A POST-SCHULTZIAN VIEW OF FOOD AID, TRADE, AND DEVELOPING COUNTRY CEREAL PRODUCTION: A PANEL DATA ANALYSIS

DISSERTATION

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By

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ABSTRACT

For nearly a half century, food aid has aroused considerable debate among economists. However, a definitive answer to the fundamental question - "What is the impact of food aid?"- has proven elusive. Theodore W. Schultz's 1960 article warned that program food aid likely had a disincentive impact on farmers in recipient countries. More recently, Christopher Barrett has maintained that food aid has little effect on local production, but rather displaces imports (2002). Both ideas are based on an examination of program food aid; food that is sold on the recipient country's market. Since the 1960s, assistance has evolved beyond program food aid to include targeted food aid, which is at least intended for free distribution to the hungry poor.

In this study a welfare analysis is performed to develop hypotheses regarding the relationships among targeted food aid, program food aid, imports and production. The central hypotheses resulting from the theoretical framework are that program food aid discourages production and it may displace imports. Targeted food aid displaces imports and may discourage domestic production.

These hypotheses are tested using a vector autoregression similar to that used by Barrett *et al.* (1998). Departures from Barrett's study include the use of fixed effects to control for differences among countries and differentiation

distinguish between targeted and program food aid. INTERFAIS data on food aid (provided by the World Food Programme) are used along with FAOSTAT data on per capita cereal production and imports by country; the data span the years 1988 to 2000 and 64 countries.

The main findings of the empirical work are that neither targeted nor program food aid affect food production in the countries receiving them and that both result in import displacement. However, the degree of import displacement is greater for program food aid than for targeted food aid. The implications of this research for policy makers are that improvements to social welfare may be achieved through distributing targeted rather than programme food aid.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Although debate surrounding the impact of food aid on food markets in recipient countries dates to the 1960s, the question – "What is the impact of food aid?" continues to elude economists, both because of poor availability of data on food aid and a failure of the debate to evolve with food aid and consider that type of assistance in its various forms. This dissertation implements a relatively new data set on food aid and recently developed econometric techniques to examine the differential effects of the two main categories of food aid on the food production and international trade patterns of the recipient country.

1.1 History of Food Aid

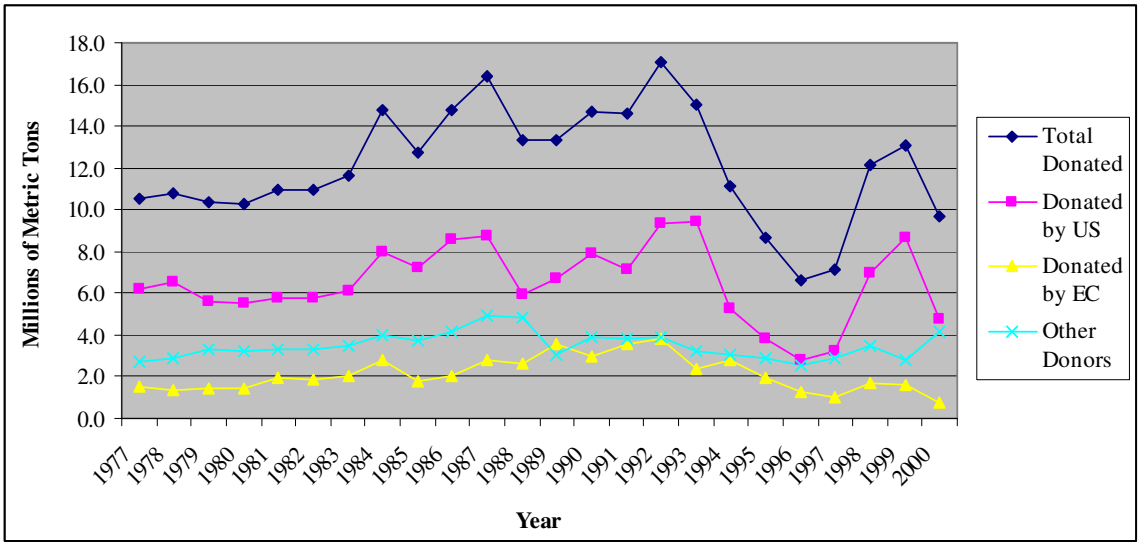
In 1954, the United States passed Public Law 480, which linked US farm policy to food aid through the disposal of grain surpluses. Enactment of this piece of legislation, also known as Food for Peace, demarcates the modern era of food aid, since from 1950 to 1963, almost all of global food aid was wheat from US surpluses (Clay, 1990). The law had enormous ramifications for US farm interests, since in the middle 1950s the value of US food aid was one-third the value of US food exports (Christensen, 2000). Technological innovation in agriculture since the 1950s means that today US cereal food

aid by weight represents a much smaller share of US cereal production. From 1988 to 2000 that share fluctuated between about one and three percent per year.

The debate over food aid dates back to 1959 when Willard Cochrane wrote an article claiming that US agricultural surplus could be dispensed in the form of food aid to promote economic development in poor countries. In 1960, Theodore W. Schultz published a rebuttal of Cochrane's argument in an article that warned that Food for Peace likely had an adverse impact on farmers in recipient countries (1993). Schultz's article was so influential that today, some 40 years later, disincentives for food production in recipient countries remain at the heart of the food aid debate. Nevertheless, warnings about disincentives based on Schultz's analysis sometimes ignore the fact that his analysis only addresses program food aid, which is produced in a rich, industrialized nation and given to a recipient country (or sold at a concessionary price). The recipient government then sells the food and generates revenue that is ostensibly used for development projects (Barrett, 1999). Program food aid was the dominant form of food aid in the 1950s and 1960s, when Schultz wrote his article. Since that time, however, food aid has evolved both in the ways in which it is procured and the ways in which it is distributed. Various types of food aid now exist and, although Schultz's argument may be relevant to program food aid, it is not necessarily applicable to other types of food aid. In addition, empirical studies fail to conclude decisively whether the Schultzian disincentive effect truly exists.

1.2 Trends and Types of Food Aid

Figure 1.1, shows that total global food aid increased from the late 1970s through the middle 1980s and reached its height at a range of 13 to 17 million metric tons annually from 1987 through 1992. After 1992, it decreased rapidly and reached a recent low of 6.5 million tons in 1996. A significant increase was seen from 1997 to 1999, followed by a sharp decline from 13 million to just under 10 million metric tons in the year 2000. Overall, the period of 1977 to 2000 was marked by a slight decline in food aid volumes, but the more obvious trend has been toward increased volatility of global shipments (http://apps.fao.org/page/collections?subset=nutrition).



