	wheat and subst crops	1-VAR MULTVAR	OLS	
India	Blandford & von Plockl	1977	1952-68	PL480	cereals	SIMUL	OLS 2SLS	
India	Mann	1967	1952-63	PL480	cereals	SIMUL	2SLS	
India	Rogers et al	1972	1956-1967	PL480	all cereals	SIMUL	OLS 2SLS	System of seven simultaneous equations incorporating distribution of food aid through differentiated market channels (fair price shops); same study is reported in Srivastava, et al.
India	SeEVERS, G.	1968	1956-57 1961-62	PL 480	cereals	STATIC		Estimates are obtained for price-output effects of PL 480 shipments -- first, for a "theoretical country" under varying supply & demand (price) elasticities, then for India using estimates derived in another study.
India	Srivastava et al	1975	1956-67	PL480	wheat, rice	SIMUL	2SLS	See Rogers et al.
Jamaica	Bolling	1983/2	1960- 1980	PL480	all food	MULTVAR	OLS	Multiple variable equation used to model changes in food imports, with explanatory variables which included real food import prices, real income, domestic food production, population, food aid, and foreign reserves.
Sri Lanka	Clay	1983	1970-1981	Title I & EEC	wheat & wheat flour	MULTVAR	OLS	Two models, one using wheat demand and food aid imports to predict commercial imports, and the other expanding on that basic model to include a dummy variable for election years and a time trend variable.

Table 1. Overview of the Literature

Key: Type of Analysis

Statistical Technique

1-VAR Single variable regression
 MULTVAR Multiple variable regression
 SIMUL Simultaneous equation system
 VECTOR Vector autoregression
 STATIC Comparative static analysis

OLS Ordinary least squares (a regression technique)
 GLS Generalized least squares (a regression technique)
 2SLS, 3SLS Two-stage or three-stage least squares (regression techniques)
 COCH Cochrane - Orcutt (a regression technique)
 INST Instrumental variables estimation (a regression technique)
 CORR Simple correlation analysis

Country or Region	Author	Year Published	Period Covered	Type of Aid	Commodities Studied	Type of Analysis	Statistical Technique	Comments
Trinidad and Tobago	Bolling	1983/3	1960-78	PL480	all food	MULTVAR	COCH	
Tunisia	Bezuneh et al	1983	1960-1979	all food aid	all food grains	SIMUL	2SLS 3SLS	System of four simultaneous equations and one market-clearing identity with nine variables in total.
Worldwide (33 countries)	Abbott	1979	1951-1973	all food aid	food grains	SIMUL	INST	Generalized reduced form net trade equation derived from system of 13 equations; instrumental variables estimation used to estimate trade price elasticities.
Worldwide (42 countries)	Morrison	1984	1979/80	all cereals	cereals	MULTVAR	OLS	Two models investigating both structural long-term factors and short-run temporary factors; multi-country pooled data.
Worldwide (77 countries)	Vengroff et al	1982	1962-1978	PL480	all food	MULTVAR	OLS CORR	Correlation analysis and OLS regression used to test six hypotheses regarding motivation for and prediction of food aid shipments
Africa (26 countries)	Lavy	1989/1	1979-87	food aid	cereals	VECTOR	GLS	Model used to measure which factors determine donor's food aid response to production shortfalls in African countries
Africa (36 countries)	Lavy	1989/2	1970-87	food aid	cereals	VECTOR	OLS/GLS	Estimates seven equations separately to measure impacts on production, food aid and imports. Examines 36 countries as a group and analyzes several subgroups (socialist/non socialist; high/low income).
Africa (17 countries)	Rosen	1989	1966-86	food aid	cereals	MULTVAR	OLS	Two models using food aid and other variables to model domestic production, commercial imports in 17 African countries - model run separately for each - 34 sets of coefficients developed
Africa (25 countries)	Shapouri & Rosen	1987	1966-84		cereals, milk	MULTVAR	OLS	Separate regressions run for each of the 25 countries, using import value & commercial food import elasticities as the 2 dependent variables. Coefficients for all 25 countries are shown in a table in annotated bibliography.

COMPARATIVE ANALYSIS OF MODELS USED

The analyses used a wide variety of model structures to explore the relationship between food aid and impact variables, both trade-related and otherwise. This variety in structure and estimating technique must be borne in mind when comparing the coefficient estimates obtained. Table 2, presented at the end of this section, summarizes the models used, showing the structure of the equation for each dependent variable. Studies using methodologies that are not suited to this presentation format are noted in the table comments; the reader should refer to the detailed annotations in Annex 1 for more complete information on the methodology of these studies.

Taken as a group, the models show a high degree of similarity, but no single methodology emerges as the standard. Reflecting the lack of an established methodology, several studies presented more than one model, either to test alternative specifications to see which gave the best fit or to explore alternative facets of the issue. In considering the diversity of methodologies used, it must be recognized that the various authors were seeking to answer a wide range of questions, and that this inevitably led them to use dissimilar methodologies. To say that the methodologies differ does not imply that some were correct and others not.

Ordinary least squares (OLS) was by far the most common methodology, used in 17 of the studies, alone or in combination with other techniques.⁹ Nearly all of the models using this technique relied on multiple explanatory variables, but two studies used simple single-variable models. Several studies developed a system of simultaneous equations, which was then generally estimated using two-stage least squares (2SLS) or three-stage least squares (3SLS), often in combination with OLS. A handful of studies used other estimating techniques, such as generalized least squares (GLS), instrumental variables, or vector autoregression (VAR). Only one study relied exclusively on techniques other than econometrics, and this study used

9. For technical reasons, simultaneous equation systems require that OLS be combined with two-stage or three-stage least squares to give reliable results.

comparative statics based on elasticity estimates obtained from an earlier econometric study.

Despite the fact that all of the studies reviewed were designed, at least in part, to address the relationships among food aid, on the one hand, and commercial imports, domestic agricultural production, and/or consumption, on the other, not all of the models included food aid as a variable.

Figure 1 summarizes the range of models and their use of food aid as an explanatory variable. It should be noted, however, that several of the simultaneous equation models used food aid as an explanatory variable for one equation in the system, and thus captured food aid's indirect impact on other dependent variables. For example, food aid might be included in the demand equation, while prices might appear as an explanatory variable for imports. Food aid's impact on imports would therefore be modeled indirectly, through its affect on prices. Altogether, 17 of the 24 studies reviewed included equations designed to measure the determinants of import levels in recipient countries. All but two of these used food aid as one of the explanatory variables. The remaining studies did not include food aid as an explanatory variable for trade, but examined import impacts indirectly, generally in the context of a simultaneous equation system.

None of the studies differentiated among different types of food aid to compare the effects of project, program, or emergency aid. Some of the studies were limited to Title I assistance, as shown in Table 1, but few of the studies provided full information on the types of food aid included and the rationale for this decision. Nearly all of the studies focused on cereals.

In addition to food aid, the most commonly used independent or predictor variables were world prices, GNP or GDP, quantity of local production (generally lagged), quantity of commercial imports, foreign exchange availability or reserves, and domestic prices. Other variables used included withdrawals from government stocks, government procurement, and quantities distributed through subsidized channels. Several of the studies included variables designed to reflect specific country conditions, such as dummy variables to capture the impact of internal disruption or a major policy shift. Use of a time trend variable was also a feature common to several models. In most cases, the variables were included as values (e.g., tons), but use of indices was also common. Relatively few of the models used other transformations, such as logarithms (see Table 2).

Taking the body of literature as a whole, it is fair to say that models that attempted to explain variation in commercial or total imports most commonly included the quantity of food aid, domestic production, and foreign exchange availability as independent variables.

As argued by several authors (see Srivastava et al., for example), models appear to perform better if they capture the differentiation of the

Figure 1. Summary of Models Used

Dependent Variable	Number of Models	Number Using Food Aid
<u>Domestic impacts</u>		
Consumer prices	3	1
Producer prices	6	4
Domestic consumption	4	4
Domestic production	10	5
National income	2	2
Concessional food sales	2	2
<u>Trade impacts</u>		
Commodity imports (quantity)	5	3
Commercial imports		
Quantity	16	15
Value	1	1

Note: For purposes of this summary, Rogers et al. and Srivastava et al. are counted separately, although it should be noted that they report on the same analysis. Counts include alternative models presented in the same analysis.

country's food market into an open or free market channel and a subsidized, targeted channel, such as India's fair price shops. This distinction continues to be important in analysis of historical data, but is less important operationally, because the roster of countries with such systems is rapidly diminishing. As noted elsewhere in this report, however, such systems have the potential to transfer income to low-income consumers, thereby increasing effective demand and avoiding possible disincentive and import displacement effects.

A final methodological distinction worth noting among the country studies is the choice between a simultaneous equation system and a multivariable regression analysis. As shown in Table 1, 8 of the 17 single-country studies used a simultaneous equation system, while the remainder used a single equation. The simultaneous equation approach has theoretical advantages in that it permits demand and supply to be treated separately, making it possible to treat price endogenously. Estimation of a simultaneous equation system is methodologically more complex, however, and it remains unclear whether the results obtained are more reliable than those generated by a single-equation system. It may be indicative that the analysts from an academic tradition have tended to use a simultaneous equation system (e.g., Hall, Blandford and von Plocki, Rogers), whereas the applied analysts have tended to rely on multivariable regression (e.g., Clay, Della Torre and Norton, and Maxwell). On balance, we might conclude that the most important consideration appears not to be which method is used, but whether the model specification includes the correct variables to serve the purpose for which it is intended.

Turning to the multi-country studies, it is noteworthy that some of the studies pooled the data from the countries studied (notably the two studies of Africa by Lavy and the worldwide study by Morrison), while others conducted separate analyses for each country (e.g., Shapouri and Rosen's study of Africa and von Braun's study of Egypt and Bangladesh). Studies in the latter group are more directly comparable to the single country analyses in both methodology and interpretation of findings. None of the multi-country studies used simultaneous equation systems, which are not suited to cross-sectional analyses at the country level.

Table 2. Comparison of Methodologies Used

Key:	Type of Variable	Form of Variable
AIDQUAN	Quantity of food aid	VAL Value in absolute terms
PRIWRLD	World price of commodity	LN Natural log of the value
GNP	Gross national product	SQ Square of the value
PROD	Domestic production	LAG1 Lagged 1 year, etc.
COMIMP	Imports of commodity	DEV Deviation from the mean
FOREX	Foreign exchange	PC Per capita
PRIDOM	Domestic price of commodity	INDX Index
GDP	Gross Domestic Product	DEF Deflated
		DIFF1 Difference from previous period, etc.

Note: a number following the author's name identifies multiple models presented in the same study; a number following the study date identifies different studies by the same author published in the same year.

Dependent Variable	Author	Country	Date	Explanatory Variables								Comments
				AIDQUAN	PRIWRLD	GNP	PROD	COMIMP	FOREX	PRIDOM	GDP	
Quantity of commodity imports	Bolling	Dominican Republic	1983/1	PC, IND (value)	IND		PC, IND			PC, IND		Dependent variable is food imports less PL-480; aid variable expressed in value terms of assistance Aid variable expressed in value terms; FOREX is per capita FX reserves in 1960 J\$; model also includes dummy for policy change See comments for Dominican Republic study FOREX = lagged degree of overvaluation of XR PROD and FOREX expressed as 1979 value as % of period mean
	Bolling	Jamaica	1983/2	PC (value)	INDX	PC	PC			PC		
	Bolling	Trinidad & Tobago	1983/3	PC (value)	PC, IND		PC, IND			PC, IND	PC	
	Della Torre & Norton	El Salvador	1988				LAG1 INDX DEV			LAG1 INDX DEV		
	Lavy Morrison	Africa Worldwide	1989/1 1984	PC		PC	DEV LAG2			DEV LAG2		
Value of commercial imports	Shapouri & Rosen	Africa	1987	VAL	VAL		VAL	VAL	VAL			
Quantity of commercial imports	Bezaneh et al	Tunisia	1983	PC			PC				INDX	Model 2 includes dummy variable for election years & time trend variable Also includes a time trend variable and CPI Also includes a time trend variable and CPI Also includes withdrawal from stocks Same variables used as in model above, predicting total imports
	Clay (1)		1983	VAL				VAL				
	Clay (2)		1983	PC								
	Hall	Brazil	1980/1	VAL			VAL			VAL	VAL	
	Hall	Brazil, Colombia	1980/2	VAL			VAL			VAL	VAL	
	Lavy	Africa	1989/1						DIFF123			
	Lavy (1)	Africa	1989/2	DIFF123			DIFF123		DIFF123			
	Lavy (2)	Africa	1989/2	DIFF12					DIFF123			
	Mann	India	1967	PC								
	Maxwell (1)	Ethiopia	1986	VAL								
Maxwell (2)	Ethiopia	1986	LAG1				LAG1					
Morrison	Worldwide	1984	PC		PC		DEV LAG2		DEV LAG2			
Rogers et al	India	1972	PC							INDX		
Rosen	Africa	1989	LN	LN		LN			LN			

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Note: a number following the author's name identifies multiple models presented in the same study; a number following the study date identifies different studies by the same author published in the same year.

Dependent Variable	Author	Country	Date	Explanatory Variables								Comments
				AIDQUAN	PRIWRLD	GNP	PROD	COMIMP	FOREX	PRIDOM	GDP	
Consumer prices	Srivastava et al	India	1975									Same analysis as reported in Rogers et al.
	Rogers et al	India	1972	PC						INDX LAG2		
	Seevers	India	1968									
	Srivastava	India	1975									
Producer prices	Blandford & v.Plockl	India	1977	VAL								Elasticity analysis, non-econometric Same analysis as reported in Rogers et al. Uses simultaneous equation system to estimate impact on prices indirectly Also includes a time trend variable and CPI Also includes a time trend variable and CPI Model measures consumer-producer price wedge ; also includes dummy variables for war years and a variable measuring real import capacity Estimates impact on prices based on econometrically estimated elasticities
	Della Torre & Norton	El Salvador	1988		INDX		LAG1		INDX			
	Hall	Brazil	1980/1	VAL	VAL					VAL		
	Hall	Brazil, Colombia	1980/2	VAL	VAL					VAL		
	Scoble	Egypt	1981	INDX	VAL					INDX		
	VonBraun	Egypt/Bangl.	1982									
Domestic consumption	Blandford & v.Plockl	India	1977	VAL								Uses simultaneous equation system to estimate impact on consumption indirectly Also includes time trend variable. Two measures of domestic demand estimated - Q demanded in open market, and Q sold concessionally Same analysis as reported in Rogers et al.
	Hall	Brazil, Col., Peru	1980/2	VAL								
	Rogers et al	India	1972	PC						INDX LAG2		
	Srivastava et al.	India	1975									
Domestic production	Blandford & v.Plockl	India	1977	VAL								Uses simultaneous equation system to estimate impact on production indirectly Model includes dummy variable
	Della Torre & Norton	El Salvador	1988				LAG1	INDX		LAG1		

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Key:	Type of Variable	Form of Variable
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Note: a number following the author's name identifies multiple models presented in the same study; a number following the study date identifies different studies by the same author published in the same year.

Dependent Variable	Author	Country	Date	Explanatory Variables								Comments
				AIDQUAN	PRIWRLD	GNP	PROD	COMIMP	FOREX	PRIDOM	GDP	
National Income	Dudley & Sandilands	Colombia	1975				INDX LN LAG1			INDX LN		for years of social turmoil in 80s Coefficients estimated are elasticities.
	Hall	Brazil, Col., Peru	1980/2	VAL								Also includes a time trend variable
	Lavy (1)	Africa	1989/2	DIFF123			DIFF123					Also estimates relation between yield and food aid, and versions of equations 1 and 2 with only 2 lags
	Lavy (2)	Africa	1989/2	DIFF123			DIFF123	DIFF123				
	Rogers et al	India	1972	PC							INDX LAG2	
	Rosen	Africa	1989				LAG1 LN				LAG1 LN	
	SeEVERS, G.	India	1968									
	Srivastava et al.	India	1975									
	Rogers et al.	India	1972	PC							INDX LAG2	
	Srivastava et al.	India	1975									
Concessional food sales	Rogers et al.	India	1972	PC							DEF INDX	Also includes price in concessional outlets
	Srivastava et al	India	1975			PC						Same analysis as reported in Rogers et al.
Quantity of food aid	Lavy	Africa	1989/1				DIFF123					
	Scoble	Egypt	1981		VAL		VAL					Model included dummy variables for war years and variable measuring import capacity
	Vengroff et al	Worldwide	1982			PC	VAL					Model included variables for agric

SYNTHESIS OF FINDINGS

The coefficients estimated in the studies reviewed are presented in Table 3 at the end of this section.¹⁰ Although we have made an effort to present findings as completely as possible, the findings from several of the studies were too complex to be presented in table form (please refer to the comments presented in the tables). More complete information on study findings is presented in the annotated bibliography annexed to this report.

Findings with Respect to Food Aid's Impact on Trade

Given the longstanding interest in food aid's interaction with commercial trade, it is perhaps surprising that only 24 studies were identified that attempted to measure this relationship quantitatively. Taken as a whole, the studies tend to support the view that increases in food aid are associated with decreases in commercial imports. This general conclusion stands, whether imports are measured in terms of total food imports (Bolling in the Dominican Republic and Trinidad), the value of commercial food imports (Shapouri and Rosen in 19 of the 20 African countries they studied although 4 of the coefficients were statistically significant), or the quantity of commercial imports (several studies covering countries including Brazil, Colombia, Sri Lanka, and Jamaica). The results for Africa suggest a caveat to this general conclusion: in countries where food aid accounts for a large share of total imports and total food availability, displacement of commercial imports is less likely to occur, and food aid may even be associated with slightly larger commercial imports.

10. In both tables, a number after the author's name (e.g., Lavy (1)) identifies one of several equations in a given study, whereas a number after the study date (e.g., 1989/1) identifies one of several studies by the same author published the same year.

Review of the Qualitative Literature

The qualitative literature generally confirms the finding that food aid is not wholly additional, that is, that it substitutes for commercial imports. Authors have varied in the estimated degree of additionality, however. This conclusion is reached by Clay and Singer in their review of recent food aid literature, one of the best of the recent reviews of food aid issues. Writing in 1985, they conclude their discussion of the additionality issue with the following comments:

Has food aid actually substituted for commercial imports? A number of recent studies have explored this question through econometric modelling and careful statistical analysis for individual countries. The balance of evidence suggests that food aid did *de facto* substitute to a significant degree for commercial imports in a number of important importing countries such as Egypt, Sri Lanka, and South Korea, whereas in India, for over 20 years the largest recipient, less than a quarter of cereals food aid has substituted for commercial purchases. Broad estimates that more than half of cereals food aid has substituted for commercial imports, whilst supported by case study data, ultimately nevertheless continue to rest on a judgment about what would have been the importing country's response in the longer run to sustained and radically different donor policies. The interpretative case histories and quantitative estimates on the substitution issue are both heavily dependent on observed importing country behavior in response to relatively short run, but large, changes in overall food aid availabilities (such as the cut-back which occurred in the early 1970s) and also to unilateral donor decisions to suspend aid to particular countries. (page 16; emphasis in the original; bibliographic references omitted)

Cathie's review of food aid issues reaches a similar conclusion, differing on the degree of substitution. Citing the use of special outlets for food aid to divert supplies away from the market (India's fair price shops, for example), he concludes:

About three-quarters of bilateral food aid does not satisfy the additionality principle, if this principle is strictly applied, which would include almost all of PL 480 Title I donations.... Whether open market sales of food aid have caused the displacement of commercial sales or indigenous production of staple foodstuffs is an empirical question.... Unfortunately, empirical evidence on this question is not plentiful. (pages 61-2)

Cathie also cites Asian experience as evidence of food aid's mixed effects on commercial imports and production, making the interesting point that food aid may have displaced traditional LDC exports, as well as commercial imports from industrial countries:

...South East Asia, once a net agricultural exporting region, has changed to a net importing region while receiving large volumes of food aid. This is especially so of rice-exporting countries (such as Thailand) whose "traditional" markets have been displaced by concessional sales of wheat. In contrast to the view that food aid has displaced local production and is therefore harmful to the long-term development of the recipient, is the example of Japan. The evolution of Japan from a concessional sales recipient to that of a hard currency purchaser of wheat is considered by the PL 480 administration to be a model example of the benefits of donations without the disruption of indigenous production, since Japan increased her own production while receiving food aid. (page 62)

Another recent review of food aid experience, Maxwell's evaluation of European food aid programs (1983), lends further support to the view that food aid is not fully additional in the typical case:

With regard to additionality, most observers have concluded that in practice there is a substantial trade-off between commercial imports and food aid, increasingly so as the balance of payments burden of food aid imports rises. Between a half and three-quarters of all food aid may substitute for commercial imports that would have been made anyway. (page 2.4)

It must be emphasized that each of these statements is based primarily on prima facie reasoning and the extensive experience of the authors, rather than on quantitative measurement of food aid impacts on trade. In particular, the often-cited estimate that approximately half of food aid is additional (Maxwell's study is the source for Clay's estimate, cited above) appears to rest on differences in food aid programming, rather than on comparison of commercial import levels with and without food aid. The logic underlying these estimates is that food aid that is distributed free (as is most project food aid) is more likely to be additional, whereas food aid that is sold in the country (such as U.S. Title I imports and most other program food aid) is not

usually additional. Maxwell's study, which is based on country case studies,¹¹ presents an example of this approach:

The country studies show an interesting difference between cereal aid and dairy aid and between direct aid and indirect aid. In general, dairy aid was far more likely to represent additional imports than was cereal aid, and indirect aid through the World Food Program or non governmental organizations was far more likely to be additional than was aid provided directly by the Community to recipient governments.... If we can generalize to say that cereal aid provided for sale is a substitute for commercial imports and therefore provides balance of payments support, whereas the rest of the program does not, then it appears that about a quarter of the Community programme by value is in effect direct balance of payments support.... (page 3.5)

These estimates therefore shed little empirical light on the degree of additionality for program food aid such as the U.S. Title I program, because they assume that such aid is additional.

Review of the Quantitative Literature

The quantitative literature supports the view that program food aid is only partly additional, but the degree of substitution for commercial imports varies greatly from country to country. Before turning to the results of the specific studies reviewed, two points that emerge from the literature as a whole deserve emphasis:

- Country policies play an extremely important role as an intermediating variable between food aid and its impact on commercial trade. Many of the studies deal with cases where commercial food imports are largely determined by the government, rather than responding directly to market forces, and/or where the domestic food market is decoupled from the international market by a range of food market interventions. It is important to note that the rapid evolution in agricultural and trade policies under way

11. Studies were completed for ten countries: Bangladesh, Egypt, Ethiopia, India, Mali, Pakistan, Peru, Tanzania, Senegal, and Somalia. Although copies of the studies could not be obtained, the description of the methodology provided by Maxwell suggests that the studies did not include quantitative analysis.

in the developing world has dramatically changed the policy framework since the time when most of these studies were completed. Market forces now play a much larger part, both in the domestic food market and in developing country trade.

- The interactions between food aid, the domestic market, and international trade are shaped and influenced by the individual country situation. The findings from analysis of a specific country experience may not apply to another country with a radically different context, nor even to the same country in a different time period.

The second factor has led several authors to comment on the indeterminacy of the formal quantitative literature and the sensitivity of the results obtained to the model and the specific data used. Clay and Singer cite one of the several Indian studies in concluding:

Blandford and Plocki show the importance of clear specification of the way in which government intervention through dual price operations affects price determination and output. They also demonstrate the sensitivity of results to analysts' choices, such as the sample periods and specifications, underlining the lack of robustness of such models. The issue cannot be determined on a head-count of modelling exercises, therefore.... (page 34)

This study confirms the diversity of results that have been obtained in the empirical analyses of individual country experience, and it highlights the absence of studies taking a broader view of experience across countries (whether such a study is possible in view of the major differences among countries is an issue that will be revisited in the final section of this report).

An interesting difference emerges between the single-country studies and those combining data from several countries in a single analysis. Whereas the single-country (pure time-trend) studies found negative impacts on commercial trade, the multi-country (cross-sectional and time-trend) studies tended toward the opposite result. Thus Lavy (1989/2) found that increases in food aid had a positive impact on commercial imports the next year and the year following, but a negative impact in the third year, while Morrison found a positive impact both on total imports and commercial imports.

The reasons for this difference are unclear, but at least two possible explanations can be suggested:

- The single-country models tend to be more sophisticated than the multi-country models, using more explanatory variables, and thus they may do a better job of measuring the true relationship.
- The multi-country models may be reflecting the fact that countries with high structural food deficits tend both to receive food aid and to import commercially, in comparison to countries that are comparatively self-sufficient. Thus, both food aid and commercial imports are related to a third variable, the overall food deficit.

These two points deserve further elaboration. With respect to the comparative sophistication of single-country studies, it is evident that the narrower focus of these studies permits the analysts to include a wider range of variables (because comparable cross-country data for many economic variables are extremely difficult to compile) and to adjust the model to reflect local conditions (by including dummy variables to reflect exogenous factors such as wars). Development of a simultaneous equation system for a multi-country analysis is also impractical and of questionable theoretical validity, limiting this useful technique to single-country studies.

Turning to the second point, it would appear logical to expect countries with a large food deficit both to import more commercially and to receive more food aid. Moreover, countries with a large food deficit in a given year are also more likely than countries without such a deficit to have a history of deficits. Given this relationship, there would be a tendency for countries receiving a large quantity of food aid in a given year to be the same countries as those receiving comparatively large quantities of commercial imports the next year. In this situation, an econometric estimate would tend to find a positive relationship between commercial imports and food aid (lagged or otherwise), even if it included production.

In this regard, it is interesting to note that Lavy's coefficient estimates for Africa are relatively unaffected by whether production changes are included as a variable explaining trade. In other words, variation in production within a given country over time (as contrasted to variation in self-sufficiency across countries) had little explanatory power regarding variation in imports. In the case of Africa, this relationship may also reflect the segmentation of the cereals market into an urban market dependent on an imported product (often wheat or rice) and a rural market dependent on a local grain (such as sorghum or maize). The literature generally does not examine these market structure or cross-product relationships in depth.

The coefficients estimated to measure food aid's impact on commercial import quantities in single-country studies do not show a tendency to cluster around a single level, but several of them are concentrated in the range

between -0.30 and -0.90. These include Clay's two estimates for Sri Lanka, Hall's two estimates for Brazil and Colombia, Mann's estimate for India,¹² and one of Maxwell's estimate for Ethiopia.¹³ Several studies found a negligible impact, however, including another study of India by Srivastava et al., Bezuneh's study of Tunisia, and Rosen's estimate for Madagascar. A small but positive relationship between food aid and commercial imports was found by Rosen in the Sudanese case (with an estimated elasticity of 0.09) and in several worldwide or regional studies using pooled data (two estimates developed by Lavy from African data and Morrison's estimate using worldwide data).

A summary of the estimates reported is shown in Figure 2, included at the end of this section. In this figure, estimates are quantity-based coefficients, unless otherwise identified.¹⁴

The three studies by Bolling (covering Jamaica, the Dominican Republic, and Trinidad and Tobago) are not included in the table because the methodology used produced coefficient estimates that are not comparable to the others, for several reasons. Bolling used total food imports (all commodities) rather than limiting the analysis to the commodity provided as food aid or to the commodity group affected (e.g., cereals). Moreover, the units of measure in this study were somewhat unusual (food aid is expressed as the real per capita value in local currency terms, while commercial food imports are expressed as a per capita quantity index, calculated based on the 1975 market basket of imports), making it difficult to interpret the coefficients. Bolling also reports elasticity estimates, calculated at the mean of the variable. The estimated elasticities are low but negative (-0.03) for Jamaica and low but positive for the Dominican Republic (0.054)

12. The reestimation of food aid's impact in India, reported in Rogers, et al., and Srivastava, et al., found a much lower coefficient, -0.01.

13. The estimate derived from the simple (single-variable) regression is -0.49, but the estimate derived from the multiple regression including production is positive (0.79).

14. The interpretation of these two types of estimates is somewhat different. A quantity-based estimate of -0.50 suggests that each additional ton of food aid reduces commercial imports by 0.5 tons. By contrast, an elasticity estimate of -0.50 suggests that a 1 percent increase in food aid causes a 0.5 percent drop in commercial imports. If food aid and commercial imports are roughly equal in quantity (each accounting for half of total imports), the two estimates give similar results: commercial imports would drop by about one-half ton for each ton of food aid if the estimated elasticity is -0.5. If, however, food aid is much smaller than commercial imports, the estimated impact of an additional ton of food aid would be much greater than one-half ton in the case of the elasticity estimate (and conversely if food aid is large relative to commercial imports).

(no estimate is reported for Trinidad and Tobago, which received relatively little food aid in the period studied).

Overall, the models performed well in explaining the variation in commercial imports over the time periods studied. Where the authors report the R^2 , it is generally in the respectable range for economy-wide studies, indicating that the models have included many of the variables that explain changes in commercial imports over time. It is not possible to determine the extent to which variations in food aid account for variation in commercial imports, however, because none of the authors presents the results of the modeling exercise with and without food aid. Moreover, where measures of the validity of the food aid estimate are reported by the authors,¹⁵ the results are mixed. Only 4 of the 25 country estimates derived by Shapouri and Rosen from African data were statistically significant at the 10 percent level or higher, suggesting that the linkage between food aid and commercial imports in Africa is weak as discussed above.

The studies examining trade impacts are noteworthy for their failure to differentiate among different types of food aid programs or to examine long-term effects. In this regard, it is noteworthy that none of the quantitative studies used lags of more than three years. Indeed, Morrison used only one year of data for his multi-country study (although he attempted to distinguish between long- and short-term impacts through selection of appropriate explanatory variables, including GNP, degree of urbanization, agricultural population density, and production).

By contrast, some of the non-econometric studies made an attempt to examine long-term impacts, although the lack of rigorous analysis makes it difficult to judge the validity of the analysis. Mason's non-econometric study of Korea, for example, demonstrates that the proportion of agricultural output accounted for by grain declined between 1955 and 1974 and that commercial imports rose dramatically over the same time period (increasing five-fold). He concludes that food aid contributed to the rise of commercial imports over time by depressing grain prices, encouraging farmers to shift to other, higher-value products.

Given the limited attention to long-term impacts, it is not surprising that the quantitative studies give very little consideration to the relationship between the source of food aid and the source of commercial imports. Vengroff demonstrates a positive relationship between a country's food aid receipts and the likelihood that it has a balance of payments deficit with the United States. Although he interprets this as evidence that food aid contributes to the recipient's dependency, it could also be seen as evidence that food aid is used as balance of payments support for customers of the United States, thereby indirectly underwriting not only U.S. commercial food

15. That is, standard errors or T-statistics.

sales but other exports as well. Political factors would appear to have played a role in the relationship between food aid levels and the source of commercial imports. Blue, for example, cites the sudden shift in Egyptian commercial wheat imports from European sources to the United States when a cut in PL 480 levels appeared imminent.

A final conclusion to be drawn from the studies is the extent to which the findings are sensitive to the modeling technique used. In both Colombia and India, longstanding controversies have arisen regarding food aid's impacts on the recipient country, both in terms of agricultural production and import levels. The analysis of the Colombian case has focused primarily on production impacts, but the more extensive Indian literature discusses both trade and production impacts. Analysts examining food aid's impacts on the Indian economy ((Blandford and von Plocki, 1977); (Mann, 1967); (Srivastava et al., 1975); and (Rogers et al., 1972)) differed greatly in the extent to which they found significant food aid impacts. Using identical data, (Mann, 1967) and (Srivastava et al., 1975) reached very different conclusions. Whereas Mann found that each ton of food aid displaced approximately one-third ton of commercial imports, Rogers et al. measured only a one-hundredth ton decline for each ton of food aid. The two analyses differed primarily in the assumptions made with regard to the demand system. Mann did not differentiate the market to reflect the large proportion of food aid moving through the subsidized government distribution system, whereas Rogers et al. did. As a result, Mann's model gave less emphasis to any potential increases in demand generated by food aid, which would have the effect of counterbalancing the increase in supply caused by food aid. (With regard to the other studies, Srivastava et al. reports the same analysis as Rogers et al.; the other authors did not measure food aid-trade interactions directly.)

Alternative estimates of the impact of food aid in Ethiopia (Maxwell, 1986) provide another example of the sensitivity of estimates to model specification. When the model is estimated with commercial imports as the dependent variable and food aid the previous year as the only independent variable, the result is a negative relationship between the two, but when production in the previous year is also included, the estimated coefficient on food aid is positive (and not significantly different from zero). Given that the R^2 is higher in the latter model (75 percent versus 37 percent), the latter estimate would appear more reliable.¹⁶

16. In effect, the R^2 measures the percentage of the variation in the dependent variable that is explained by the independent variables. Thus, in this case, food aid alone "explains" 37 percent of the variation in commercial imports, whereas the variables in the larger model account for 75 percent of the variation.

Implications for Food Aid Policy and Practice

The analytic studies of food aid's impact tend to support the widespread view that this impact is largely determined by the policy environment within which food aid programming is implemented and, in particular, by the degree to which the government intervenes to support producer prices or lower consumer prices. The studies highlight the extent to which interventions in the consumer market (such as subsidized distribution) can play a role in reducing or eliminating possible negative impacts on both imports and domestic production by increasing demand or by channeling food aid to recipients who are not a significant source of market demand in the absence of such aid.

Several examples of the role of policy in shaping food aid's impact on trade may be drawn from the literature studied:

- The Indian literature — particularly Srivastava et al. — demonstrates that policy interventions that partition the food market to channel food aid to individuals outside the commercial market greatly reduce the potential for negative impacts on commercial imports, and on domestic production.
- Dudley and Sandilands' study of Colombia argues that misguided policies in the agricultural sector inhibited domestic production, making both concessional and commercial imports larger than they would have been had domestic price signals been more efficient.
- Clay argues that commercial imports, rather than food aid, have been used by the Government of Sri Lanka as the swing variable, providing supplies to balance shortfalls in local production and unexpected changes in concessional aid. In the absence of food aid, commercial imports would presumably have been greater.
- Della Torre and Norton's study of El Salvador suggests that policies regulating the exchange rate and foreign exchange availability have been the driving force behind domestic agricultural performance, depressing production and making it necessary to rely on both commercial and concessional imports.
- Hall finds that Brazilian commercial exports were reduced both directly and indirectly by PL 480, with the latter impact due to use of PL 480 revenues to support local

prices, leading to increased production, and therefore reduced commercial imports.

- Maxwell concluded that food aid was compensating for the shortfall in domestic marketing that resulted from the poor performance of the agricultural marketing parastatal, rather than driving out commercial imports.