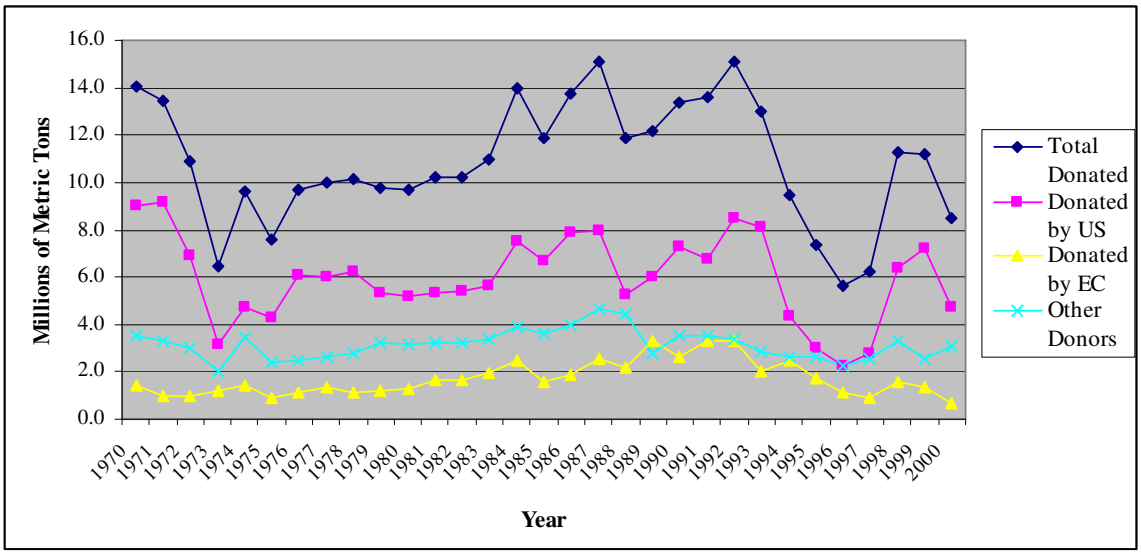
Source: FAOSTAT

Figure 1.1: Total Food Aid by Donor 1977 – 2000

Since 1977, the largest contributor of total food aid by tonnage has been the US; during the 1990s other major contributors were, in more or less descending order: the European Union, Japan, Canada and Australia (www.wfp.org/interfais/2000). US food

aid shipments were at least 50% of total food aid shipments by weight for each year in the period 1977 through 2000. Moreover, US food aid explains in large part the volatility of total donations from year to year. European Community (EC) donations are substantial, but they have exhibited a steady decrease after 1992.

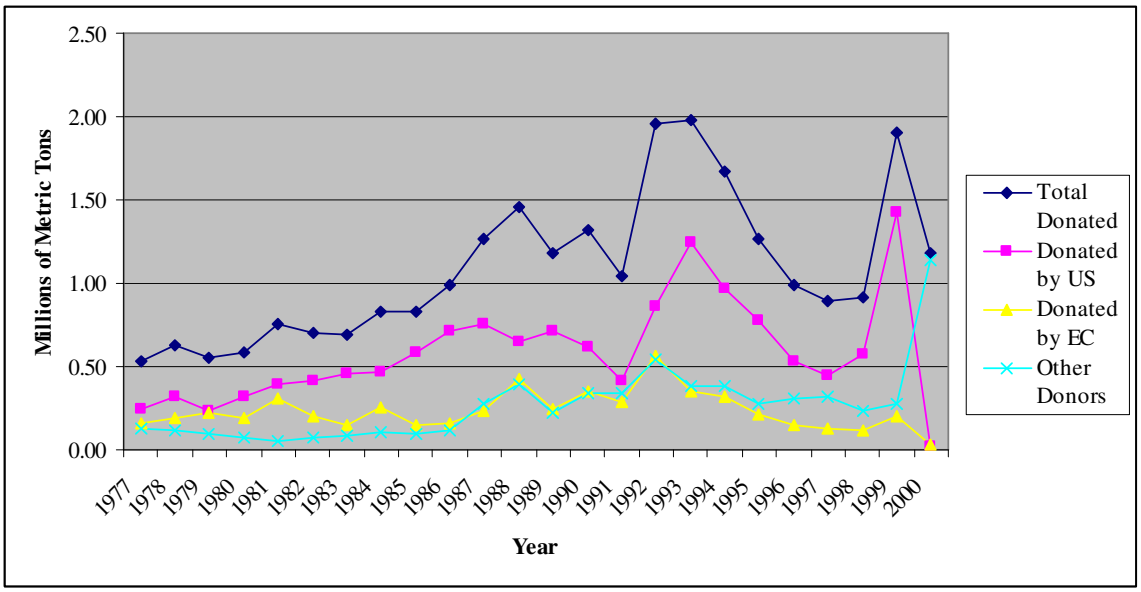
Cereals make up the bulk of food aid receipts (Figure 1.2); in a typical year between 80 and 90% of food aid is cereal food aid. Approximately 50 to 60% of cereal donations are made by the US.



Source: INTERFAIS

Figure 1.2: Cereal Food Aid by Donor 1970 – 2000

Non-cereal food aid is a small portion of total food aid when measured by weight (about 10 to 20%); the US is the major donor of non-cereal food aid as well (Figure 1.3).