The studies confirm that food aid does displace commercial imports to a greater or lesser extent, at least in the short run. They provide little explanation for the variation in this impact across countries, although variability in access to foreign exchange appears to play a major role (and should be incorporated into future analysis). In other words, as common sense would suggest, countries with limited capacity to import commercially are unlikely to increase their commercial imports if food aid is reduced. Further analysis would be necessary to determine the factors that increase or decrease food aid's impact on private trade and how these factors might be incorporated into food aid planning to minimize negative trade impacts.

The conclusion that food aid's disincentive impact is lessened by use of below-market-price distribution channels, which must be regarded as highly tentative, suggests a need to reexamine the trend toward sale of food aid into market channels (and away from subsidized or targeted distribution programs). As noted by Isenman and Singer¹⁷ and Schultz in the context of possible disincentive effects, programs that provide a net increase in consumption by low-income consumers are less likely to reduce demand in market channels. Whether such programs can be implemented effectively (without substantial linkage into upper income levels) or sustained financially is another question, of course.

It must be emphasized that program design characteristics that appear likely to limit short-run negative impacts on commercial imports are, to a large extent, the same characteristics that would appear least likely to lead to positive long-term impacts on commercial trade. In other words, food aid programs that use food aid to subsidize consumption in the low-income population are not likely to lead to the types of structural changes that would support commercial import expansion. These programs are almost always implemented through government channels, and thus do not help to build up private channels either domestically or internationally. They are at least partially dependent on the subsidy element inherent in food aid (whether Title I or Title II) and would be difficult to sustain based on commercial imports. They reduce the pressure to raise local agricultural production or

17. Annotated in the supplemental bibliography on production effects in Annex 3.

find other ways of sustainably raising rural and urban incomes, thus delaying policy and programmatic actions needed to speed economic growth.

On the other hand, the income transfer provided may help to fuel demand-led growth in other sectors of the economy (including non-staple crop agriculture, as may have been the case in Korea), leading to broad-based economic expansion, increased demand for food, and expanded import opportunities. The complexity of the linkages among local production and incomes, consumption, food aid, and trade argue for a more focused examination of these issues and how the relationships among them have evolved in fact, rather than in theory.

Table 3. Summary of Quantitative Findings on Trade Impacts

Key:

AIDQUAN Quantity of food aid
 PRIWRDL World price of commodity
 GNP Gross national product
 PROD Domestic production
 COMIMP Imports of commodity
 PRIDOM Domestic price of commodity
 FOREX Foreign exchange
 AIDVAL Value of Food Aid
 GDP Gross Domestic Production

Note: a number following the author's name identifies multiple models presented in the same study; a number following the study date identifies different studies by the same author published in the same year.

Dependent Variable	R sq	Author	Country	Date	Coefficients on Explanatory Variables								Comments	
					AIDQUAN	PRIWRDL	GNP	PROD	COMIMP	PRIDOM	FOREX	GDP		
Quantity of commodity imports	0.924	Bolling	Dom.Rep.	1983/1	-6.899	-2.187		-0.223					133.738	Elasticity of imports w.r.t. food aid 0.054; T-stat. on food aid 0.807 (not significant at 5% level) All but PROD significant at 95%; t-stat on food aid 1.195; elasticity of imports w.r.t. food aid -.030 F-stat = 37.7311; DW stat = 2.152 Forex was excluded due to multicollinearity w/ reserves; t-stat on food aid = 2.125 (signif. at 95%); elast. = -.016 F-stat = 49.384 DW stat = 2.0408 4 years of lag coefficients calculated sum of lag = -0.38 T-stat on AIDQUAN = 8.28
	0.921	Bolling	Jamaica	1983/2	-5.969	-0.411	0.235	0.494			0.343			
	0.883	Bolling	Trinidad	1983/3	-2.337	-0.311		0.365			*comment		0.037	
	0.9251	Della Torre & Norton	Salvador	1988				-0.2711				1.5653		
	0.42	Lavy	Africa	1989/1				*coef 11						
	0.82	Morrison	Worldwide	1984	1.96		0.06	-20.5/				-4.36		
Value of commercial imports		Shapouri & Rosen	Africa	1987	*comment	*comment		*comment	*comment		*comment		All coefficients for each of 25 countries reported in annotated biblio Countries shown are those where food aid variable is significant at 10% level. Estimates are elasticities	
			Liberia		0.07	-0.34		-3.45			1.23			
			Mali		0.13	NA		-2.34			0.46			
			Sudan		-0.06	-0.21		-0.35			0.1			
			Senegal		0.17	-0.26		-0.4			0.21			
Quantity of commercial imports	0.9382	Bezuneh	Tunisia	1983	0.0002			0.8678			-0.0001		DW stat = 1.44 Coefficient on DUM = 5.87; on time trend = 0.70; all but dummy are significant at 5% level. Reduced form multiplier = -.809 Reduced form multiplier = -.404 Each 1 MT decr in dom grain prodn is met by .38 MT in imports, over 4 yrs.	
	0.582	Clay/1	Sri Lanka	1983/1	-0.67				0.91					
		Clay/2	Sri Lanka	1983/2	-0.76									
		Hall	Brazil	1980/2	-0.8935			-0.839			2.1811	0.1008		
	0.424	Hall Lavy	Colombia Africa	1980/2 1989/1	-0.5226			-1.6722 -0.38			-15.4932	0.2245		

Table 3. Summary of Quantitative Findings on Trade Impacts

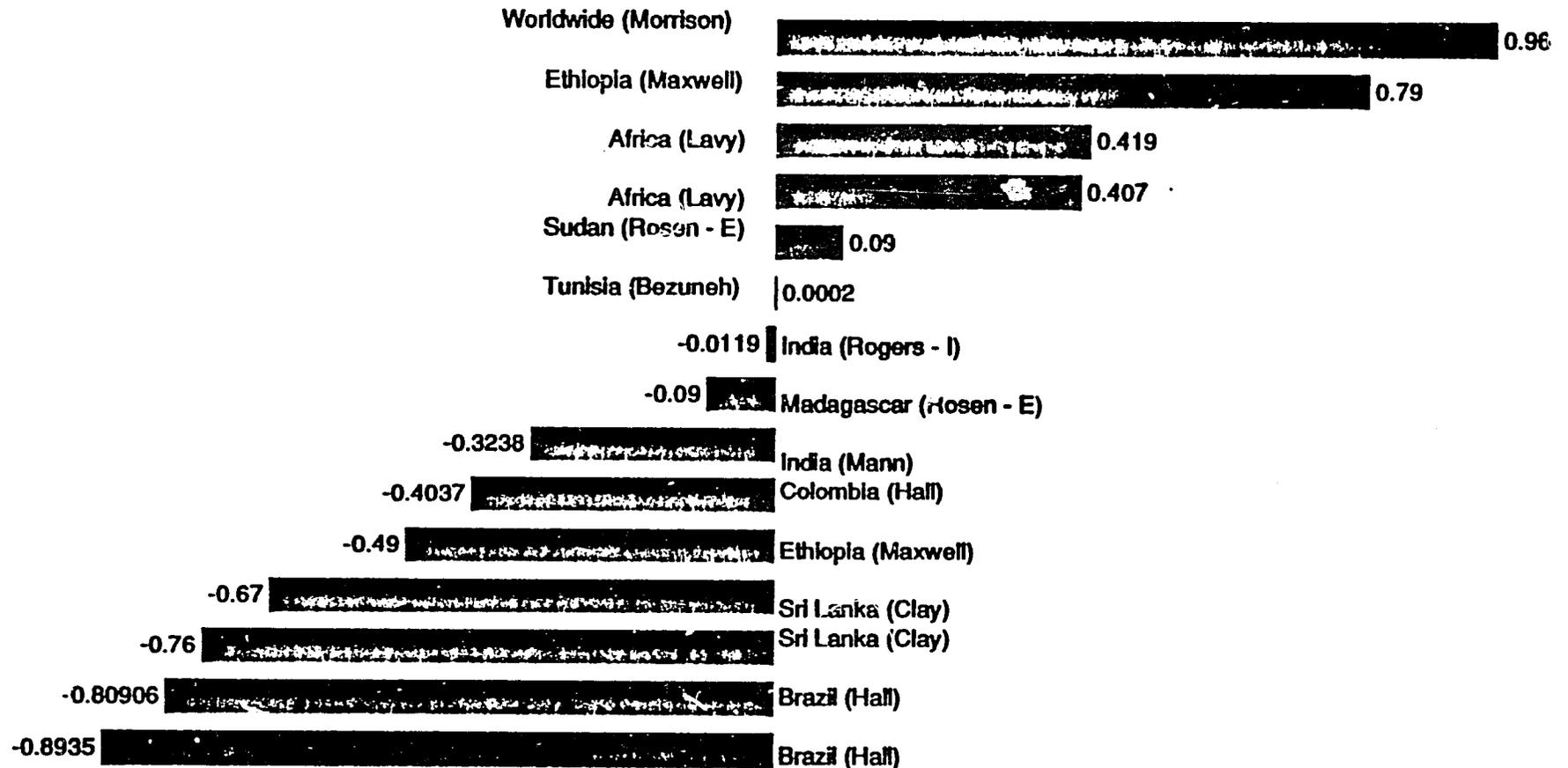
Key:

AIDQUAN Quantity of food aid
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 AIDVAL Value of Food Aid
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Note: a number following the author's name identifies multiple models presented in the same study; a number following the study date identifies different studies by the same author published in the same year.

Dependent Variable	R sq	Author	Country	Date	Coefficients on Explanatory Variables							Comments	
					AIDQUAN	PRIWRLD	GNP	PROD	COMIMP	PRIDOM	FOREX		GDP
		Lavy/1	Africa	1989/2	0.407			-0.015	-0.59				Impact of variable lagged 1 yr Impact of variable lagged 2 yr Impact of variable lagged 3 yr Impact of variable lagged 1 yr Impact of variable lagged 2 yr Impact of variable lagged 3 yr Also includes a supply variable, with estimated coefficient of -0.354 T-stat on AIDQUAN = 4.06 Impact multipliers calc. from reduced form 17 sets of coefficients reported, one for each country studied— see biblio Countries shown are those where food aid coefficient significant at 5% or higher. Coefficients are elasticities. Same analysis as in Rogers et al.
					0.128			-0.004	-0.318				
		Lavy/2	Africa	1989/2	-0.012			0.005	-0.095				
					0.419				-0.6				
					0.112				-0.327				
		Mann	India	1967	-0.3238				-0.083				
	0.37	Maxwell/1	Ethiopia	1986	-0.49								
	0.747	Maxwell/2	Ethiopia	1986	0.79			-0.0605					
	0.66	Morrison	Worldwide	1984	0.96		0.06	-20.57		-4.36			
		Rogers et al	India	1972	-0.0119					-0.0424			
	0.61	Rosen	Africa	1989	*comment	*comment		*comment		*comment			
	0.41		Madagas.		-0.09	-0.23		-6.21		1.03			
			Sudan		0.09	-0.41		-0.32		-0.2			
		Srivastava	India	1975									

Figure 2. Coefficient Estimates of Food Aid Impact on Commercial Imports



Coefficients shown estimate change in commercial import tonnage per ton of food aid, except entries designated E (which are elasticities) and entry designated I (which is an impact multiplier)

QUESTIONS REMAINING TO BE ANSWERED

Gaps in the Literature

Taken as a whole, the evidence presented in the formal literature tends to confirm the common-sense expectation that food aid displaces commercial trade in the short term, at least in part. As the foregoing discussion makes clear, however, several major issues are left unexplored by the studies completed to date, making it difficult to draw firm conclusions for programming. The direction and nature of food aid's long-term effects on commercial trade is scarcely addressed by currently available studies, nor are the short-term impacts fully explored.

Turning first to the long-term impacts on trade, the basic issue that emerges is how food aid recipients' participation in international markets evolves over time, and how this evolution is related to food aid. Within this broad issue, we can identify four questions where further information would be highly desirable in understanding food aid's role in development and trade:

- Are food aid recipients more or less likely to become commercial importers as their economies grow, compared to economies with similar growth performance but not receiving food aid?
- Whether or not commercial imports expand, is the food aid donor more or less likely than other suppliers to capture a share of any market growth that may occur, or to increase its share of the total import level?
- Do shifts in demand or supply patterns take place as the result of food aid that increase consumption of imported commodities at the expense of local commodities (the taste preference issue)?
- What role does food aid play in promoting or accelerating the growth of income and agricultural

production, leading to changes in import patterns over time?

As further discussed below, the first three questions appear readily subject to quantitative analysis with the information available. The fourth question, however, is extremely complex and, as noted above, may be inherently indeterminate on a global level.

Fewer gaps remain in our overall understanding of short-term impacts, but the picture at this level is far from complete, in four respects. First, it should be noted that, although three analyses have been undertaken using cross-sectional data from a large sample of countries, each of these studies is flawed with respect to its methodology or its relevance to food aid programming. Morrison uses a data set with only one year of observations (and, moreover, the year selected — 1979/80 — was the year of the second oil shock and thus may not be representative). Vengroff's study shows a clear bias toward a view of food aid as a tool of economic dependency and, in any case, does not directly link food aid and commercial imports. Abbott's study appears to be sound methodologically, but the data set used does not extend beyond 1973. The substantial changes that have occurred in both world grain markets and food aid programming since that time, as well as both oil price shocks and the emergence of the debt crisis, suggest that this analysis should be updated. In sum, there is not an up-to-date, methodologically sound analysis of the interaction of food aid and trade levels in the short run across the full range of countries.

Second, this gap is only partially filled by the country and regional studies. Although the single-country literature that was identified by the team covers a wide range of countries and time periods and produces generally consistent results, it falls well short of providing a comprehensive overview of experience. Several of the major recipients of food aid, particularly the important Asian "graduate" group, are overlooked in the current literature. This gap could usefully be filled by a small group of well-chosen and methodologically consistent case studies, providing a sound basis for determining whether the studies cited in the non-analytic literature that argue for additionality stand up to closer scrutiny.

Third, the literature does not effectively differentiate impacts by type of program. With increasing emphasis on program food aid and on the sale of food aid of all types, this differentiation should be made to clarify how program design affects food aid's impact on trade and production. Here again, a limited set of case studies using a consistent methodology offers the most direct means of filling an important gap.

A fourth gap in the literature on short-term impacts exists with respect to the incorporation of the effect that alternative food aid distribution systems (targeted/untargeted, subsidized/unsubsidized) have on the presence

or absence of trade impacts. Although the literature (and in particular the series of articles on India, where such programs play a major role) suggests that the incorporation of the domestic market's structural features would add to the power of the analysis, a further review of data availability would be necessary to determine whether this refinement could be included. In the absence of such information, we would suggest that this feature could be included in a series of country case studies, but it would be very difficult to include in a worldwide model, due to the difficulty of assembling reliable information on the scale and targeting of such programs over time in a large number of countries. As noted earlier in this report, large food subsidy programs are being phased out in a growing number of developing countries for reasons of cost that are only indirectly related to food aid programming. The evolution toward market systems makes it less important to include this feature as a guide to future programming, although it may still be useful in understanding the historical experience.

What Is the Next Step?

Major gaps clearly exist in the formal literature, making it impossible to draw firm conclusions regarding food aid's long-term impacts on commercial trade and market shares. Given these gaps, it is appropriate to ask whether these gaps can be filled and, if so, whether an effort should be made to find the answers to the questions outlined above.

The answer to the first question is a guarded "yes." The body of single-country and multi-country literature provides a sound methodological basis for a more comprehensive and updated analysis of the data. This task could best be approached along two parallel tracks:

- A worldwide analysis using a methodology based on that used by Lavy, but modified if data permit to capture longer-term impacts, to differentiate among types of food aid programs, and possibly to incorporate macroeconomic variables, such as changes in national income and/or the trade balance. Additional methodological work is necessary to decide whether to pool data or examine major recipients individually, focusing on the countries with a 30 year history as food aid recipients. To keep the number of variables within acceptable limits, it would be necessary to combine food aid levels in earlier periods (average receipts over each five-year period, for example), but the appropriate methodology for doing so requires further examination.

- Selected country case studies for countries with a long history of food aid, using an expanded methodology based on the models developed by Abbott, Shapouri and Rosen, Clay, and others. Several approaches should be examined to deal with the question of domestic market differentiation, including expansion of the model to include data on the proportion of food moving through such channels (if available), or countries with large targeted subsidy programs could be excluded from the analysis. Like the cross-country model, the country models would incorporate world price levels and basic macroeconomic information.

These complementary analyses would greatly clarify the relationship between food aid and trade over time, including the link, if any, between the food aid donations and later commercial sales, the evolution over time in the commodity mix of imports and local production, and other specific issues of interest. The analysis proposed would move the debate on food aid impacts beyond the level of anecdote, providing a broad-based and definitive answer to the four questions cited above.

It is more difficult to predict whether the study proposed would demonstrate a causal linkage between food aid and the evolution of the commercial market, as opposed to an association between food aid and subsequent increases in commercial imports. Even if such a causal linkage cannot be demonstrated, the study would constitute a major addition to current understanding of food aid's role in long-term market development.

The primary value of the study for food aid planning would be to clarify food aid's role in long-term market development. Market development considerations have been a central part of the food aid program rationale since its inception, and they have been an important element of food aid decision-making. The appropriateness of including such considerations in food aid allocation and management decisions clearly depends on the validity of the food aid-trade relationship. If, in actual fact, food aid does not appear to have a significant market development impact, then market development should not be a factor in these decisions. Conversely, if food aid does appear to be linked to the later evolution of commercial markets, then a better understanding of these linkages should lead to better food aid policy from the perspective of both the recipients and the donors.