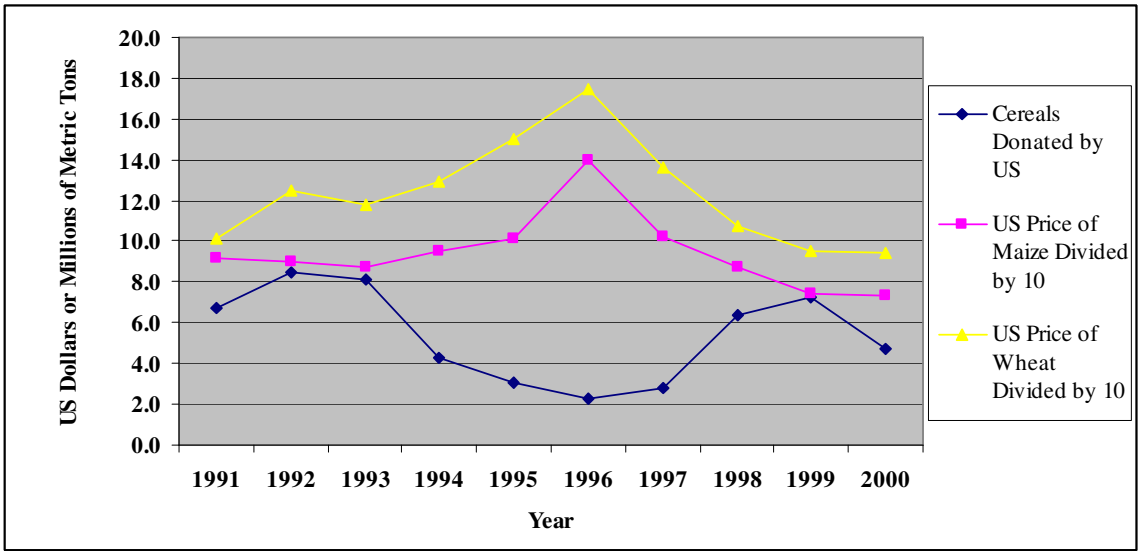


Source: INTERFAIS

Figure 1.3: Non-Cereal Food Aid by Donor 1977 – 2000

Both cereal and non-cereal food aid show increased volatility over time; trend lines indicate that cereal food aid has decreased slightly over the period 1977 to 2000 whereas non-cereal food aid has increased significantly from 1977 to 2000 (http://apps.fao.org/). Donations of both types of food from donors other than the US or EU countries are remarkably stable over time; this would suggest that the allocation of food by countries and entities other than the US or EU may be more of a response to perceived need of recipient countries for such food. Figure 1.4 shows the quantity of cereal food aid donated by the US and the producer price for wheat and maize in the US. When the price of staple grains is high (1995 – 1997) food aid from the US is scarce and when the price of maize and wheat is low in the US (as in 1992 and 1999), large amounts of food aid are delivered by the US. Although this figure only covers a short time period, the literature suggests that allocations of cereal food aid by the US are based in large part

upon agricultural surpluses rather than conditions in recipient or potential recipient countries (Shaw, 2001).



Source: INTERFAIS, FAOSTAT

Figure 1.4: US Donations of Cereals and Producer Prices for Maize and Wheat in the US 1991 – 2000

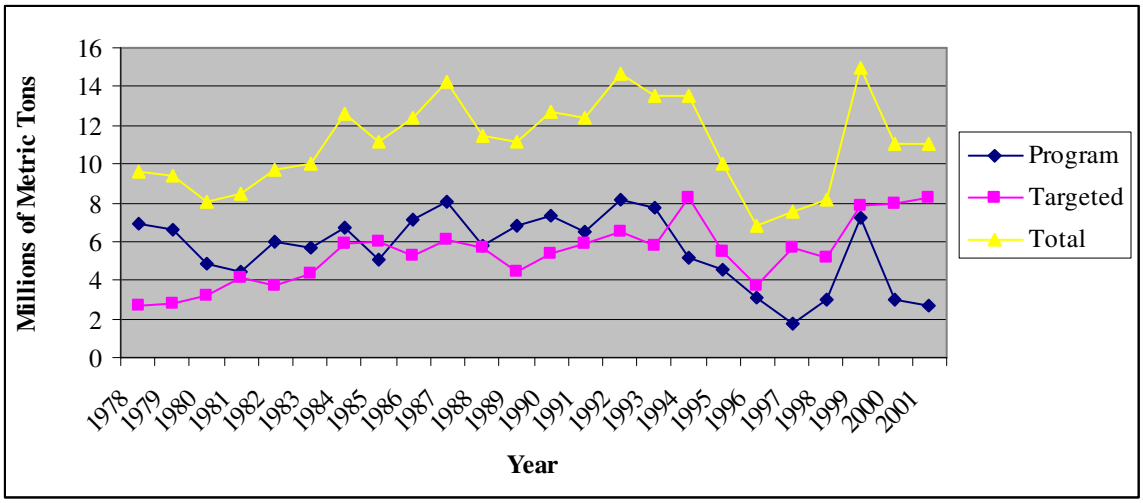
Food aid may be classified according to mode of distribution and mode of procurement. There are two major types of food aid distribution: program and targeted. As already indicated, program food aid is sold by a recipient government to its citizenry. Targeted food aid is distributed for free to those citizens thought to be hungry; the literature refers to the effort to get food aid into the hands of the hungry poor as targeting. Targeted food aid is typically multilateral; it involves many donor countries and is distributed through an international organization. Although rare, there is some bilateral food aid that is targeted. In 1963, the World Food Programme (WFP) was formed with the goal of counteracting any possible disincentive effects on local agriculture in recipient

countries by providing targeted food aid and implementing food aid for agricultural development projects (Clay, 1990). All WFP food aid is targeted and may be further differentiated as being either emergency or project food aid.

Emergency food aid includes short-term emergency operations (EMOPs) and protracted relief (and recovery) operations (PR(R)Os). EMOPs are efforts to distribute food over the very short term to alleviate famine. PROs and PRROs are established when natural disasters necessitate longer-term responses. Project food aid typically takes the form of development projects such as food for work or school feeding. Food for work programs employ the otherwise jobless or underemployed (when successfully targeted) in the enhancement of agriculture (eg, building irrigation systems) and infrastructure (such as road building) projects. Through school feeding, students with strong attendance records are provided with lunch or rations to incentivate children's enrollment in and regular attendance at school (Shaw, 2001). Ravallion (1977) stresses the unclear distinction between project and emergency food aid. Some emergency relief programs contain elements of food for work or school feeding. Furthermore, synergies likely exist between the two types of aid; safety nets provided through emergency alleviation facilitate future development efforts and development projects may prevent the need for emergency relief.

We shift our focus to cereal food aid as it serves as a reliable proxy for total food aid. Cereal food aid typically accounted for 90% of total food aid by weight for any given year from 1978 to 2001. Figure 1.5 shows annual shipments of cereal food aid by type. The most obvious tendency in recent years is one of increased volatility in total food aid levels from year to year. Examining summary statistics on yearly total program

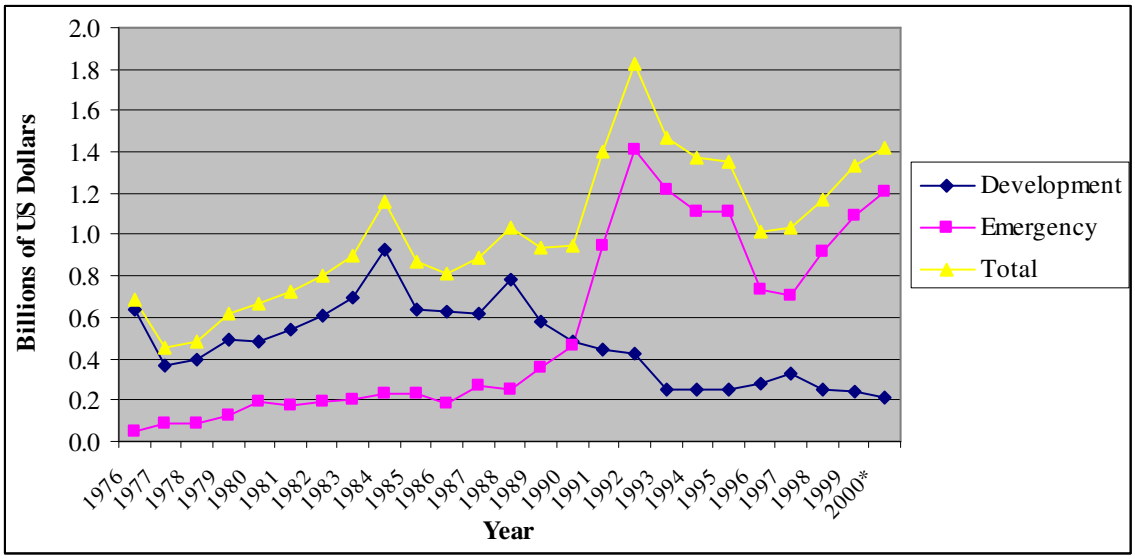
food aid and total targeted food aid (from 1978 to 2000) does not reveal a difference in the volatility of the two types of food aid. Inspection of summary statistics of observations at the country year level from 1988 to 2000 (the time frame used in our study) reveals a sharp difference in the volatility of program and targeted food aid. For a given country program food aid tends to be more volatile from year to year than does targeted food aid. The trend shows a slight increase in total cereal food aid over the period 1978 to 1992. Both targeted and program food aid increased from 1978 until 1992. From 1992 until 2001 program food aid decreased while quantities of targeted food aid increased. Total food aid levels exhibited a slight increase from 1992 until 2001 and it would appear that targeted food aid has been replacing program food aid. Most of the increase in targeted food aid was the result of increased emergency food aid, rather than project food aid. Indeed, the atmosphere at WFP suggests fierce competition between those seeking to secure food for emergency purposes and those seeking funds for food for development goals.



Source: INTERFAIS

Figure 1.5: Total Cereal Food Aid by Mode of Procurement 1978 – 2001

Christensen (2000) writes that recent years have been marked by increased civil unrest, armed conflict, natural disasters and thus famine emergencies, but food aid supplies have not increased commensurately over the same period. As a consequence of this rising need for food aid (if one accepts it as an appropriate response to hunger and famine) and a limited increase in donations, the main use of targeted food aid shifted from mainly development projects in the 1980s to mostly emergency operations in the 1990s. WFP expenditures have mirrored this trend; as shown in Figure 1.6, the expenditures on emergency food aid (including PRROs and PROs) exceeded expenditures on food aid for development after 1990 and commitments to emergency relief determined in large part the overall level of food aid (www.wfp.org/interfais/2000).



Source: www.wfp.org

Figure 1.6: WFP Expenditures on Development and EMOPs 1976 – 2000

In addition to the distinctions between its various uses, targeted food aid can be grouped according to mode of procurement. These include traditional food aid, local purchases, triangular transactions, and triangular swaps. Traditional food aid results from food that is produced in a donor country and shipped to a recipient country. Local purchases involve a donor purchasing food in the recipient country for distribution to the hungry poor in that recipient country. Triangular transactions involve three countries; the donor country donates cash, which is used to purchase food supplied by a developing country for shipment to another developing country (the recipient) where it is distributed as food aid. Triangular swaps involve a donation of food of one type, which is traded for a different type of food in a developing country; this different type of food is then sent to another developing country as food aid.

1.3 Problem Statement

The major arguments in the debate over food aid are those made by Schultz in the 1960s and Barrett in recent years. The former maintained that program food aid discourages domestic production in recipient countries whereas the latter has claimed that rather than affecting production, program food aid displaces imports to recipient countries. Empirical studies fail to provide consistent evidence supporting either of these theories and thus the question of the impact of food aid remains empirically unresolved. Furthermore, Schultz and Barrett focus on program food aid and ignore targeted food aid, which has represented a significant share of total food aid for several years now. As food aid resources have become more volatile in recent years, agencies such as the World Food Programme find it difficult to attract reliable funding and donations. Given such resource constraints, it is perhaps more important than ever that we understand the difference between targeted and program food aid so that scarce food aid resources may be put to their best use.

1.4 Research Objectives

The objective of my dissertation is threefold. First, a theoretical framework is developed in order to identify hypotheses regarding the impact of food aid on production and imports. I rely on a literature review and preliminary inspection of the dataset to develop hypotheses regarding the impacts of production levels and import ability on food aid allocation. Second, these hypotheses are tested empirically. Lastly, I offer policy recommendations based on the results of the hypothesis testing.

1.5 Outline of the Dissertation

The dissertation contains six chapters. The first chapter describes the history of food aid, defines the problem statement for the dissertation, and outlines the dissertation. Chapter Two first reviews the literature on the relationship between food aid, imports, and production and then it uses supply and demand analysis as a simple theoretical framework for considering the impacts of various types of food aid on imports and production. Hypotheses to be tested in the empirical portion of the dissertation are derived from the theoretical analysis and literature review.

Chapter Three reviews the various methodologies that have been used to study the impact of food aid on production and imports. Justification is provided for the use of vector autoregression with fixed effects. This methodology has three advantages. First, it requires few assumptions. Second, the methodology allows for an examination of the dynamic interaction of production, imports and food aid over time and across several countries. Third, it can be implemented given the data available.

In Chapter Four I describe the INTERFAIS data on food aid, and the FAOSTAT data on production, trade and population as well as the strengths and limitations of these data. It then details the methodology used to construct a measure of total cereal food aid that is comparable to the FAO measure of total cereals for production, imports, and exports. Definitions and some descriptive statistics are provided for the variables constructed for use in the vector autoregression models.

Chapter Five provides results, which include hypothesis testing and parameter estimates from the vector autoregression with fixed effects. The sixth and final chapter provides an interpretation of the results and their implications for agricultural policy.

CHAPTER 2

LITERATURE REVIEW AND PROBLEM DEFINITION

2.1 Impacts of Food Aid

Despite more than a half century of food aid distribution and an extensive literature on the subject matter, the answer to a fundamental question - "What is the impact of food aid?" - has eluded the economics profession in the sense that various theories exist, but no consensus has been reached.

2.1.1 Existing Literature

Various contributions to the literature address the impacts of program food aid on domestic production and on imports. There are fewer studies that examine the effect of targeted food aid on domestic production and on imports.

2.1.1.1 Impact of Program Food Aid on Domestic Production

The scenario investigated later on in the chapter in section 2.1.2.1 and shown in Figure 2.1 (see page 24) is essentially the same as that described by Theodore W. Schultz in his 1960 article, one of the earliest works on food aid, which remains a fundamental part of the literature today. Schultz wrote that program food aid creates a price disincentive effect for food producers in the recipient country and thereby decreases

domestic production. Although he warned that his idea (food aid discourages agricultural production in the recipient country) was mere speculation and was not supported by any empirical evidence, his paper shaped thought on food aid for many decades. He described a country that receives free food under PL480, it continues to import the same amount of food as it did prior to the PL480 receipts (this amounts to the successful specification and enforcement of the UMR), and it has no substitutes in production or consumption of the relevant food item. Given such a market, a receipt of program food aid would decrease the price of the food item and thus result in a price disincentive to local farmers (Schultz, 1960).