Both parts of the analysis would draw primarily on information that is readily available in published sources, including food aid levels, commercial import levels by source, agricultural production, foreign exchange position, and income. In order to finalize the methodology outlined above and to determine the appropriate scope and scale of an expanded analysis of food aid impacts, it would be necessary to reach a more complete understanding

of the resources required to carry out the analysis. This understanding would require a review of the availability of the information needed for the study in more detail, to confirm which data are available and to consider alternative model structures based on data availability and comparability.

The next step in the analysis of food aid impacts is therefore to review this information and to develop a model structure that is both methodologically sound and feasible, taking into consideration both the information available and the nature of the issues to be studied. Whether or not the decision is made to go forward with the analysis at this time, such a data review would serve a valuable secondary purpose for food aid planning, making it a useful exercise in itself.

ANNEX 1. ANNOTATED BIBLIOGRAPHY

This bibliography consists of three sections. The first section lists the studies referenced in the text, including both those that provide a rigorous examination of food aid impacts and other key references on this issue. The second section provides fully annotated entries for the analytic studies. (Studies in the first bibliography that are annotated but do not include quantitative analyses are indicated with a +; non-quantitative studies that were not annotated are marked with an asterisk.) The third section provides a bibliography of food aid studies, developed by the team as the basis for identifying quantitative studies. Most of these studies were obtained and reviewed by the team, but a few could not be located due to time and resource constraints; some of the studies in the latter group undoubtedly contain quantitative analyses of food aid impacts on trade, but these could not of course be reviewed by the team.

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- Srivastava, U.K. et al. *Food Aid and International Economic Growth*. Iowa State University Press. 1975.
- Vengroff, Richard, and Yung Mei Tsai. "Food, Hunger, and Dependency: PL 480 Aid to the Third World." *Journal of Asian and African Studies*, v. 17., pp. 250-265. 1982.
- von Braun, Joachim. "Effects of Food Aid in Recipient Countries. Egypt and Bangladesh, a Comparative Study." *Economics*, Volume 26, Tübingen, Germany: Institute for Scientific Co-operation, 1982. 47 pages.

Part 2. Annotated Bibliography

- Abbott, Philip C. *Modelling International Grain Trade with Government Controlled Markets*. Volume 61, Number 1. American Journal of Agricultural Economics. February 1979.

Nature of the document: A model of international grain trade, treating government as an endogenous variable rather than an exogenous influence, used to interpret parameters in a net import demand model.

Country or countries covered: Worldwide, 33 countries

Time period covered: 1951 - 1973

Summary of findings on production impacts and interactions: Estimates tentatively support the hypothesis that there is not a one-to-one correspondence between trade and production, as suggested by the USDA-type models. Government self-sufficiency policies and segmentation of domestic markets are cited as causing variation in net import demand to be substantially less than variations in production.

Summary of findings on trade impacts and interactions: The linear price response coefficients obtained in estimations were used to determine consumption-based net import demand price elasticities. The econometric estimates obtained are weak, but some consistent results have been obtained. The data does support the hypothesis that importing countries that must allocate limited foreign exchange to payments for grain may be influenced by export receipts and foreign capital inflows, or by the receipt of foreign aid in kind, when they make import decisions.

Summary of other findings: None discussed

Methodology used: A generalized reduced form net trade equation derived from a system of 13 equations; instrumental variables estimation techniques used.

Formula or model presented: Reduced form net trade equation derived from system of equations:

$$\begin{aligned}
 XT = & c' - d \cdot PW \frac{XC_0}{PW_0} + bXA - a'XP + j'FX + k'XS + g_2POP \\
 & + g_3INC + g_4T + g_5AN
 \end{aligned}$$

The food aid equation in the underlying equation system is expressed as:

$$XT = XC - XQ + bXA$$

Where

- XT = net imports
- d = short-run adjustment to the world price (change in the consumer price, given a change in the world price)
- PW = world market price
- XC = consumption
- XQ = domestic marketed supply
- XP = production
- FX = foreign exchange inflows
- XS = stocks on hand
- POP = population
- INC = national income at constant prices
- T = time trend
- AN = stock of animals in relative feed units
- XA = aid in kind received
- b = fraction of aid in kind which becomes additional demand

NOTE: The published version of the study, which is based on the author's dissertation, does not report the coefficients for XA (aid).

- Bezuneh, Mesfin and B. J. Deaton. *Food Aid Disincentives and Economic Development: Some Reconsiderations of the Tunisian Experience*. Virginia Polytechnic Institute and State University. 1983.

Nature of the document: An econometric analysis of the developmental impact of food aid to Tunisia.

Country or countries covered: Tunisia

Time period covered: 1960 - 1979

Summary of findings on production impacts and interactions: The model predicts impact multipliers which indicate that an increase in one metric ton of food aid in the current year has no effect on domestic supply and real income in the current year, but is expected to result in a reduction of 1.0 unit in the value of the price index (thus an increase in real incomes) in the same year. The authors suggest that food aid may not have a significant disincentive effect in either short-run or long-run time periods.

Summary of findings on trade impacts and interactions: The model predicts that one metric ton of food aid in the current year results in an increase of 0.0003 MT of commercial imports, thus an increase in total food supply.

Summary of other findings: The authors view the effects on Tunisia's agricultural sector as ambiguous. The greater demand for food resulting from growing real incomes and the income effect of cheaper food may stimulate demand -- on the other hand, the negative multiplier of food aid for domestic supply could dampen production incentives.

Methodology used: A system of four simultaneous equations and one market-clearing identity, with a total of nine variables.

Formula or model presented:

$$IC = a_0 + a_1Q_s + a_2PQ + a_3FA$$

Where

IC = per capita commercial imports of grains
 Q_s = per capita domestic production
 PQ = wholesale price index of food grains
 FA = per capita food aid imports

- Blandford, David, and Joachim A. von Plocki. *Evaluating the Disincentive Effect of PL 480 Food Aid: The Indian Case Reconsidered*. Cornell University, Department of Agricultural Economics, July 1977.

Nature of the document: This study was completed by the authors while affiliated with Cornell University's Department of Agricultural Economics. The study seeks to identify and remedy deficiencies in previously completed econometric studies that attempted to calculate the disincentive effects of food aid. The authors review previous quantitative models, namely those of Mann (1967); Rogers, Srivastava, and Heady (1972), and Barnum (1971) and specify a new model, based on various assumptions and parameters of the earlier models, to estimate the disincentive effects of food aid imports. The authors' model estimates the effect of PL 480 imports on production during a single time period; a series of time periods, and over time using various impact multipliers.

Country or countries covered: India

Time period covered: 1952 - 1968

Summary of findings on production impacts and interactions: The study found that, during a single time period, a unit increase in PL 480 (1 million tons) decreases the cereal price index by 2.25 units. Using a long-run multiplier, the study estimated the production impact of a sustained increase of 1 million tons of PL 480 imports to be -0.149. Therefore, sustained increases in food imports of 1 million tons would reduce domestic production by 149,000 tons over the seven-year long-term period. The results indicate that the greatest impact of food aid imports on domestic production occurs in the next year with a long-run equilibrium reached in the seventh year.

Summary of findings on trade impacts and interactions: The study found that, during a single time period, roughly 81 percent of a hypothetical 1-million ton increase in food aid would displace commercial imports, leading to a decline of 12.9 percent in such imports.

Summary of other findings: For a single time period, the study found that a unit increase in food aid imports increases consumption by 1.86 kg per capita, replaces withdrawals from government stocks by 6 percent, and decreases the food gap by the amount of the additional aid.

Methodology used: A simultaneous equation model was used employing impact multipliers.

Formula or model presented:

$$\begin{aligned}
(1) \quad A_t &= 11.1208 + 0.3463A_{t-1} + 0.1061P_{t-1} + 0.1104R_t + 62.5715N_t \\
(2) \quad Y_t &= -0.2412 + 0.0024R_t + 0.0117T \\
(3) \quad QDC_t &= 86.0746 - 0.8260P_t + 0.2685PS_t + 0.3183IC_t \\
(4) \quad I_t &= 49.9835 + 0.3344QS_t + 0.4435QI_t \\
(5) \quad M_t &= -0.1684 + 0.1291QG_t + 0.1618FX_t \\
(6) \quad W_t &= 0.0752 + 0.0600QG_t + 0.5901S_t - 0.2700PR_t \\
(7) \quad QS_t &= A_t Y_t \\
(8) \quad QD_t &= 0.875QS_t + M_t + W_t + PL480_t \\
(9) \quad QDC_t &= QD_t / N_t \\
(10) \quad IC_t &= I_t / N_t \\
(11) \quad QG_t &= QM_t - 0.875QS_t - PL480_t
\end{aligned}$$

Where

A	=	area sown to cereals
Y	=	yield
QS	=	total domestic cereal supply
P	=	deflated wholesale price index of cereals
I	=	total consumer income
M	=	commercial imports
W	=	withdrawal from stocks
QDC	=	per capita demand for cereals
QD	=	total demand for cereals
IC	=	per capita consumer income
QG	=	expected food gap
R	=	rainfall index
T	=	time trend
PS	=	deflated price index of consumption substitutes for cereals
QI	=	index of industrial production
FX	=	effective level of foreign exchange reserves
S	=	beginning period stocks
PR	=	internal procurement of cereals by the government
N	=	population
QM	=	physiologically necessary minimum availability of cereals
PL480	=	food aid imports
t	=	calendar year

- Bolling, H. Christine. *Jamaica: Factors Affecting its Capacity to Import Food*. International Economics Division, Economic Research Service, U.S. Department of Agriculture. FAER-176. January 1983.

Nature of the document: An empirical examination of Jamaica's food imports and the factors affecting her ability to import food, including regression analyses of those factors' importance.

Country or countries covered: Jamaica

Time period covered: 1960 - 1980

Summary of findings on production impacts and interactions: Domestically agricultural production is directly related to food imports in this model, but was found not to be statistically significant. The author notes that domestically produced foods do not really compete with imports since the types of food imported are quite different from those grown locally.

Summary of findings on trade impacts and interactions: The regression analysis shows real income, government reserves, real import prices, and food aid as highly significant variables determining the quantity of food imported. A ten percent increase in food aid (per capita) resulted in a less than one percent decline in commercial food imports.

Summary of other findings: None discussed

Methodology used: Multiple variable equation analyzed with ordinary least squares (OLS) techniques.

Formula or model presented:

$$PCQIIMP = a_0 + a_1PCREALRES + a_2PCREALGDP + a_3PCAGPROD + a_4REALIMPPR + a_5PCREALAID + a_6DUMMY$$

Where

PCQIIMP = per capita quantity index of food imports adjusted for P.L. 480 imports
 PCREALRES = per capita foreign reserves in constant Jamaican \$
 PCREALGDP = per capita real GDP in constant prices
 PCAGPROD = per capita domestic food production index
 REALIMPPR = food import price index adjusted for import tariffs
 PCREALAID = per capita real value of PL480 imports
 DUMMY = policy changes in 1974 - 1976

- Bolling, H. Christine. *Trinidad and Tobago: Factors Affecting its Capacity to Import Food*. International Economics Division, Economic Research Service, U.S. Department of Agriculture. FAER-178. January 1983.

Nature of the document: Econometric study to explain changes in food imports from changes in real income, real food import prices, population, food supplies and domestic food production, food aid, and foreign reserves.

Country or countries covered: Trinidad and Tobago

Time period covered: 1960 - 1978

Summary of findings on production impacts and interactions: The effect of food aid imports on domestic production was not studied.

Summary of findings on trade impacts and interactions: The quantity indexes of commercial and P.L. 480 imports were found to be inversely related, but statistically insignificant. The effect of food aid imports on the level of commercial imports was impossible to detect statistically due to the limited level of food aid imports to Trinidad and Tobago. There had been no P.L. 480 sales since 1972.

Summary of other findings: Gross domestic production was found to be single most important determinant of Trinidad and Tobago's food imports, with each 10 percent rise in real per capita GDP resulting in a 6 percent increase in the quantity of food imports. Population growth also was found to increase the country's food import requirements by 1.5 annually since 1960. Other variables that were found to influence food imports were real food import prices (each 10 percent rise in real prices reduced imports by 4 percent); foreign reserves (these had little influence over food imports due to their sustained high level through most of the study period); and domestic production (a 10 percent increase in per capita food production reduced food imports by less than 4 percent).

Methodology used: Econometric regression analysis was used to estimate the results using the Cochrane-Orcutt method of estimation.

Formula or model presented:

$$(1) \quad PCQIIMP = f(PCGDP, PCAGPROD, PCRELRES, PCREALAID, REALIMPPR)$$

where

PCQIIMP	=	per capita quantity index of food imports adjusted for P.L. 480 imports
PCGDP	=	per capita GDP in constant 1960 Trinidad and Tobago dollars
PCAGPROD	=	per capita domestic food production index
PCRELRES	=	per capita foreign reserves in constant 1960 Trinidad and Tobago dollars
PCREALAID	=	per capita real U.S. P.L. 480 exports to Trinidad and Tobago in constant 1960 Trinidad and Tobago dollars
REALIMPPR	=	food import price index in constant 1960 Trinidad and Tobago dollars

- Bolling, H. Christine. *Dominican Republic: Factors Affecting its Capacity to Import Food*. International Economics Division, Economic Research Service, U.S. Department of Agriculture. FAER-183. August 1983.

Nature of the document: Econometric study to explain changes in food imports from changes in real income, real food import prices, population, food supplies and domestic food production, food aid, and foreign reserves.

Country or countries covered: Dominican Republic

Time period covered: 1960 - 1980, data for 1974 - 1976 were not available.

Summary of findings on production impacts and interactions: The effect of food aid imports on domestic production was not studied.

Summary of findings on trade impacts and interactions: Food aid imports were not found to offset commercial food imports to any measurable extent, although food aid comprised nearly 30 percent of total food imports during the study period and almost 50 percent of total imports in three years.

Summary of other findings: Gross domestic production was found to be single most important determinant of Trinidad and Tobago's food imports, with each 10 percent rise in real per capita GDP resulting in a 20 percent increase in the quantity of food imports. Population growth of 3 percent annually also was found to increase the country's food import requirements by 3 percent annually from 1960 to 1980. Other variables that were found to influence food imports were real food import prices (each 10 percent rise in real prices reduced imports by 7 percent); foreign reserves (these had little influence over food imports due to their sustained high level through most of the study period); and domestic production (a 10 percent increase in per capita food production reduced food imports by 5 percent).

Methodology used: Econometric regression analysis was used to estimate the results using ordinary least squares (OLS) method of estimation.

Formula or model presented:

$$(1) \text{ PCQIIMP} = f(\text{PCGDP}, \text{PCAGPROD}, \text{PCRELRES}, \text{PCREALAID}, \text{REALIMPPR})$$

where

PCQIIMP	=	per capita quantity index of food imports adjusted for P.L. 480 imports
PCGDP	=	per capita GDP in constant 1960 Dominican Republic pesos
PCAGPROD	=	per capita domestic food production index
PCRELRES	=	per capita foreign reserves in constant 1960 Dominican Republic pesos
PCREALAID	=	per capita real U.S. P.L. 480 exports to the Dominican Republic in 1960 Dominican Republic pesos
REALIMPPR	=	food import price index in constant 1960 Dominican Republic pesos

- Clay, E.J. *Sri Lanka: Food Aid as a Resource Transfer*. Food Policy, Volume 8, No. 3. August 1983.

Nature of the document: A case study on the long-run significance of wheat and wheat flour (EEC, USA, Australian, Canadian) as a resource transfer and the extent to which food transfers have substituted for or been additional to commercial imports.

Country or countries covered: Sri Lanka

Time period covered: 1970 - 1981

Summary of findings on production impacts and interactions: None discussed.

Summary of findings on trade impacts and interactions: Food aid has largely provided balance-of-payments support rather than additional cereals imports, and have substituted for commercial imports. Concessional supplies have been very volatile in the short-run, and commercial imports have been used to stabilize the level of total imports.

Summary of other findings: Unresponsive programming by donors seriously reduced the effectiveness of food aid as a transfer and food security mechanism.

Methodology used: Several multiple variable regression models using ordinary least squares (OLS) methodology.

Formula or model presented: Two models were presented and discussed:

$$(1) \quad \text{COM} = b_0 + b_1\text{WHEAT} + b_2\text{AID}$$

$$(2) \quad \text{PCCOM} = b_0 + b_1\text{PCAID} + b_2\text{DUM} + b_3\text{TIME}$$

Where

COM = commercial wheat imports
 WHEAT = indirectly estimated wheat demand
 AID = wheat and wheat flour food aid
 PCCOM = per capita commercial wheat imports
 PCAID = per capita wheat food aid
 DUM = dummy variable for election years
 TIME = time trend

- Della Torre, Mirna and Roger Norton. *Food Imports: Agricultural Policies and Agricultural Development in El Salvador*. Report to USAID/El Salvador by Robert R. Nathan Associates. June 1988.

Nature of the document: An external study funded by USAID on agricultural policies and food imports (commercial and food aid) in El Salvador, including a historical survey of agricultural policy from 1960 to 1987, and an econometric analysis of the effects of food imports and other variables on agricultural development.

Country or countries covered: El Salvador

Time period covered: 1960 - 1987 (data on 1971-1986)

Summary of findings on production impacts and interactions: Real producer prices have dropped sharply since the late 1970s, after increasing for more than a decade before that. These price trends have contributed to lower production in agriculture, lower agricultural earnings of foreign exchange, and lower average purchasing power in rural households. Econometric analysis found that the overvalued exchange rate has been the major determinant of the decline in real farmgate prices. Results also show that it is not the quantity of agricultural imports (food aid and commercial) in recent years that has depressed local production, but rather the prices of the imports, and that it has been the exchange rate which has been the principal factor in making the import prices low relative to domestic farm prices.

Summary of findings on trade impacts and interactions: The growth of agricultural imports over the past decade has not been sufficient to fully offset the diminishing levels of production. Econometric analysis shows that imports themselves are not depressing domestic production, but that they are both jointly determined by a third force, the exchange rate policy. Authors suggest that appropriate magnitudes for the appropriate increases in agricultural imports each year can be calculated from the import equation estimated in the model, while another of the estimated equations can be used to calculate the likely effect of alternative policies on real farmgate prices.

Summary of other findings: A change in macroeconomic policies would be the key to a program designed to increase agricultural production, increase agricultural exports, and decrease demand for agricultural imports.

Methodology used: Multiple variable regression analysis using ordinary least squares (OLS) method.

Formula or model presented: Three models presented and discussed:

$$(1) \quad \text{IMP} = b_0 + b_1\text{PC} + b_2\text{LDQ} + b_3\text{LOVV}$$

$$(2) \quad \text{RPPI} = b_0 + b_1\text{OVV} + b_2\text{IMPP} + b_3\text{DPC} + b_4\text{DLDQ}$$

$$(3) \quad \text{DQ} = b_0 + b_1\text{LRPPI} + b_2\text{DUM} + b_3\text{IMP} + b_4\text{LDQ}$$

Where

- IMP = quantum index of agricultural imports
- PC = real aggregate private consumption expenditure
- DQ = domestic food production
- LDQ = DQ lagged one year
- OVV = degree of exchange rate overvaluation
- LOVV = OVV lagged one year
- RPPI = real farmgate price index deflated by CPI
- LRPPI = RPPI lagged one year
- IMPP = agricultural import price index (in \$)
- DPC = % annual change in PC
- DUM = dummy variable for years of conflict

- Dudley, Leonard and Roger J. Sandilands. *The Side Effects of Foreign Aid: The Case of Public Law 480 Wheat in Colombia*. Economic Development and Cultural Change, Volume 23 (2). January 1975.

Nature of the document: An analytical examination of the impact of PL480 wheat imports into Colombia, presenting the history of the PL480 program, a theoretical model of wheat marketing, a discussion of the data showing the effects of the PL480 program, and a regression model explaining decreased domestic production by changes in producer prices. No empirical modelling using food aid imports directly as an explanatory variable.

Country or countries covered: Colombia

Time period covered: 1951 - 1971

Summary of findings on production impacts and interactions: Regression analysis shows that decreases in domestic production is a lagged response to decreased domestic prices. As presented in the theoretical model, a discrepancy exists between the socially optimal price and the price which maximizes government revenues. The authors argue that it is this calculation, and the subsequent pricing policies which the government pursues, which affect the domestic production, not the quantity of PL480 imports. From 1958 to 1971, the price received by Colombian producers averaged 20 percent lower than the estimated socially optimal level -- selling imported wheat at a price low enough to eliminate the greater part of domestic production, but still high enough to yield substantial revenues on the imports which replaced the domestic wheat.

Summary of findings on trade impacts and interactions: As a result of these non-optimal pricing policies and the government's medium-term profit-maximizing behavior, Colombia imported 1,400,000 tons of wheat which could have been produced domestically at a lower opportunity cost.

Summary of other findings: None discussed.

Methodology used: Multiple variable regression analysis, using ordinary least squares (OLS) techniques.

Formula or model presented:

$$\log S_t = a_0 + a_1 \log P_t + a_2 \log S_{t-1}$$

Where

S_t = domestic production in year t, in tons

P_t = price of wheat received by producers in year t

- Grigsby, S. Elaine, and Praveen M. Dixit. *Alternative Export Strategies and U.S. Agricultural Policies for Grains and Oilseeds, 1950-83*, U.S. Department of Agriculture, Economic Research Service Staff Report No. AGES860616. September 1986.

Nature of the document: This paper surveys the range of export programs and strategies employed by the U.S. government during the 1950 - 1983 time period. Although it presents no original econometric analysis, it does present several theoretical models and then refers to a few empirical studies.

Country or countries covered: Examples used from multiple countries; no country-specific analyses

Time period covered: 1950 - 1983

Summary of findings on production impacts and interactions: The report cites an empirical study (completed by one of the authors of this report) on the impact of export credit sales programs. An estimate of the impact of trade credit to Columbia through PL 480 Title I expanded demand for commercial imports as well as for Title I imports (estimates U.S. revenues from increased exports of wheat were \$2.00 per dollar of Title I credit).

Summary of findings on trade impacts and interactions: The report also cites a number of studies which analyze the hypothetical impact of global and targeted export subsidies (including food aid) on U.S. export demand. The studies indicate that "U.S. export demand increases in response to both global and targeted subsidies in the short- and the long-run. But the cost of these subsidies to U.S. taxpayers is extremely high, especially when comparing the price to the marginal cost of additional exports." None of these studies cited examine the impact of such programs as they actually exist.

Formula or model presented: None

- Hall, Lana L. *Evaluating the Effects of P.L. 480 Wheat Imports on Brazil's Grain Sector*. American Journal of Agricultural Economics. Volume 62, Number 1. February 1980.

Nature of the document: An econometric analysis of the grain sector in Brazil published in AJAE, examining supply and demand relationships for wheat, corn, rice, and soybeans in a system of simultaneous equations. This is a condensed version of Hall's study of Brazil and Colombia, reported below.

Country or countries covered: Brazil

Time period covered: 1954 - 1970

Summary of findings on production impacts and interactions: As commercial imports and PL480 imports of wheat increase, so does the wheat support price for the upcoming season. The authors posit that PL480 wheat, by reducing the cost of total imports, contributes to increased government revenues and thus increased support prices for domestically produced wheat. Domestic wheat production has tripled during the time period studied (1954-1971), jumping from 30% to 53% of total wheat consumed.

The cumulative multipliers derived from the reduced form equations show that a sustained increase of 1000 MT of PL 480 wheat would result in an increased domestic wheat production of 447 MT in five years, in addition to increased domestic corn and rice production.

Summary of findings on trade impacts and interactions: As PL 480 wheat imports increase, commercial imports decline, confirming that food aid is indeed substituting for commercial imports in spite of the usual marketing requirement (UMR). Using the reduced form of the seven-equation system, the author estimates that the initial impact of an increase of 1000 MT of PL 480 wheat would be divided between increased consumption (19% of the imported quantity, equivalent to 0.00243 kilos per capita) and displacement of commercial imports (80% of the imported quantity).

Summary of other findings: The impact on grain prices is not as large as that on quantities imported. The impact of PL 480 wheat on domestic prices includes its direct upward pressure on the price at which government sells wheat to mills and its indirect negative effects through displacement of commercial imports and corresponding implied increase in consumer prices.

Methodology used: System of seven simultaneous equations illustrating the supply and demand relationships for wheat, corn, rice, and soybeans;

ordinary least squares (OLS) analysis and two-stage least squares (2SLS) analysis conducted.

Formula or model presented: Seven equations, 22 endogenous variables, 28 exogenous variables (seven each for the four grains). Of particular interest are the following two equations, which were specified only for wheat (the dominant grain):

$$M_t = f(QS_t, PL480_t, FXR_t, P_t, CPI_t, Tr)$$

$$P^*_{t+1} = f(M_t, PL480_t, IP_t, CPI_t, Tr)$$

Where

M_t	= quantity of commercially imported wheat
QS_t	= total domestic production of wheat
$PL480_t$	= quantity of PL480 wheat imported
FXR_t	= foreign exchange reserves
P_t	= price of wheat
CPI_t	= consumer price index
Tr	= time trend
P^*_{t+1}	= domestic support price for wheat in upcoming year
IP_t	= international price of wheat

- Hall, Lana L. *The Effects of PL 480 Wheat Imports on Latin American Countries*. Department of Agricultural Economics, Cornell University. April 1980.

Nature of the document: To analyze the effects of PL 480 wheat imports on the production and consumption of grains in Brazil and Colombia, this study develops an econometric model that disaggregates by grain, incorporates their relationships in production and consumption and government policy variables. Peru is discussed as a comparison case, but not analyzed empirically.

Country or countries covered: Brazil and Colombia

Time period covered: 1950 - 1975

Summary of findings on production impacts and interactions: In Brazil, because of the use of government revenues from wheat imports to support prices to wheat producers, PL 480 wheat imports affected wheat support prices and production positively, whereas in Colombia, PL 480 wheat imports affected wheat prices and production negatively. In Peru, which serves as a control comparison case because it did not receive large amounts of PL 480 wheat, commercial wheat imports were found to respond negatively to increases in PL 480 imports and to increased local production.

Summary of findings on trade impacts and interactions: In Colombia, a unit increase of 1,000 metric tons of PL 480 wheat has a 40% displacement effect on commercial imports, reducing them by 400 metric tons. In Brazil, the effect is a much larger 80% (a reduction of 800 metric tons of commercial imports).

Summary of other findings: On the issue of self-sufficiency, the author used the Colombian and Brazilian models to estimate what wheat imports would have been had there been no PL 480 imports (using estimated reduced forms and the total method of simulation). She found that Brazilian imports would have been 43% higher without PL 480, and Colombian wheat imports 20% higher. This reflects both the partial substitution of PL 480 for commercial imports and (in Brazil) the increased domestic wheat production which would have reduced reliance on any kind of imports.

Methodology used: Reduced form equations from a system of simultaneous equations, using ordinary least squares (OLS) and two-stage least squares (2SLS) techniques and cumulative multiplier analysis.

Formula or model presented: Same model as in the previous document.

- Lavy, Victor. *Development Food Aid and Food Production: The Lessons from Sub-Saharan Africa*. Department of Economics, Hebrew University. Jerusalem. July 1989 (draft).

Nature of the Document. Draft report prepared for the World Bank in support of their program on food security in Africa.

Country and Time Period Covered. Uses data from 36 Sub-Saharan countries covering the years 1970-1987 (Angola, Burundi, Benin, Burkina Faso, Botswana, Central African Republic, Chad, Cameroon, Djibouti, Ethiopia, Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Mauritania, Mauritius, Mali, Malawi, Mozambique, Niger, Rwanda, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Uganda, Zaire, Zambia, and Zimbabwe (note: this list is drawn from the draft and includes only 33 countries).

Findings on Production and Consumption Impacts. Finds that food aid has a positive impact on production in the following two years, but that production has no appreciable impact on food aid in subsequent years. An increase in food aid of 1000 tons in Year One would cause an increase in local grain production of 800-900 tons in Year Two and 700-800 tons in Year Three (but a decrease of 300 tons in Year Four). Reductions in cereal yield are associated with increases in food aid in subsequent years, however. Although consumption effects are not measured directly, the finding that food aid is associated with increases in both production and imports in subsequent years suggests a positive impact on consumption as well.

Findings on Trade Impacts. Finds that food aid is associated with an increase in commercial cereal imports in subsequent years (measured in tons). Thus an increase of 1000 tons in food aid in Year One would lead to an estimated increase in imports of 400 tons in Year Two and 100 tons in the Year Three.

Methodology Used. Uses vector autoregression (VAR), a technique in which the dependent variable is regressed against itself in lagged form and against lagged form of the independent variable(s). First differences were used to eliminate individual country effects. Equations were also estimated for subsets of the total data base (socialist vs. non-socialist countries, and high- versus low-income countries), but the results did not differ substantially from the base run. Estimated equations using OLS or GLS (not clear in the draft) as follows:

Dependent Variable

Grain production

Independent Variables

Food aid (lagged 1, 2, and 3 years),
production (lagged 1, 2,
and 3 years)

Food aid	Grain production (lagged 1, 2, and 3 years), food aid (lagged 1, 2, and 3 years)
Food aid	Grain yield (lagged 1, 2, and 3 years), food aid (lagged 1, 2, and 3 years)
Yield	Grain yield (lagged 1, 2, and 3 years), food aid (lagged 1, 2, and 3 years)
Food aid	Food aid (lagged 1, 2, and 3 years), production (lagged 1, 2, and 3 years), grain imports (lagged 1, 2, and 3 years)
Grain production	Food aid (lagged 1, 2, and 3 years), production (lagged 1, 2, and 3 years), grain imports (lagged 1, 2, and 3 years)
Grain imports	Food aid (lagged 1, 2, and 3 years), production (lagged 1, 2, and 3 years), grain imports (lagged 1, 2, and 3 years)

- Lavy, Victor. *Alleviating Transitory Food Crisis in Africa: The Role of Aid and Trade*. Department of Economics, Hebrew University, Jerusalem. Draft. No date.

Nature of the document: Analysis of the determinants of donors' response (with food aid resources) to African countries' needs.

Country or countries covered: 26 countries in Africa

Time period covered: 1979 - 1987

Summary of findings on production impacts and interactions: Impact of food aid on production not discussed.

Summary of findings on trade impacts and interactions: The role of food aid is compared to that of commercial imports by modelling the response of both donor food aid programs and commercial food imports to transitory production shocks. Results show that both food aid and commercial imports are used to stabilize domestic food consumption, with food aid compensating for up to 50 percent and commercial imports making up an additional 30 percent of the drop in domestic output below trend. The analysis suggests that, on average, every unexpected drop of one ton of domestic cereal production is offset by 0.8 ton of cereal inflows from abroad, but that the additional food aid lags the drop in production by up to four years.

Summary of other findings: None discussed

Methodology used: Simple correlation analysis was used to form hypotheses; then, autoregression analysis with generalized least squares (GLS) techniques were used.

Formula or model presented: The independent variables used were:

Y_t = annual domestic production -- deviation from the mean
 Y_{t-1} = annual domestic production -- deviation from the mean, lagged one year
 Y_{t-2} = annual domestic production -- deviation from the mean, lagged two years
 Y_{t-3} = annual domestic production -- deviation from the mean, lagged three years

These same four independent variables were used to model three separate dependent variables:

Emergency food aid response -- cereal aid
 Emergency food aid response -- non-cereal aid
 Commercial cereals imports

- Mann, Jitendar. "The Impact of Public Law 480 Imports on Prices and Domestic Supply of Cereals in India. *Journal of Farm Economics*. Vol. 49, No. 1, February 1967.

Nature of the document: Journal article by a research associate at the University of Minnesota.

Country or countries covered: India

Time period covered: 1952-1963

Summary of findings on production impacts and interactions: Mann finds that PL 480 imports have a negative impact on production and a positive impact on the availability of cereals for consumption. Like several other models, his model assumes a two-year lag between the food aid import and its impact on production, because of the lag between farmer price observations, their production decisions, and the appearance of the grain on the market. He finds that each pound of food aid imported *per capita* will reduce production per capita after two years by 0.49 pounds, after four years by a total of 0.21 pounds, and ultimately by about 0.32 pounds. A one-time (unsustained) increase of one pound per capita (220,000 metric tons in 1962) would cause prices to fall by 0.54 percentage points in the year received, but would cause prices to rise by 0.30 percentage points in the following year. PL 480 imports were found to increase total consumption, however, with an ultimate net increase of approximately 0.7 pounds (per capita) for each pound imported (per capita).

Summary of findings on trade impacts and interactions: Although Mann does not consider the effect on imports in depth, he estimates that commercial imports fall by 0.32 pounds per capita for each pound of PL 480 cereals imported per capita. Other trade issues are not discussed.

Summary of other findings: None.

Methodology used: A system of five equations (plus a market-clearing identity equation) is estimated using two-stage least squares (with the exception that the production equation is estimated using ordinary least squares). The reduced form of the system is calculated from the estimates to derive impact multipliers.

Formula or model presented:

$$y_1 = a + b x_1 + b x_2$$

$$y_2 = a - b y_3 + b y_4 + b x_3$$

$$y_4 = a + b y_1 + b x_4$$

$$y_5 = a - b y_1 - b y_6 - b x_5$$

$$y_6 = a + b y_1 - b y_5 - b x_5 - b x_6$$

Where:

a = the constant terms

b = the estimated coefficients

y_1 = per capita domestic cereal supply from production, net of loss, etc.

y_2 = per capita demand (equals production plus imports plus withdrawal from stock)

y_3 = the deflated index of wholesale cereal prices

y_4 = the index of per capita output (GDP)

y_5 = per capita non-PL 480 cereal imports

y_6 = per capita withdrawal from government cereal stocks

x_1 = the deflated index of wholesale cereal prices, lagged two years

x_2 = the average cereals yield per acre, lagged one year

x_3 = the deflated index of wholesale other-food prices

x_4 = the deflated index of government expenditure per capita

x_5 = PL 480 cereal imports per capita

x_6 = the initial stock of cereals in period t

- Maxwell, Simon. *Food Aid to Ethiopia: Disincentive Effects and Commercial Displacement*. Institute of Development Studies, Discussion Paper No. 226, December 1986.

Nature of the document: A research report reports the results of a study that examined whether food aid to Ethiopia has caused agricultural disincentives or led to the displacement of commercial imports.

Country or countries covered: Ethiopia

Time period covered: 1975/76 - 1983/84

Summary of findings on production impacts and interactions: The study found that food aid for sale had no measurable impact on the free market price of wheat or substitute cereals and did not influence the Agricultural Marketing Corporation's buying price. Total quantities of food aid imports were small compared to total demand; therefore, price effects were insignificant. Food aid imports did not attract labor away from agricultural activities or force agricultural wages up.