Schultz's speculation was so influential that it became perhaps the single most recognized work on food aid ever written; a generation of students in undergraduate courses was taught oversimplified versions of Schultz's argument. One problem with the popularization was that people confused the food aid Schultz described with all food aid. Schultz was writing in 1960 about program food aid; since then targeted food aid has become the dominant form of food aid. The World Food Programme was founded in 1963 in an effort to avoid the very disincentive effects Schultz discussed through targeted food aid programs; targeted food aid is distributed for free to the poor who ostensibly would not otherwise be able to purchase enough food to satisfy their minimum caloric requirements. Furthermore, people ignored other assumptions that Schultz made. Schultz revealed the impact of non-targeted food aid under a given set of conditions that rarely hold. The most obvious deviation relates to the additionality of food aid. In order for food aid to create the Schultzian disincentive effect, it must be additional to imports,

otherwise stated imports must not change, but this has rarely been found to be the case (Fitzpatrick, 1989; Saran, 1991; Barrett, 1999, 2002).

Not only was Schultz's argument used inappropriately, but myriad attempts have failed to provide empirical evidence of the disincentive impact of food aid. A World Bank report examining the dynamic relationship between all types of food aid and local production finds that food aid (whether program or targeted) actually increases local production; the author attributes this to food aid's ability to relax liquidity constraints facing those recipients who are also food producers (Lavy, 1990). Barrett used a methodology similar to that in the World Bank report and found that U.S. program food aid decreases local production in the short run, but by a negligible amount which decreases over time; the contemporaneous correlation of U.S. program food aid and local production is negative, but statistically insignificant (Barrett, 1999). Various studies find evidence in support of disincentives (Isenman, 1977; Maxwell and Singer, 1979; Fitzpatrick, 1989). In performing case studies of Ethiopia, Senegal and the Sudan, Simon Maxwell found evidence that the impact of food aid on prices varies according to what government policy is implemented in a country (1991). Raymond Hopkins reviews 25 country-level studies that were completed in an effort to evaluate the disincentive effects of food aid and finds that, taken together, the results of these studies are inconclusive (1992). He also finds Vernon Ruttan's dismissal of the importance of Schultzian disincentives typical of the predominant view of food aid in the 1980s and early '90s.

Hopkins quotes Ruttan:

> The major impact of the professional literature on food aid has been to narrow the range of controversy about food aid impact. It is difficult for anyone who has limited familiarity with the literature to continue to argue that food aid has a pervasive negative impact on the growth of agricultural production.
>
> (Ruttan, 1989)

Domestic production is not the only source of non-concessional food that may be impacted by program food aid; imports may also be affected by such food aid.

2.1.1.2 Impact of Program Food Aid on Imports

The scenario examined in section 2.1.2.2 and shown in figure 2.2 is consistent with most studies of the relation between food aid and food imports, which support the hypothesis that food aid is not fully additional but instead displaces imports (Fitzpatrick, 1989; Saran, 1991; Barrett, 1999). Christopher Barrett, probably the economist with the most academic experience in food aid research, has found that food aid displaces food imports but has little effect on food production (1999, 2002). Evidence from a study by Barrett *et al.* (1999, 1998) showed a negative correlation between U.S. program food aid and contemporaneous imports by recipient countries. The study also indicates that program food aid from the U.S. displaces imports by recipient countries in the short term, leading to short term dependence on program food aid. Program food aid was found to increase imports to recipient countries in the long run. Since Barrett's work uses U.S. program food aid data only, it is not clear whether the same holds for targeted food aid and for food aid from donors other than the US. Treatment of the import displacement and production disincentive effects of program food aid is common in the literature, but

there have been few rigorous studies of targeted food aid in relation to domestic production and imports.

2.1.1.3 Impact of Targeted Food Aid on Domestic Production

Disincentive effects may result from targeted food aid for various reasons. The poor may receive more food aid than they need and sell the excess on the local market. Alternatively, targeted food aid (which is intended only for the poor) may be distributed to the non-poor who otherwise would have purchased such food. These "unneedy" recipients will accept the free food and decrease their purchases of food from local markets. This translates into decreases in the quantity of food demanded in the market, and to local producers it means lost sales. One could argue that the food aid recipient will purchase other goods locally as a result of the funds freed up by the food aid receipts. The disincentive to the staple food producer is, nevertheless, very real and may cause local farmers to move to activities other than food production as their market shrinks; the end result is decreased local production and, unless the country experiences economic growth which allows it to import food, it will become dependent on food aid. The degree to which targeting is not successful in preventing market disturbances determines the extent of disincentives.

Many studies have examined the success of food aid targeting and most suggest that targeting is unsuccessful to a greater or lesser extent. A study of the determinants of participation in food for work (FFW) in the Tigray region of Ethiopia indicates that targeting was successful in that it included all of the poor (no errors of exclusion), but a failure in that it also included some of the non-poor (errors of inclusion) (Gebremedhin,

2001). Further evidence of unsuccessful targeting in FFW programs lay in the apparently overly lucrative nature of FFW remuneration in the Damit Woyde Awraja district of Ethiopia (Maxwell, 1994). Evidence indicates that FFW in Bangladesh changed the composition of demand for food (FFW participants' demand increased, whereas the demand of non-participants decreased). However, the total amount of food demanded did not change (Dorosh, 1997). A report on aid in Malawi provides evidence of unsuccessful targeting in the school-feeding program, which the report deemed wasteful since poor children were not the ones in school. If such was the case in the Malawian school feeding program, and food used in the school feeding program was not purchased locally, a demand side disincentive may well have resulted (Smith, 2001).

2.1.1.4 Impact of Targeted Food Aid on Imports

It is plausible that targeted food aid displaces imports less than program food aid does since recipients of targeted food aid are, given effective targeting, those people who have low purchasing power and who therefore are unable to purchase food imports. There are few studies that examine the impact of targeted food aid on imports. Targeted food aid is often monetized or sold on the market in a recipient country; this practice likely makes targeted food aid more similar to program food aid in its impacts on imports. In a study of targeted food aid that is monetized, Herrman *et al.* find evidence that the effect of the food aid depends on how the recipient government uses revenues generated from monetization; government subsidies of demand for food lead to increased imports whereas stimulus of food supply leads to decreases in imports (1992).

The literature on the effect of food aid on non-concessional food availability may be summarized, as in Table 2.1, according to the type of food aid in question (program or targeted) as well as the impact being examined (the impact of food aid on local production or the impact of food aid on imports to the recipient country).