Summary of findings on trade impacts and interactions: Food aid was not found to displace commercial imports and would be unlikely to displace future imports due to the failure of the Agricultural Marketing Corporation to meet its sales commitments.

Summary of other findings: The availability of foreign exchange was the greatest determinant of the level of commercial imports. While consumption of wheat had increased due to food for work programmes, it was not likely that wheat would replace the preferred staples in the diet — teff and sorghum.

Methodology used: Single and multiple variable regression analysis using ordinary least squares (OLS) analysis were used.

Formula or model presented:

$$(1) \quad I_t = 157 - 0.49 A_{t-1}$$

$$(2) \quad I_t = 356 + 0.79A_{t-1} - .0605Q_{t-1} - 22.2 t$$

Where

I_t = commercial imports in year t
 A_{t-1} = food aid in year t-1
 Q_{t-1} = quantity of production in year t-1

- Morrison, T.K. *Cereal Imports by Developing Countries: Trends and Determinants*. Food Policy, Volume 9(1), pp. 13-26, 1984.

Nature of the document: An econometric analysis of the determinants of cereals imports in developing countries, examining long-term structural factors as well as short-term factors.

Country or countries covered: Forty-two countries worldwide

Time period covered: 1979 - 1980

Summary of findings on production impacts and interactions:

Summary of findings on trade impacts and interactions: Food aid is the only short-term explanatory variable that is significant, with its explanatory power evenly divided between the short-term financing effect substituting for commercial imports and the longer term effect on tastes and created demand (but note that this study includes data from one year only; per capita GNP is used as a proxy for long-term variables). The data analysis suggests that the country allocation of food aid over time may be stable enough for per capita food aid to explain commercial as well as concessional cereal imports. Import financing capacity, measured by international reserves, is not a strong or significant determinant of import levels.

Summary of other findings: Long-term structural factors appear to better explain cereals imports than short-run variables. The level of economic development, measured by GDP, is the most significant long-term explanatory variable.

Methodology used: Multiple variable regression analysis using ordinary least squares (OLS) methodology.

Formula or model presented: Two models presented, each with same set of independent variables:

$$(1) \quad M = b_0 + b_1G + b_2D + b_3PV + b_4A + b_5R$$

$$(2) \quad MA = b_0 + b_1G + b_2D + b_3PV + b_4A + b_5R$$

Where

M = per capita total cereal imports 1979/80
 MA = per capita commercial imports 1979/80
 G = per capita GNP 1978
 D = population density on arable land
 PV = percentage variation in production (cereals production in 1979/average cereals production 1977-78)

- A = per capita cereals food aid 1979
R = reserve standing (international reserves in 1979/average reserves in 1977-78)

- Rogers, K.D., U.K. Srivastava and E.O. Heady. *Modified Price, Production and Income Impacts of Food Aid Under Market Differentiated Distribution*. American Journal of Agricultural Economics, Volume 54 (2). 1972.

Nature of the document: AJAE journal article on PL 480 in India presenting results from statistical analysis of a system of simultaneous equations, positing that earlier models overestimated the negative impact of food aid on production (including Mann, 1968), because they did not include a parameter for the differentiated market sales through "fair price shops".

Country or countries covered: India

Time period covered: 1956 - 1967

Summary of findings on production impacts and interactions: Authors state that estimation of the negative production impacts for food aid rests heavily on measuring price changes, assuming an exogenous shift in supply resulting from the distribution of imported commodities but ignoring any income effect on demand. Results support the idea that distribution of food aid commodities to consumers at concessional prices provides an increase in real income and thus a corresponding shift in demand, compensating in part for the exogenous shift in supply and thus reducing the total impact on domestic prices. Analytical results show that, based on this model of market differentiation through sales in fair price shops, the production impact in India is one tenth of previous estimates.

Summary of findings on trade impacts and interactions: Estimates that only 1 percent of PL-480 imports were at the expense of commercial imports. Other impacts not discussed.

Summary of other findings: None discussed.

Methodology used: System of seven simultaneous equations, using both ordinary least squares (OLS) and two-stage least squares (2SLS) techniques.

Formula or model presented: Seven-equation system with 16 variables, including:

M_p	=	per capita imports of PL 480 cereals
Q_s	=	per capita quantity of domestic cereal production
Q_d	=	per capita quantity of cereals demanded in open market
Q_c	=	per capita quantity of cereals distributed concessionally
P_c	=	index of real wholesale cereal prices
Y	=	real per capita consumer income

M_o = per capita quantity of commercial cereals imports
 W = per capita net withdrawals of government cereals stocks

The results of the econometric analysis are also presented in Srivastava et al.; see the annotation of this article for the impact multipliers calculated.

- Rosen, Stacy. *Consumption Stability and the Potential Role of Food Aid in Africa*. U.S. Department of Agriculture, Economic Research Service, Staff Report No. AGES 89-29. June 1989.

Nature of the document: U.S. Government report that examines the causes for variability in agricultural production levels in 17 African countries. The study examines the consumption patterns of African countries, identifies the main factors that shape the consumption trend, and estimates the expected need for food aid under different target consumption levels.

Country or countries covered: 17 countries in Africa including Ethiopia, the Gambia, Kenya, Lesotho, Liberia, Madagascar, Mali, Morocco, Niger, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Tunisia, Zaire, and Zambia.

Time period covered: 1966 - 1986

Summary of findings on production impacts and interactions: The analysis estimated the levels of food aid required to stabilize consumption.

Summary of findings on trade impacts and interactions: The study found that the commercial import responsiveness to food aid was insignificant in all countries except Madagascar and Sudan. Commercial import determination is made based on the basis of foreign exchange allocation, consumer policies, and any *a priori* knowledge of food aid levels. Since governments do not know the projected levels of food aid imports in most cases, food aid imports do not influence commercial imports. In fact, commercial and food aid imports move in the same direction and are both used to reduce any shortfalls in domestic production. The capacity to import, defined as the sum of net credit flow plus export earnings, is the best determinant of levels of food imports.

Summary of other findings: The study found that weather was the primary determinant of production variation.

Methodology used: Single variable regression analysis using ordinary least squares was the methodology used.

Formula or model presented:

- (1) $P = f(PX_{t-1}, P_{t-1}, DB, DG)$
- (2) $FE = CR + X$
- (3) $FI = f(P, FE, WPX, FA)$
- (4) $TC = PCC * POP$
- (5) $FA = TC - P - FI$

Where

PX _{t-1}	=	real producer price lagged one year
P _{t-1}	=	production lagged one year
FE	=	foreign exchange availability
CR	=	credit
X	=	export earnings
FI	=	commercial imports
WPX	=	world cereal prices
TC	=	target consumption
PCC	=	target per capita consumption
POP	=	population
FA	=	food aid
DB	=	dummy variable for inclement weather
DG	=	dummy variable for good weather

In the commercial imports equation, production was lagged one period in the case of Ethiopia, Kenya, Morocco, Senegal, Somalia, Tanzania, and Zambia, while all variables were lagged in estimating the equations for Lesotho, Liberia, Mali, Nigeria, and Zaire.

Estimation of the food import equation yielded the following results (an asterisk indicates significance at the 5 percent level; the T-statistic is shown in parentheses):

Country	Food Production	Foreign Exchange Availability	Food Price	Food Aid	R ²
Ethiopia	-1.49 (-.47)	1.00 (.97)	1.44 (.90)	.40 (0.87)	.36
Gambia	-.38 (-1.07)	.38* (2.48)	-.24 (-.80)	.02 (1.02)	.76
Kenya	-4.82* (-2.40)	1.27* (3.53)	-.81 (-.93)	.02 (.29)	.60
Lesotho	-.62* (2.41)	.42* (3.41)	-.63* (-1.94)	.03 (1.12)	.89
Liberia	-3.45* (-2.53)	1.22* (3.31)	-.34 (-1.49)	.07 (1.77)	.74
Madagascar	-6.21 (1.18)	1.03* (2.11)	-.23 (-.25)	-.09* (-1.82)	.61
Mali	-3.15* (-2.55)	.52* (1.97)	-.43 (-.66)	.17 (1.51)	.59

Morocco	-1.09 (-1.65)	1.52* (4.67)	.83 (.97)	-.27 (-.94)	.78
Niger	-7.27* (-1.82)	1.26 (1.42)	-9.62* (-3.07)	.11 (.43)	.59
Senegal	-.47* (-2.12)	.11 (.95)	-.27 (-1.10)	.06 (.47)	.40
Sierra Leone	-2.05 (-1.61)	.43 (1.62)	-.83* (-2.10)	.01 (.35)	.46
Somalia	-.17 (-.13)	.23 (.38)	-.56 (-.64)	.12 (.25)	.35
Sudan	-.32 (-.68)	-.20 (-.74)	-.41 (-1.05)	.09* (2.20)	.41
Tanzania	-1.57 (-.83)	1.68* (2.30)	-.59 (-.61)	-.24 (-.86)	.49
Tunisia	-1.84* (-2.22)	1.18 (1.68)	1.13 (0.65)	-.06 (-.67)	.55
Zaire	-.48 (-.89)	.85* (2.98)	-.10 (-.36)	-.03 (-.95)	.68
Zambia	-.09 (-.10)	1.74* (3.00)	-.30 (-.64)	-.02 (-1.41)	.69

- Schultz, Theodore W. *Value of U.S. Farm Surpluses to Underdeveloped Countries*. Journal of Farm Economics, Volume 42(5), pp. 1019-1030. December 1960.

Nature of the document: The seminal article on disincentive effects of PL 480 to local agricultural production, presenting the theoretical support for the possibility of negative developmental impacts of food aid. Addressed three questions:

- 1) What is the value of PL 480 products to countries receiving them, relative to U.S. costs?
- 2) What do these countries "pay" us for PL 480 products?
- 3) What are the effects of PL 480 farm products upon the agriculture of the countries that receive them?

Country or countries covered: No specific country discussions

Time period covered: No specific data treated

Summary of findings on production impacts and interactions: Discussion of potential disincentive effects to domestic production centered around the idea that if the price response (price elasticity of supply) of farmers is not zero, as had been assumed, then there will be some disincentive to local production stemming from the reduction in domestic relative prices of their goods due to inflow of imports. At the time the author wrote on this topic, few data had been analyzed, or even collected, on this topic, and no empirical studies on the effects of PL 480 had been conducted.

Summary of findings on trade impacts and interactions: No specific impacts reported

- Scobie, Grant. *Government Policy and Food Imports: The Case of Wheat in Egypt*. International Food Policy Research Institute Research Report No. 29. Washington, DC. December 1981.

Nature of the document: IFPRI research report.

Country or countries covered: Egypt

Time period covered: 1949-1979 (food aid began in 1955)

Summary of findings on production impacts and interactions: Finds that the availability of aid has encouraged the Egyptian government to maintain low prices for producers relative to consumers, although the impact is not substantial: an increase of food aid by 1000 metric tons would decrease the farmers' price by only 0.016 percent, leading to a reduction in production of 88 tons (calculations by the reviewer from coefficients reported in the study).

Summary of findings on trade impacts and interactions: Finds that aid has generally substituted for commercial imports, confirming other studies.

Summary of other findings: Finds that aid levels are inversely related to the world price, are affected by political factors (as measured by dummy variables for periods of war and peace and changes in the relationship with the United States), but are not affected by variations in Egyptian production (as measured by wheat yields, which have an extremely low variance in Egypt for technical reasons).

Methodology used: A system of eight structural equations and fifteen identities, estimated using OLS. The analysis uses several dummy variables to reflect the influence of war on foreign aid and domestic production.

Formula or model presented: The structural equations are as follows, excluding error terms:

$$\begin{aligned}
 M &= M(C, DW2, R_{t-1}, F, DF) \\
 QD &= QD(C, INCAP, PCC) \\
 AIDC &= AIDC(C, PWC, DQC, DW4, DA1, DS1) \\
 INV &= INV(C, PWC, DW6, IMC) \\
 DOMW &= DCMW(C, PWC, DFPI_{t-1}, DW6, IMC, AIDC) \\
 AC &= AC(C, DW6, PPE_{t-1}, PPC, IMC) \\
 INVE &= INVE(C, PWC, PWE, IMC) \\
 AE &= AE(C, DW6, T, PPE_{t-1}, IMC_{t-1}, PPC)
 \end{aligned}$$

Where

$$AC = \text{area sown with wheat}$$

AE	=	area sown with cotton
AIDC	=	foreign aid shipments of wheat, in tons
C	=	the constant terms
DA1	=	dummy for foreign aid (1 for 1949-58)
DF	=	change in F relative to the previous year
DFPI _{t-1}	=	change in the domestic food price index relative to the previous period
DOMW	=	difference between producer and consumer prices of wheat, in Egyptian pounds per ton
DQC	=	deviation of current wheat output from trend
DS1	=	dummy for Suez war (1956-57)
DW2	=	dummy for the war years 1967-69 and 1973-75
DW4	=	dummy for the 1967-73 war years
DW6	=	dummy for the 1966-73 war years
F	=	deflated total foreign exchange receipts
IMC	=	import capacity, deflated
INCAP	=	GNP per capita
INVE	=	difference between world and producer prices of cotton, in Egyptian pounds per ton
M	=	total deflated import expenditures
PCC	=	deflated consumer price of wheat
PPC	=	deflated average wheat price to producers
PPE	=	deflated average cotton price to producers
PWC	=	average import price of wheat (cif), deflated
PWE	=	export price of cotton (fob), deflated
QD	=	total wheat disappearance in KMT
R _{t-1}	=	deflated foreign exchange reserves, lagged
T	=	time trend (years)

- Seevers, Gary. *An Evaluation of the Disincentive Effect Caused by PL 480 Shipments*. In American Journal of Agricultural Economics, Vol. 50, No. 1968, pp. 630-642.

Nature of the document: A journal article that reports the results of a study examining the domestic price and output effects of changes in PL 480 shipments using data for India between 1956/57 and 1962/62.

Country or countries covered: India

Time period covered: 1956/57 and 1962/62

Summary of findings on production impacts and interactions: The study first estimated the price and output effects of food aid shipments to a hypothetical country as a share of total utilization, for various ranges of elasticities of demand and supply. The price and output effects resulting from a 1 percent change in the ratio of PL 480 to total utilization was found to be negative if shipments increase and positive if they decrease. For smaller values of either the income elasticity of demand or the proportion of foodgrains in real income, the counteracting influence of income diminishes and price and output effects enlarge, but decrease if shipments are imperfect substitutes for domestically produced foodgrains. On balance, for many possible elasticity combinations, the disincentive effects of marginal changes in PL 480 shipments are not substantial. If shipments contributed to 5 percent of total utilization, the disincentive effects would be insignificant in many cases. The same static model was then used to estimate the price-output effects of food aid shipments for India for the same period. An increase in food aid shipments of 560,000 metric tons would effect a decrease in cereals prices of 1.58 percent and domestic production of 0.40 percent.

Summary of findings on trade impacts and interactions: The analysis showed that, for India, any potential displacement of commercial imports by PL 480 would be minimized due to the new production possibilities they permit due to resources released from domestic production and freed foreign exchange.

Summary of other findings: In terms of the impact of food aid on consumption, the study found for India that the negative effects on production and commercial displacement would be minimized by the beneficial effects on labor productivity and nutrition.

Methodology used: Comparative static model using demand and supply equations and ordinary least squares.

Formula or model presented:

$$S(PG) + M + I = D(P,Y,N)$$

Where

- S = aggregate annual supply of foodgrains from domestic output
- P = producer prices
- G = government investment in food production
- M = commercial imports
- I = PL 480 shipments
- D = demand
- P = consumer prices
- Y = real income at the producer level
- N = population

Note: The actual estimated form of the equation was not presented.

- Shapouri, Shahla and Stacey Rosen. *Effect of Fiscal Austerity on African Food Imports*. U.S. Department of Agriculture, Economic Research Service, Foreign Agriculture Economic Report, No. 230, May 1987.

Nature of the document: U.S. Government research report analyzing the effects of individual economic factors on the food importing capacity of 25 countries. Authors use econometric analysis to project the impact of various financial conditions on food importing patterns to 1994. The study examined the affect of domestic food production, world food prices, quantity of food aid, and import capacity on the quantity of food imports. A country's import capacity was defined as being dependent on foreign credit and export earnings.

Country or countries covered: 25 countries in Africa organized into low- and middle-income, and oil exporting. Low-income countries include Benin, Ethiopia, The Gambia, Kenya, Liberia, Madagascar, Mali, Niger, Sierra Leone, Somalia, Sudan, Tanzania, Togo, and Zaire. Middle-income countries include Lesotho, Morocco, Senegal, Zambia, and Zimbabwe. Oil-exporting countries include Algeria, Cameroon, Egypt, Côte d'Ivoire, Nigeria, and Tunisia.

Time period covered: Data on 1966 - 1984

Summary of findings on production impacts and interactions: None discussed.

Summary of findings on trade impacts and interactions: Food aid was not found to affect commercial imports to any great extent since aid is generally donated in times of national emergencies and overall levels of food aid remain constant, thus, reducing long-term affects on level of commercial imports.

Summary of other findings: The study found that the greatest determinants of a country's commercial import levels were the capacity to import with export earnings being the single most important variable, followed by available credit, domestic food production, import capacity, food aid, and world food prices. The availability of credit was found to be less important for determining import levels for middle-income and oil-exporting countries. Foreign exchange supplies and changes in domestic production were found to influence import levels, while world food prices had little effect on import levels for the countries studied.

Methodology used: Multivariable regression analysis using ordinary least squares (OLS) method.

Formula or model presented:

(1) $CM = f(CF, EX)$

(2) $Q_{fm} = f(Q_{dp}, P_{fw}, Q_a, CM)$

Where

CM	=	import capacity
Q_{fm}	=	quantity of food imports
CF	=	foreign credit
EX	=	export earnings
Q_{dp}	=	domestic food production
P_{fw}	=	world food prices
Q_a	=	quantity of food aid

NOTE: Because there are coefficients reported for all variables for two equations each for all 25 countries, the coefficients are presented in the following tables in lieu of entering them in the summary matrices.

Dependent Variable: Total Import Value

Country	Coefficient for Credit	Coefficient for Export Earnings	Form
Low Income:			
Benin	0.84	0.74	all lagged
Ethiopia	0.88	0.02	value
Gambia	0.39	0.46	value
Kenya	0.46	1.41	all lagged
Liberia	1.29	0.91	value
Madagascar	0.46	1.26	value
Mali	0.89	0.66	value
Niger	0.39	0.89	value
Sierra Leone	1.08	0.97	value
Somalia	0.55	0.65	value
Sudan	0.42	0.16	all lagged
Tanzania	0.51	0.65	all lagged
Togo	0.38	0.51	value
Zaire	0.38	0.34	value
Middle-income:			
Lesotho	0.66	0.55	value
Morocco	0.53	1.09	value
Senegal	0.51	0.63	value
Zambia	0.34	0.31	all lagged
Zimbabwe	0.55	0.65	value
Oil-exporting:			
Algeria	0.46	0.59	value
Cameroon	0.53	0.27	value
Egypt	0.78	0.01	value

Cote d'Ivoire	0.35	0.98	value
Nigeria	0.32	1.11	all lagged
Tunisia	0.59	0.86	value

Dependent Variable: Commercial Food Imports Elasticities

Country	Food Production	Imports Value	World P Ratio	Food Aid	Form
Low Income:					
Benin	-1.24	0.65	-1.10	n.a.	all lagged
Ethiopia	-3.27	0.78	n.a.	0.04	all lagged
Gambia	-0.38	0.38	-0.24	0.03	value
Kenya	-3.82	1.53	n.a.	-0.14	all lagged
Liberia	-3.45	1.23	-0.34	0.07	all lagged
Madagascar	-1.13	0.93	-0.06	0.14	price lagged
Mali	-2.34	0.46	n.a.	0.13	all lagged
Niger	-1.45	0.72	-1.42	0.02	value
Sierra Leone	-2.05	0.43	0.83	0.01	price lagged
Somalia	-0.91	0.10	-0.34	0.07	prod. lagged
Sudan	-0.35	0.10	-0.21	-0.06	price lagged
Tanzania	-2.50	1.54	-0.74	-0.05	value
Togo	-0.20	0.36	-1.33	n.a.	all lagged
Zaire	-0.24	0.66	-0.24	-0.05	prod. lagged
Middle-income:					
Lesotho	0.43	0.28	-0.36	0.00	price lagged
Morocco	-1.74	1.23	n.a.	-0.22	value
Senegal	-0.40	0.21	-0.26	0.17	prod. lagged
Zambia	-1.34	0.61	-1.06	0.00	prod. lagged
Zimbabwe	-2.32	0.56	-1.79	n.a.	prod. lagged
Oil-exporting:					
Algeria	-0.49	0.68	-0.21	n.a.	price lagged
Cameroon	-0.87	0.45	-0.61	n.a.	value
Egypt	-1.48	0.46	-0.24	0.02	prod. lagged
Cote d'Ivoire	0.23	0.25	-1.30	n.a.	all lagged
Nigeria	0.30	0.45	-0.81	n.a.	all lagged
Tunisia	-3.99	1.24	n.a.	-1.13	value

- Srivastava, U.K. et al. *Food Aid and International Economic Growth*. Iowa State University Press. 1975.

Nature of the document: Chapter in a larger work reviewing the state of knowledge on food aid and international economic growth.

Country or countries covered: India

Time period covered: 1956 - 1967

Summary of findings on production impacts and interactions: Finds that the quantity distributed through the government's concessional (ration shop) channel is highly correlated with food aid levels and that increases in food aid levels are highly correlated with a reduction in offtake from government stocks. Using parameters estimated by the model, the authors estimate that each additional kilogram of food aid per capita decreases cereal prices by .1314 units of the index, increases market demand by .07 kilograms per capita, and increases concessional distribution by .86 kilograms per capita. In other words, an estimated 93 percent of the imports are additional, while 1 percent displace commercial imports and 6 percent are drawn from government stocks in the short run. On the production side, each metric ton of food aid is estimated to reduce production two years later (due to lagged price effects) by only 32 kilograms and by a total of only 27 kilograms over time. These estimates differ sharply from Mann's, despite using identical data, which the authors attribute to the lack of differentiation between market demand from the ration shops in Mann's model, which therefore does not capture the income effects of the ration shop program. Srivastava's estimate of total production loss, 12,600 metric tons, is less than one-tenth Mann's estimate of 143,200 metric tons over 14 years.

Summary of findings on trade impacts and interactions: As stated, Srivastava estimates that only 1 percent of PL-480 imports were at the expense of commercial imports. Impacts on the source of supply are not discussed.

Summary of other findings: None discussed

Methodology used: A system of seven simultaneous equations (a supply equation, which is estimated using exogenous variables, and simultaneous equations for open market demand, concessional market distribution [fair price shops, where a fixed quantity is sold at a below-market price], income, commercial imports, withdrawal from stocks, and excess demand) is estimated using two-stage least squares (a reduced form of the equation system is used for estimation).

Formula or model presented: The model is the same as shown above under Rogers et al., which also presents the quantitative results of the analysis. Explanatory variables include rainfall, cereal yield as a proxy for technological factors, lagged wholesale cereal prices, non-cereal prices, per capita consumer income, the concessional price, food aid, per capita industrial output, per capital government expenditure, and government cereals procurement on the domestic market. Key feature of methodology is differentiation of demand side into open market and ration shops to capture income transfer effects of food aid.

The structural equations were used to calculate reduced form coefficients (multipliers). The multipliers estimated for PL 480 impacts are as follows:

<u>Variable Affected</u>	<u>Impact Multiplier</u>
Per capita domestic supply	0.0
Per capita open market demand	0.0727
Per capita concessional market demand	0.8557
Deflated index of cereal prices	-0.1314
Deflated consumer income per capita	0.0
Per capita commercial imports	-0.0119
Per capita withdrawal from stocks	-0.0597

- Vengroff, Richard and Yung Mei Tsai. *Food, Hunger, and Dependency: PL480 Aid to the Third World*. Journal of Asian and African Studies, v. 17., pp. 250-265. 1982.

Nature of the document: A study of the distribution of U.S. food aid to 77 developing countries, using regression analyses and correlation analysis to test six hypotheses derived from the stated goals of the PL 480 program.

Country or countries covered: Seventy-seven countries worldwide

Time period covered: 1962 - 1978

Summary of findings on production impacts and interactions: Correlation analysis found a positive but very weak relationship (0.05) between food aid and agricultural growth, and a generally insignificant relationship between food aid and food production (except for the period 1975 - 1978, where the relationship significant, negative, and small (-0.23).

Summary of findings on trade impacts and interactions: Population size was found to be the most potent and robust predictor of U.S. food aid shipments to a country, followed by trade considerations as measured by the country's balance of trade with the United States.

Summary of other findings: Little statistical relationship was found between need and total or per capita amount of food supplied. Hypotheses about granting food aid as part of a strategy of expanding markets for U.S. goods or rewarding political supporter nations with food received some statistical support. The authors suggest that the most potent predictor, population size, should be considered as a measure of market size and trade potential, not as a proxy for need.

Methodology used: Correlation analysis, along with multiple variable regression analysis using ordinary least squares (OLS) techniques.

Formula or model presented: A multiple variable model applied to data from three time periods -- 1962-1978, 1962-1975, 1975-1978.

Dependent variable = Natural log of quantity of food aid.

Independent variables =
 population
 balance of trade with U.S. 1969-79
 average votes against U.S. in U.N.
 trade w/ U.S. as % of total trade
 calorie supply per capita
 GNP per capita

- von Braun, Joachim. *Effects of Food Aid in Recipient Countries. Egypt and Bangladesh, a Comparative Study.* Economics, Volume 26, Tübingen, Germany: Institute for Scientific Co-operation, 1982. 47 pages.

Nature of the document: Journal article presenting the results of a study that examined the disincentive effects of food aid imports of production in Egypt and Bangladesh.

Country or countries covered: Bangladesh and Egypt

Time period covered: 1976 - 1978

Summary of findings on production impacts and interactions: For Egypt, the study found that for average data on wheat acreage and yields, per capita supply quantity, and food aid quantity from 1976-78, food aid imports lowered wheat farm product prices by 7 percent. This 7 percent reduction in domestic farm gate prices for wheat would reduce output by 65,000 tons or 3.7 percent of total food aid imports. The relative importance of food aid to total supply determines the negative effect for domestic production. Using the same supply elasticities, the author estimated the production effect from the 18 percent reduction in real wheat prices from 1973-75 to 1976-78 to be 170,000 tons or 9.8 percent of food aid quality. The author includes a caveat, however, for these results since they do not take world market price developments and changes in competing products into account and, therefore, overestimate the price-damping effect of food aid during these periods.

Due to the limited availability of data for Bangladesh, the author did not attempt to estimate the disincentive effects of food aid imports on production of rice. Due to the relatively inelastic supply elasticity for rice and the government's efforts to coordinate food aid with its agricultural price policy, effects of food aid imports on production in Bangladesh are said to be minimal.

Summary of findings on trade impacts and interactions: The author maintained that commercial imports in Bangladesh were widely replaced by food aid imports but did give rise to increased capital imports through balance of payments effects. In Egypt, commercial imports are controlled by balance of payments and budget constraints; therefore, food aid did not displace commercial imports, but had positive effects on total supply and nutrition. The author did not offer a statistical justification for these conclusions.

Summary of other findings: Other findings by the author, while not derived from statistical investigation, follow. In both countries, there was no evidence of food aid deliveries resulting in decreased public investment

in agriculture. The positive impact of food aid on consumption in Bangladesh was found to be minimal due to the country's inadequate and ineffective food distribution systems. This was less so in Egypt due to the country's relatively well developed feeding programs. While food aid imports had mixed results for consumption, they increased saving rates and investment in the aggregate in both countries.

Methodology used: Multivariable regressions using ordinary least squares (OLS) method were used for this analysis.

Formula or model presented:

$$(1) \quad d_n = a_n y_n - a_o y_o$$

$$(1a) \quad y_n = y_o (1 + \epsilon_y \Delta N/A)$$

$$(1b) \quad a_n = a_o (1 + \epsilon_a \Delta N/A)$$

Where

- $a_{n(o)}$ = wheat acreage with (without) food aid
 $y_{n(o)}$ = wheat yields with (without) food aid
 ϵ_y = price flexibility of demand for wheat (relative to kg per capita)
 $\epsilon_a(y)$ = price elasticity of wheat acreage (of wheat yield)
 d_n = disincentive effect (in t of wheat)
 $\Delta N/A$ = relative change in supply (A; kg per capita) due to food aid (N; kg per capita)

Part 3. General Bibliography on Food Aid

The following bibliography was developed by the team in the course of the team's literature review. It is included here as a guide to readers interested in the broader literature on food aid impacts. Articles reviewed by the team are identified with an asterisk.

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ANNEX 2. LIST OF INDIVIDUALS CONSULTED BY THE TEAM

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 Roger Norton, Sigma One
 John O'Rourke, AID/FVA
 Per Pinstруп-Andersen, Cornell University
 Shlomo Reutlinger, World Bank
 Bea Rogers, Tufts University
 John Schnittker, Schnittker Associates
 Shahla Shapouri, USDA
 Mark Smith, USDA
 Don Street, USDA
 Mitch Wallerstein, National Academy of Science

ANNEX 3. IMPACTS ON THE DOMESTIC FOOD ECONOMY

The study presented in this report focuses on aid-trade relationships, but these relationships are greatly affected by interactions between aid and agricultural production in the recipient country. This annex reviews the study's findings in this area to complement the trade-related findings in the main body of the report. It also presents a brief supplemental bibliography, with annotations of six quantitative analyses that were reviewed by the team but did not discuss trade impacts. Several of the other studies reviewed above and included in the bibliography in Annex 1 discuss production and consumption impacts as well as trade impacts. Both sets of studies have been drawn on for this discussion.

The main issues surrounding food aid's impact on production and the domestic food economy can be summarized as follows:

- *Prices:* Food aid may decrease prices to consumers and/or producers by increasing the supply, by financing below-market-price distribution systems, or by encouraging adoption of policies with these effects; it may increase prices to producers by funding price support systems; it may reduce marketing costs by financing a range of rural development investments, thus increasing prices to producers and reducing them to consumers.
- *Food Production:* Food aid may reduce production in the recipient country by driving down prices; it may promote a shift away from food crops and toward cash crops¹⁸; alternatively, it may increase production by funding investments in rural development or raising labor productivity through better nourishment.
- *Consumption:* Food aid may increase consumption generally or among low-income consumers by raising supply, lowering prices, or both, or by supporting concessional food distribution programs; alternatively, it may have no impact on consumption if it serves only to

18. This effect may be viewed as a positive or negative impact, depending on the nature of the shift and who is doing the assessing.

displace local production and commercial imports; it may reduce consumption if it leads to slower income growth generally or in the agricultural sector.

- ***Agricultural sector growth:*** It may promote more rapid growth of agricultural production overall by adding to resources for investment, by relieving the food constraint, or by encouraging greater expenditures on agriculture; alternatively, it may slow growth in the sector through direct (price) or indirect (policy) disincentives.
- ***National income:*** It may increase national income by funding development programs and saving scarce foreign exchange; it may reduce the growth in national income if it has negative impacts on policies or programs in the agricultural sector.
- ***Government finance:*** It may increase government spending for development or direct a greater share toward the rural sector; it may encourage the continuation of costly subsidy programs and thus have a negative effect on government expenditure patterns over time.
- ***Commercial imports:*** It may decrease commercial imports in the short term; it may increase commercial imports in the long term by promoting economic growth; it may encourage commercial ties with the donor country; it may finance commercial imports of other commodities by relieving a balance of payments constraint.
- ***Agricultural exports:*** It may increase agricultural exports by the recipient country by promoting economic development and relieving the food constraint.

Table 4 presents the findings of the quantitative analyses reviewed in this report. Despite the range of results presented, it is clear that the formal literature falls far short of providing a quantitative assessment on each of the issues identified above. As the detailed annotations in Annex 1 demonstrate, the studies have concentrated on direct and short-term impacts, with relatively little discussion of other impacts.

Taken as a whole, the studies offer support both to food aid's supporters and its detractors. On the positive side, only one of the econometric studies found a large negative impact on producer prices (Blandford and von Plocki's study of the Indian case), while several found a positive impact (Deaton and Siaway in Haiti and Hall in Brazil). One study (Scobie in Egypt) found a small negative impact. Looking at production,

Table 4. Summary of Findings on Production

Key:
 AIDQUAN Quantity of food aid
 PRIWRLD World price of commodity
 GNP Gross national product
 PROD Domestic production
 COMIMP Imports of commodity
 FOREX Foreign exchange
 PRIDOM Domestic price of commodity

Dependent Variable	R sq	Author	Date	Coefficients on Explanatory Variables							Comments
				AIDQUAN	PRIWRLD	GNP	PROD	COMIMP	FOREX	PRIDOM	
Consumer prices		Rogers et al	1972	-0.1314							An increase of 560,000 MT reduces price index by 1.58%
		Seevers, G. Srivastava et al.	1968								
Producer prices		Blandford & von Plockl	1977	-2.25							One M MT increase in PL480 decreases cereal prices by 2.25 M MT
	0.83	Deaton & Slaway	1987	2.94							F-stat = 84.751 DW stat = 2.401 DW stat = 1.63; coefficient on time trend = -12.886 Brazil coefficients Colombia coefficients
	0.9686	Della Torre & Norton	1988		0.3734		-0.1568		-0.6374		
		Hall	1980/1	0.1361	0.2781				-0.0434		
		Hall	1980/2	0.10096							
				-0.0067							
	0.816	Norton & Benito (1)	1987		0.358	-0.076	-0.934				
	0.832	Norton & Benito (2)	1987		0.365		-0.907				
0.868	Norton & Benito (3)	1987			-0.137	-0.867	-0.319				
0.866	Norton & Benito (4)	1987				-0.823	-0.326				
Domestic consumption		Scobie von Braun	1981/2 1982	-0.01	-0.02					0.49	Import capacity results are .004 .07 price-dampening effect of food aid on producer price, = 3.7% of food aid quantity
		Blandford & von Plockl	1977	1.86							81% of an increase in imports would increase consumption 1.86 kg per capita (static)
		Hall	1980/2	0.19093							Brazil coefficients Colombia coefficients
		Rogers et al	1972	0.0727						0.2268	Q demanded in open market
		Srivastava et al.	1975	0.7989						-0.0934	Q sold concessionally
											Same results as in Rogers et al.