Effect of:	On Local Production	On Imports
Program Food Aid	• Decreased Production (Schultz, 1962) • Increased Production (Lavy, 1988) • Impact Varies/ Ambiguous (Maxwell, 1991; Hopkins, 1992) • No Impact (Arndt and Tarp, 2001)	• Decreases Imports (Fitzpatrick, 1989; Saran, 1991; Barrett, 1999, 2002)
Targeted Food Aid	• Decreased Production (Maxwell, 1994; Dorosh, 1997; Gebremedhin, 2001; Smith, 2001) • Increased Production (Lavy, 1988) • Impact Varies/ Ambiguous (Maxwell, 1991; Hopkins, 1992) • No impact (Arndt & Tarp, 2001; Barrett, 2002)	• Impact Varies (Herrman, 1992)

Table 2.1: Review of Literature on Effects of Food Aid on Production and Imports

2.1.2 A Theoretical Framework

Various attempts have been made to prevent food aid from displacing commercial food trade and discouraging food production in recipient countries. In 1954 the Food and Agricultural Organization of the United Nations founded the Consultative Sub-Committee on Surplus Disposal (CSSD) in an effort to limit market distortions arising

from food aid (FAO, 2000). As described in the CSSD handbook, The Principles of Surplus Disposal, the committee's aim is to "assure that food and other agricultural commodities which are exported on concessional terms result in additional supplies for the recipient country and do not displace normal commercial imports; and similarly, that domestic production is not discouraged or otherwise adversely affected" (FAO, 1992). Fundamental economic theory suggests that committee's mandate is not possible. Food aid will always discourage domestic production to a greater or lesser degree and under some conditions it may displace commercial imports. The degree and type of market distortion will, however, be affected by CSSD policy as well as by the type of food aid.

The CSSD introduced the concept of the Usual Marketing Requirement (UMR) or minimal quantities of imports that countries must purchase at non-concessional prices before they are permitted to import program food aid at concessional prices. The UMR quantity and price for a given commodity and recipient country are determined through consultation among representatives of countries that export the commodity to that recipient country. The UMR is set to equal the average quantity and price of commercial imports of the commodity by the recipient country over the preceding five years. By obliging recipients to import the UMR, the CSSD aims to prevent import displacement (FAO, 1992). In 1963, the FAO established the World Food Programme and introduced targeted food aid as an attempt to provide food aid without displacing imports or discouraging production; targeted food aid is exempt from the UMR (Shaw, 2001).

The effects of the two types of food aid on trade and production in a food-importing country can be examined using a basic supply-and-demand framework, with various scenarios depicted in Figures 2.1, 2.2 and 2.4. The figures depict a uniform

commodity, food, which is a perfect substitute for food aid. This commodity is traded or otherwise exchanged among three countries. Modeling a three-country scenario allows one to examine the global welfare impacts arising from food aid since it differentiates between the implications of food aid for the welfare of three different country types. The three country types incorporated in our model correspond to the agents considered by the CSSD when establishing UMRs, so that this framework also allows modeling of the impact of food aid given various degrees of UMR enforcement and specification. One country, the donor country, practices protectionist measures; it subsidizes food production and donates the resulting surplus as program food aid to a recipient country. I assume that, without the subsidy, the domestic price of food in the donor country equals P_E, which is the world price of food in the absence of donations. Another country is a food exporter that does not subsidize its food market; it has a comparative advantage in food production if the world price is not distorted by food aid. The third country, which I refer to as the recipient country, lacks comparative advantage and is a recipient of food aid from the donor country and imports commercial food from the exporter.

As shown in part A of Figure 2.1 (in the following section), subsidies paid to farmers raise the price of food in the donor country to P_S. To maintain this price, the country's government must block any imports of food from other countries. The donor country, which has no comparative advantage in food production, produces a surplus of food equal to FA as a result of the government's subsidization of the food market. For the sake of simplicity I assume that the entire surplus is designated as food aid for the recipient country. This scenario is the same in Figures 2.2A and 2.4A (on pages 28 and 34, respectively).

2.1.2.1 Impact of Program Food Aid on a Cereal Importer given Correct UMR Specification and Enforcement

Figure 2.1 shows the impact of program food aid on a food importer when UMRs are correctly specified and enforced. Let us assume that for a five year period the exporter ships a quantity of food equal to X at a price of P_E to the recipient/ importing country. In the sixth year the donor country begins to subsidize food production and institutes a food aid program. Negotiations through the CSSD are successful in correctly specifying the Usual Marketing Requirement as equal to the quantity X and price P_E; the UMR is also successfully enforced. The donor country's subsidization leads to a quantity of food aid equal to FA; for simplicity we assume that the entire surplus resulting from the subsidy is designated as program food aid to be given to the government of the recipient country. Consumers in the recipient country will pay a maximum of P_{R1} for FA + X, but UMR enforcement translates to a mandate that the exporter is going to sell X at P_E to the recipient country. The recipient government purchases the UMR at the original world price of P_E and it receives FA at zero cost; it then resells all of the food to consumers at P_{R1}. The government takes a loss on the resale of the UMR equivalent to the area labeled B, but it is able to recover such losses through profits it makes when reselling the food aid (the profit equals the difference between the shaded area labeled A and that which is labeled B).

Given proper UMR specification and enforcement, there are various welfare implications resulting from the donor country's subsidization scheme. Consumers in the donor country lose surplus whereas producers in the donor country gain surplus at the expense of the donor country's government which bears the costs of subsidizing the food

sector. The exporting country experiences no change in welfare. The recipient country experiences gains in consumer surplus and losses in producer surplus. Finally, there is a welfare loss in the donor country as taxes are raised to subsidize agriculture; this loss is not represented in Figure 2.1 or Figure 2.2.

Figure 2.1A: Donor

Figure 2.1B: Exporter

Figure 2.1C: Recipient/Importer

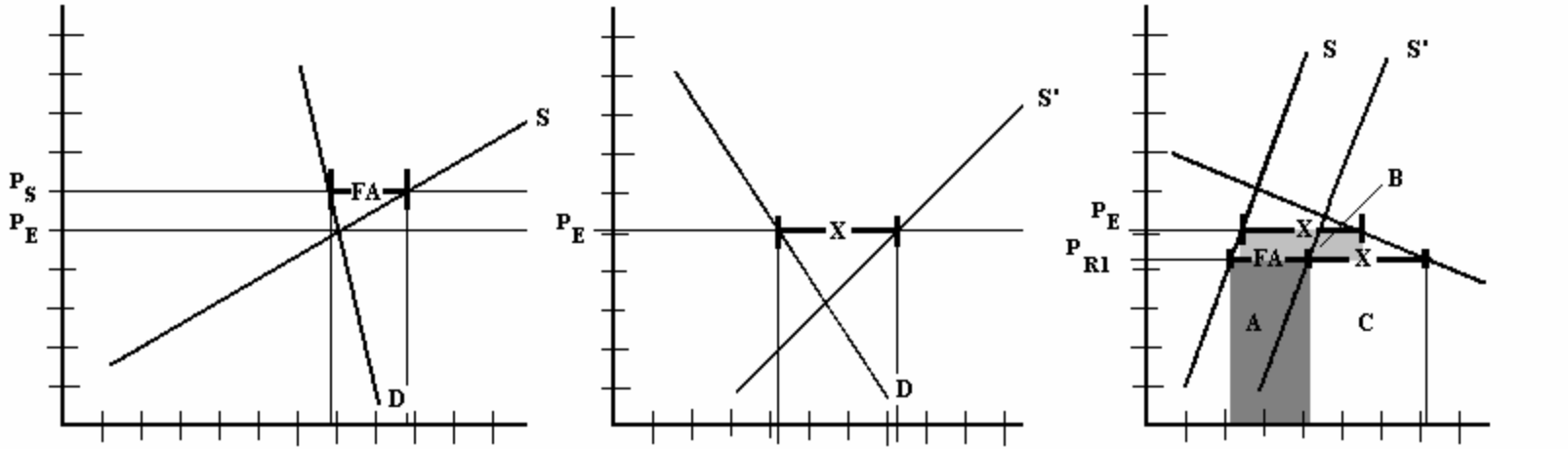


Figure 2.1: Impact of Program Food Aid Given UMR Correctly Specificed and Enforced