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Dependent Variable	R sq	Author	Date	Coefficients on Explanatory Variables							Comments
				AIDQUAN	PRIWRLD	GNP	PROD	COMIMP	FOREX	PRIDOM	
National income		Rogers et al	1972	-0.234			0.061	0.066			Impact of variable lagged 3 yr
		Rosen	1989		*comment		*comment			0.2442	17 sets of coefficients –see annotations in bibliography An increase of 560,000 MT would reduce prodn by 0.4 % Same results as in Rogers et al.
		SeEVERS, G.	1969					*comment		*comment	
		Srivastava et al.	1975								
		Rogers et al	1972	0.00						0.1955	
Srivastava et al.	1975										
Concessional food sales		Rogers et al.	1972	0.7989							Same results as in Rogers et al.
		Srivastava et al	1975	*comment						-0.0934	
Quantity of food aid		Lavy	Africa	1989/1				0.45			Each 1 MT decr in dom grain prodn is compensated by .45 MT inc. in food aid
	0.55	Scoble	India	1981/1			-1.86		-0.06		Production variable is deviation of current output from trend Coefficient on "balance of trade w/ US" = -0.332; correlation #s 0.05 for ag growth, -0.23 for prodn
	0.369	Vengroff	Worldwide	1981/2 1982			-1.78		0.26 -0.23		

positive impacts were found by Deaton and Siaway (in Haiti), and Lavy (in a multi-country study of Africa). Several of the studies found a positive impact on domestic consumption levels (Blandford and von Plocki, Hall, and Rogers et al.)

Commercial imports, by contrast, were found to be associated with lower producer prices in Brazil (Hall) and Honduras (Norton and Benito), although a positive impact was recorded in El Salvador (Della Torre and Norton).

Evidence of negative impacts on producer prices or production levels was limited. In addition to the negative price impact found by Blandford and von Plocki, the same authors measured a negative impact on production. Hall found a very slight negative impact on prices in Colombia, and Scobie and Seevers found an equally slight impact in Egypt and India, respectively. Lavy found positive impacts for changes in aid levels lagged one and two years, but a negative impact for the three-year lag. Fedeler found a negative impact on production exceeding the level of food aid imports, using an input-output model to analyze potential impacts on the Indian economy. Von Braun used elasticities to estimate that food aid's negative impact on Egyptian production was equal to less than 4 percent of the aid quantity provided.

Taken as a whole, the studies support the view that food aid's impact is related to the way that the commodity and local currency proceeds (if any) are programmed. Hall (1980/2), for example, found that food aid had a positive impact on prices and production in Brazil because food aid revenues were used to support producer price supports. The debate on food aid's impact on the Indian economy must be viewed as unresolved, however, as the six studies reviewed reached different conclusions. Rogers et al., and Srivastava et al. (two reports covering the same piece of analysis) developed a model that took into consideration the segmentation of the market into an open-market component and a subsidized distribution component. When they used this model to analyze the same data used by Mann and other analysts who found a substantial negative impact on production, these authors found only a very small impact. They concluded that the use of food aid revenues to subsidize consumers (indirectly, in this case) has increased demand to a degree that largely cancelled out any negative impact on prices and production.

Given the strong and continuing interest in the possible impact of food aid on domestic production, the paucity of systematic efforts to explore this issue is somewhat surprising. Perhaps the most important gap in the literature is the failure to explore the potential relationship between food aid and agricultural development over time. Anecdotal evidence suggests that food aid has played a major role in shaping agricultural policy, generating resources for investment in the agricultural sector, and influencing the development of local markets. With lags limited to a maximum of three years, the studies do not provide information on the long-term or cumulative

impact of food aid. Because food aid's negative impacts (if any) are primarily related to its short-term depressing effect on prices, while its positive impacts are related to long-term growth in income and strengthening of agricultural institutions, this short-term bias seriously prejudices the value of the studies completed to date as a guide for future policy making and program design for U.S. food aid.

Supplemental Bibliography on Production Impacts

- Deaton, Brady and Arthur Siaway et al. *A Food Aid Strategy for Haiti: Maximizing Developmental Effectiveness*. A Report of the Technical Support to Mission USAID/Haiti. 110 pages.
- Fedeler, Jerry Allen. *An Analysis of Commodity Aid and Policies to Eliminate its Negative Effects upon the Commercial Market*. Ph.D. Dissertation, Ames, Iowa: Iowa State University, 1972.
- Goering, Theodore J. *Public Law 480 in Colombia*. Journal of Farm Economics, Volume 44. 1962.
- Isenman, Paul J. and H. W. Singer. *Food Aid: Disincentive Effects and Their Policy Implications*. Economic Development and Cultural Change, Volume 25 (2). January 1977.
- Norton, Roger D. and Carlos A. Benito. *An Evaluation of the PL480 Title I Programs in Honduras*. Report of Winrock International Institute for Agricultural Development to the Office of Rural Development, USAID/Honduras, September 1987. 51 pages.
- Svedberg, Peter. *The Price-Disincentive Effect of Food Aid Revisited: A Comment on Isenman and Singer*. Economic Development and Cultural Change, Volume 27 (3). 1979.

Annotation of References on Production Impacts

- Deaton, Brady and Arthur Siaway et al. *A Food Aid Strategy for Haiti: Maximizing Developmental Effectiveness*. A Report of the Technical Support to Mission USAID/Haiti, 1987.

Nature of the document: Study commissioned by USAID/Haiti to provide the mission with a food aid strategy and recommendations for commodity mix for the FY88 Title III program. Analysis was conducted of the

production trends of major food crops and food needs in the country on the basis of the age and sex composition of the population.

Country or countries covered: Haiti

Time period covered: 1976 - 1985

Summary of findings on production impacts and interactions: Analysis of food aid, domestic grain production, and price trends provide no evidence of disincentives of food aid imports on domestic production. Food aid was found to help the food needs of the country without negative production effects. Disincentives were understood to be negative effects on cost-reducing technologies, government pricing policies, and consumer/human capital gains.

Summary of findings on trade impacts and interactions: No analysis was completed concerning the impact of food aid imports on commercial trade.

Summary of other findings: The study recommended that future levels of food aid should depend on the degree of malnourishment in the country, local government and PVO commitment to the program, and leadership emphasizing economic development and management capacity. General findings with respect to the food production and needs situation in the country are the following: the agricultural sector is stagnating with little chance of domestic production meeting needs; while domestic prices have been above world price levels, farmers have not been able to respond to these prices to increase their production levels; increased production potential does not exist in the country in absence of yield-increasing technologies; and there is no trend in the production of export crops such as coffee, sugar cane, and cotton. There exists a significant gap between domestic production and demand even taking food aid imports into account. With respect to nutrition levels in the country, the study found that there exist serious nutritional deficiencies among children and women in the country with the closing of nutritional centers having a significant negative effect on nutritional levels.

Methodology used: Single variable regression analysis using ordinary least squares method of analysis was used.

Formula or model presented:

$$(1) \quad PG = A_0 + A_iFA$$

$$(2) \quad PROD = B_0 + B_iFA$$

Where

FA = food aid (grains)
 PG = domestic grain prices
 FA = food aid (volume)

- Fedeler, Jerry Allen. *An Analysis of Commodity Aid and Policies to Eliminate its Negative Effects upon the Commercial Market*. Ph.D. Dissertation, Ames, Iowa: Iowa State University, 1972.

Nature of the document: Ph.D. dissertation that uses input-output analysis to estimate the impact of commodity aid on 39 aggregated sectors of the Indian economy. Impacts are specifically estimated for imports of foodgrains, cotton, and vegetable oil.

Country or countries covered: India

Time period covered: 1964 - 1965

Summary of findings on production impacts and interactions: Assuming no structural transformation (introduction of fertilizer in matrix) will occur during the study period the impact of imports of foodgrains, cotton, and vegetable on the Indian economy and its own sector are the following:

Foodgrains: Total gross negative impact caused by 1 million rupees of foodgrain imports (of which 76 percent were Title I P.L. 480 imports) on all sectors was 1,146,000 rupees. 96 percent of the decrease is accounted for by the foodgrains sector. The total gross negative impacts were 114.6 percent of the aid. The impact on the foodgrains sector was 109.7 percent of the aid with or without structural change.

Cotton: The output and final demand of the cotton products sector must increase by 903 and 563 million rupees, respectively, if 174 million rupees of cotton imports, which were aid, are prevented from depressing the output of the cotton sector. 30 percent of total cotton imports are aid.

Cotton and Vegetable Oil: Only 79 percent of the vegetable oil and cotton import impacts occur in the vegetable oils and cotton sectors. The remaining 21 percent was chiefly in the oilseeds sector. The total negative impact of vegetable oils and cotton imports was 128.7 percent of the aid. The total impact of the combined cotton and vegetable oil imports was only 102.3 percent on the cotton and vegetable oils sectors.

Summary of findings on trade impacts and interactions: Was not studied.

Summary of other findings: not applicable.

Methodology used: Input-output analysis for 39 aggregated sectors.

Formula or model presented:

$$q^a = (I - A)^{-1} y^g$$

where

q^a	=	changes in production levels
I	=	identity matrix
A	=	input coefficients matrix
y^g	=	change in final demand from domestic production

- Goering, Theodore J. *Public Law 480 in Colombia*. Journal of Farm Economics, Volume 44. 1962.

Nature of the document: A study of PL480 Title I and II commodity imports to Colombia comparing the percentage change in prices and domestic production and proposing explanatory hypotheses about the causal linkages between domestic price and production and PL480 imports.

Country or countries covered: Colombia

Time period covered: 1954 - 1960

Summary of findings on production impacts and interactions: Seven commodities examined -- wheat, cotton (these two were imported under the PL480 program), barley, potatoes, corn, beans, and sesame. Data analysis shows that domestic production has increased most in the three crops whose prices have increased most (cotton, barley, sesame). Production trends thus are not shown to be solely explained by the relative quantities imported under PL480. Partial explanation is given by changes in government pricing policies. PL480 imports of wheat allowed government policies to shift away from supporting domestic wheat and towards supporting domestic barley production, a competitor for Colombia's limited cool climate land area. Thus the primary impact has been altered production patterns, not a net disincentive to domestic production. Retail price impacts of PL480 are judged to have been "modest" -- farm price support prices were increased greatly during the time period, overwhelming any price effect of PL480 imports.

Summary of findings on trade impacts and interactions: PL480 produced balance-of-payments benefits for Colombia partly because it coincided with a sharp drop in world coffee prices and resultant decrease in the country's foreign exchange earnings.

Summary of other findings: None discussed

Methodology used: Comparison of percentage change in indicators over time, with causal explanations proposed.

Formula or model presented: None

- Isenman, Paul J. and H. W. Singer. *Food Aid: Disincentive Effects and Their Policy Implications*. Economic Development and Cultural Change, Volume 25 (2). January 1977.

Nature of the document: Survey of literature on disincentive effects of food aid imports on domestic production, discussing empirical work done to date (primarily on India). Appendix includes a comparison of empirical results and some original analysis of changes in yields during food aid period (using yield as proxy for price impact.)

Country or countries covered: India

Time period covered: 1957 - 1971

Summary of findings on production impacts and interactions: Authors used weather and time-trend corrected estimates of expected food grain yields to see if deviations from those expected yields could be explained by changes in relative prices, thus exploring the connections between food aid imports, prices, and domestic production. Yields are thus used as a measure of the impact of prices, since they serve as a proxy for the pace of modernization of agricultural practices. Overall, the authors found "surprisingly little evidence of any systematic detrimental effects on prices on yields." This result tends to support the low price elasticity of supply for major cereal crops found in other more complex studies. "In sum, the expected detrimental price effect of food aid on Indian agricultural production was offset by increased food distribution and a low price elasticity of supply, and in the slightly longer run, by income-induced demand increases to which the food aid contributed."

Summary of findings on trade impacts and interactions: None discussed

Summary of other findings: None discussed

Methodology used: Multiple variable regression used to calculate weather and time-trend corrected estimates of expected grain yields.

Formula or model presented:

$$\text{YIELD} = a_0 + a_1R_t + a_2R_t^2 + a_3T$$

Where

R_t = all-India production-weighted rainfall index for year t
 T = year ($T = 1$ in 1951/52)

- Norton, Roger D. and Carlos A. Benito. *An Evaluation of the PL480 Title I Programs in Honduras*. Report of Winrock International Institute for Agricultural Development to the Office of Rural Development, USAID/Honduras, September 1987.

Nature of the document: Study funded by A.I.D. to evaluate the Title I program in Honduras by examining the program's contributions to consumption and nutrition, its effects on domestic agricultural producer prices, its role in the government budget and the balance of payments, and its developmental effects for the country's agricultural sector.

Country or countries covered: Honduras

Time period covered: 1974 - 1986

Summary of findings on production impacts and interactions: In the face of steadily declining domestic producer prices for selected principal foods (particularly corn), the study examined the effect of PL 480 Title I imports (wheat imports) and prices on domestic prices and production. The study found that the real price of corn is inversely related to the quantity of wheat imports since each 10 percent increase in the quantity of imported wheat reduces the real price of corn by 3.2 percent. Reducing wheat imports marginally would result in higher domestic prices for wheat and corn and somewhat more domestic production of corn. Therefore, management of import levels at the margin can result in a reduction of the potential negative domestic production effects associated with food aid imports. All effects would have occurred in the absence of the Title I program; therefore, they should be regarded as effects of wheat imports and not necessarily those of Title I.

In terms of the distribution of benefits from food aid (wheat) imports, all consumers and the smallest-scale producers gain from wheat imports, while the medium- and larger-scale producers lose. Some consumers gain from the increased availability of wheat and others gain from the resulting decrease in corn prices.

Summary of findings on trade impacts and interactions: The study did not examine the impact of food aid imports on other imports.

Summary of other findings: The study found that the real price of corn (domestic production) was influenced by income (gross domestic product) and the quantity of corn produced. The study also examined the development effects of PL 480 on the Honduran agricultural sector. This analysis focussed on the effects of expenditures on the productivity of certain staple and export crops. The study found that the program has had a positive effect on the agricultural sector, but

did not improve the institutional caliber of the Ministry of Natural Resources.

Methodology used: The study used multivariable regression analysis with the ordinary least squares (OLS) method.

Formula or model presented:

$$(1) \quad P = hQ^ePW^mY^n$$

$$(2) \quad P = hQ^ePW^m$$

$$(3) \quad P = hQ^eQW^mY^n$$

$$(4) \quad P = hQ^eQW^m$$

Where

P = real price of corn
 Q = quantity supplied of corn
 PW = real price of wheat
 Y = per capita income
 QW = quantity imported of wheat

- Svedberg, Peter. *The Price-Disincentive Effect of Food Aid Revisited: A Comment on Isenman and Singer*. Economic Development and Cultural Change, Volume 27 (3). 1979.

Nature of the document: A commentary note on the Isenman and Singer (1977) article. Isenman and Singer posited that "the deep concern often expressed in the literature about disincentive effects is unwarranted...the disincentive effects are small, and the increases in total supply of food brought about by food aid have several positive external effects on development."

Country or countries covered: No specific countries analyzed

Time period covered: NA

Summary of findings on production impacts and interactions: The author proposes that the disincentive effects of food aid are "even less of a problem than conceived of by Isenman and Singer", arguing that additionality, which is a central discussion point in the disincentive debate, is "neither sufficient or necessary to render disincentive effects an economic price problem worthy of special study". The author

argues that 1) in the long run, recipient countries have large substitution possibilities, 2) the various control systems which seek to limit that substitution are only marginally effective, and 3) empirical data from 1970 - 1973 show that all countries examined have commercial grain imports above their concessional imports.

Summary of findings on trade impacts and interactions: None discussed

Summary of other findings: None discussed

Methodology used: No empirical model presented

Formula or model presented: No empirical work presented

ANNEX 4

Article III - Scope of Work

1) Organization of the Study

The Contractor shall:

- a) formulate the relevant issues in the form of testable hypotheses;
- b) identify, collect and systematically review all available literature on these issues;
- c) categorize and summarize the major findings, conclusions and recommendations which pertain to the relevant issues as found in the literature; and
- d) identify gaps in the literature.

In addition to a review of written documentation, the contractor shall conduct interviews with knowledgeable individuals in the World Bank, the U.S. Department of Agriculture, the academic community, etc. These interviews will help identify relevant studies and data sources to include in the literature review, such as published and unpublished academic studies, A.I.D. reports, audit reports and World Food Program documents. Of particular interest are quantitative studies of the food aid/commercial import relationship such as single and multi-country econometric analyses.

2) Long Versus Short Term View

The Contractor shall review the literature carefully and systematically to determine in precise and clearly synthesized terms both long and short term impacts. Over the long term, a set of specific questions can be framed:

- How do changes in commercial imports relate to the level and form of food aid provided?
- To what extent does food aid expand recipient countries' demand for imports of agricultural commodities?
- Can a causal relationship be substantiated by the literature? If not, can an associational relationship be established?

Over the short-run, the relationship between food aid and commercial imports of food should be expressed in terms of how "additional" is program food aid and what are the implications of greater or lesser "additionality" for assessing program impacts...That is, does food aid displace commercial imports of food over the short term or does it add to the domestic supply of food available? Often it may be a matter of partial-additionality, greater in some countries and under certain circumstances than in others. A major issue in the short run analysis is how to measure "additionality".

3) Gaps in the Literature

The FVA Bureau believes that very little hard evidence exists about the market development and/or trade expansion effects of U.S. food aid, and the Bureau therefore expects that critical gaps will be encountered in the literature survey. The contractor shall clearly summarize the identified gaps, indicate which are critical to a full understanding of the relationship between food aid and commercial imports of food and suggest methodologies, especially quantitative methodologies such as econometric or budget analyses, most appropriate to addressing the critical gaps.

- 12/10