2.1.2.2 Impact of Program Food Aid on a Cereal Importer given the UMR is not Enforced

We now consider the case of UMRs not being enforced; the resulting effects on production and imports resemble findings from work by Barrett (1999) and others rather than the theoretical model provided by Schultz (1960). Documentation from the Food and Agricultural Organization of the United Nations indicates that recipient countries often resell program food aid at the world price for food (www.fao.org/tc/tca/pubs/tmap40/40chap3.htm). This is possible only if the UMR is not enforced and when the UMR is not enforced the world price of food may be lowered as a result of the food aid. Figure 2.2 portrays this scenario in detail. The enforcement of the UMR changes the welfare of the exporter and the recipient. When the UMR was enforced, the recipient was bound to import X at P_E and it received FA at no cost. If the UMR is not enforced, the recipient will continue to receive FA at zero cost, and the price at which the recipient government chooses to resell FA will determine the production level of the exporter and the consumption level of the importer. Should the recipient government decide to levy tariffs to protect domestic food producers, and resell FA at P_E then the amount of food consumed in the recipient country will equal X, but it will consist of FA in food aid and X' in non-concessional imports. The reduced demand for the exporter's cereal food will cause the exporter to decrease the quantity it exports from X to X'. Should the recipient country not implement protectionist policies, a new, lower world price of cereals would be reached at the point where excess supply in the exporting country equaled excess demand in the importing country; in Figure 2.2 this price is PE'. Regardless, the effect of program food aid under no UMR enforcement is import

displacement. The price at which the recipient country's government resells the food aid is crucial in determining the effect on the exporting country and on producers in the recipient country. If the government chooses to implement protectionist policies and resell food aid at the original world price then imports are displaced by FA and domestic production is not discouraged. Should the recipient government resell food aid at a price below P_E then domestic production will be discouraged.

The welfare implications of program food aid when the UMR is overlooked are different from those when the UMR is enforced. The donor country experiences gains in producer surplus and losses in consumer surplus as it did under the previous scenario. When the UMR is not enforced the exporting country producers' surplus is lowered and consumers' surplus is increased relative to the levels of producer and consumer surplus that arise in the exporting country when the UMR is properly specified and enforced. Decreases in the surplus of producers in the recipient country are smaller when the UMR is not enforced than when it is enforced and consumer surplus is smaller when the UMR is not enforced than it is when the UMR is enforced.

In summary, it would appear that there is a fundamental tradeoff in the enforcement of UMRs: the CSSD may either correctly specify and enforce UMRs so that imports to recipient countries are not displaced, but production in recipient countries is discouraged, or it may relax UMRs so that imports are displaced and production in recipient countries is discouraged less. As such, the aim of the CSSD to "assure that food and other agricultural commodities which are exported on concessional terms result in additional supplies for the recipient country and do not displace normal commercial imports; and similarly, that domestic production is not discouraged or otherwise

adversely affected" (FAO, 2000) is an impossible goal. Otherwise stated, the opportunity cost of UMR enforcement is additional production disincentives in recipient countries whereas the opportunity cost of not enforcing UMRs is import displacement.

Figure 2.2A: Donor

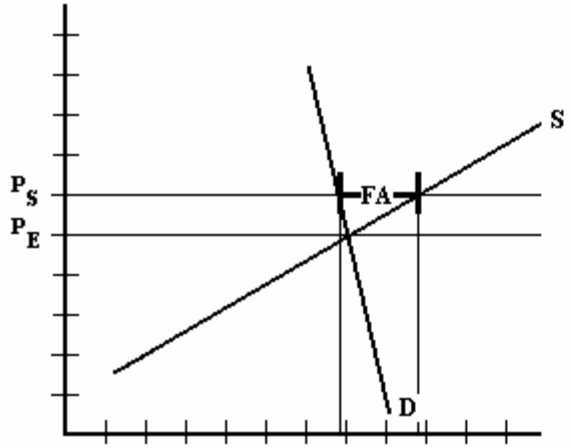


Figure 2.2B: Exporter

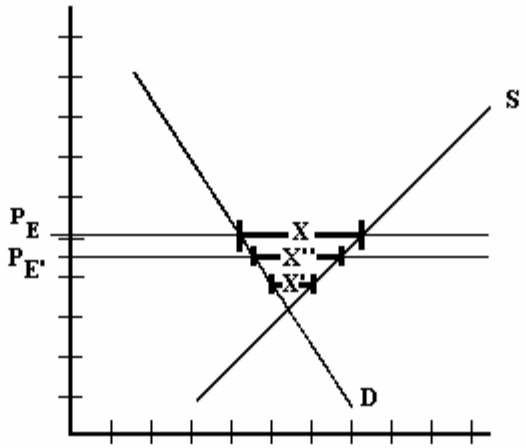


Figure 2.2C: Recipient/Importer

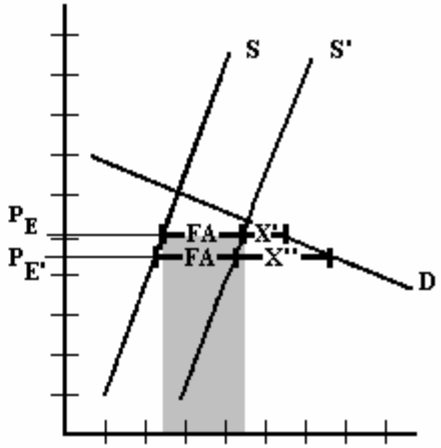


Figure 2.2: Impact of Program Food Aid When the UMR is Not Enforced

2.1.2.3 Impact of Targeted Food Aid on a Cereal Importer

When food aid is targeted, or distributed for free to vulnerable groups, it has different welfare implications than program food aid does. We shift momentarily from partial equilibrium analysis to general equilibrium analysis. Figure 2.3 considers the effects of targeted food aid in a market with two goods: food (F) and non-food (NF) and with two consumers: one who is poor (P) and the other who is non-poor (NP). The smaller rectangle represents the market before food aid is distributed. Given their individual preferences and budgets, the Pareto optimal allocation of food and non-food among the poor and non-poor consumer is at the point A, where each consumer is maximizing his utility given his budget constraint. When FA in targeted food aid is distributed to the poor, it is as if the available food has increased by FA; we therefore represent this transfer as an increase in the horizontal axis from F_P to F_P' and a shift from point A to point B.

At point B the poor consumer has attained a higher level of utility than he had at point A represented by his movement from the indifference curve IP to IP'. At point B the indifference curve of the poor consumer and the indifference curve of the non-poor consumer are not tangent, which indicates that the allocation is not Pareto efficient; there is room for one of the agents to attain a higher level of utility without decreasing the utility of the other agent. Points in the area shaded grey between the indifference curve of the non poor and that of the poor consumer are Pareto superior allocations. Point B results from food aid being fully additional; because it is not Pareto efficient we know that there are opportunities for both agents to gain (or at least not be made worse off) from trading (Mas-Colell, 1995). As long as the marginal utility of food is diminishing

(and according to Engel's Law it is), fully additional food aid will not be possible. Once his endowment is altered by the food aid, the poor agent will trade food for non-food items. The finite supply of non-food and the increased demand for non-food will cause an increase in the price of non-food with respect to food. The two agents will trade, both achieving higher levels of utility as a result and ultimately reaching a Pareto efficient allocation along the new contract curve, CC'.

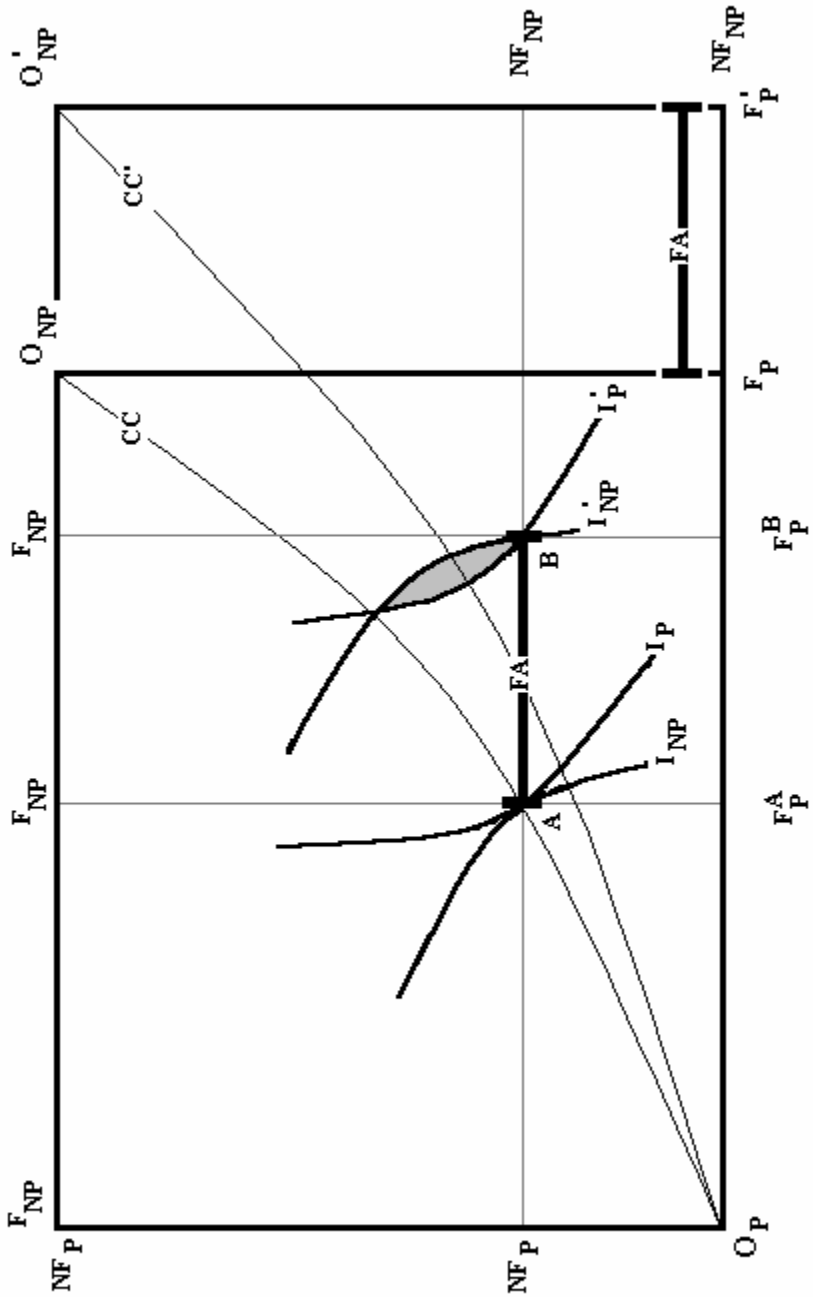


Figure 2.3: Fully Additional Targeted Food Aid is Not Pareto Optimal

Figure 2.4 returns to the partial equilibrium framework, depicting the effect of targeted food aid on food markets. UMRs are not considered since they are not enforced in relation to targeted food aid (FAO, 2000). The donor country subsidizes its food production and designates FA, the surplus, as food aid (shown in Figure 2.4A) which an organization such as the World Food Programme distributes for free to vulnerable groups in the recipient country. Given that recipients obtain the food free of charge and they are able to resell their food receipts on the market, the distribution of such food for free is equivalent to an increase in the recipients' income; targeted food aid is therefore represented as a demand shift as well as a supply shift. The more successful the targeting, the poorer the recipient and the higher the income elasticity of demand for food. Regardless of how poor the recipients of free food are, their income elasticity of demand for food will be greater than zero and less than one, as it is for anyone. For this reason, and for reasons discussed in relation to Figure 2.3, it is inevitable that the targeted food aid will not be perfectly additional, but leakage will occur. Figure 2.4C shows that as the degree of leakage, μ (a value between zero and one), increases, food aid will be less additional and imports will be displaced; the degree of displacement is represented by the distance between D_A and D'. The extent to which demand is not fully additional because of leakage leads to import displacement. The amount imported will be reduced from X to X-μFA. Production in the recipient country is not discouraged unless μFA (the amount of imports displaced) exceeds X.

As under any food aid scenario, targeted food aid causes producers in the donor country to gain welfare as a transfer from the government whereas consumers in the donor country lose welfare. The welfare effects of targeted food aid on the exporter and

the recipient contrast those of program food aid. The exporter loses producer surplus and gains consumer surplus; this was the result from program food aid given the UMR is not enforced. To the extent that targeted food aid reaches food insecure people the discouragement of the exporter's production will be less severe under targeted food aid than it would were the food unsuccessfully targeted. The welfare of producers in the recipient country is only affected after food aid has displaced all imports; thus for producer surplus to be decreased, leakage of targeted food aid must exceed the quantity that would be imported were there no food aid. Targeted food aid increases consumer surplus in the recipient country.

Figure 2.4A: Donor

Figure 2.4B: Exporter

Figure 2.4C: Recipient/Importer

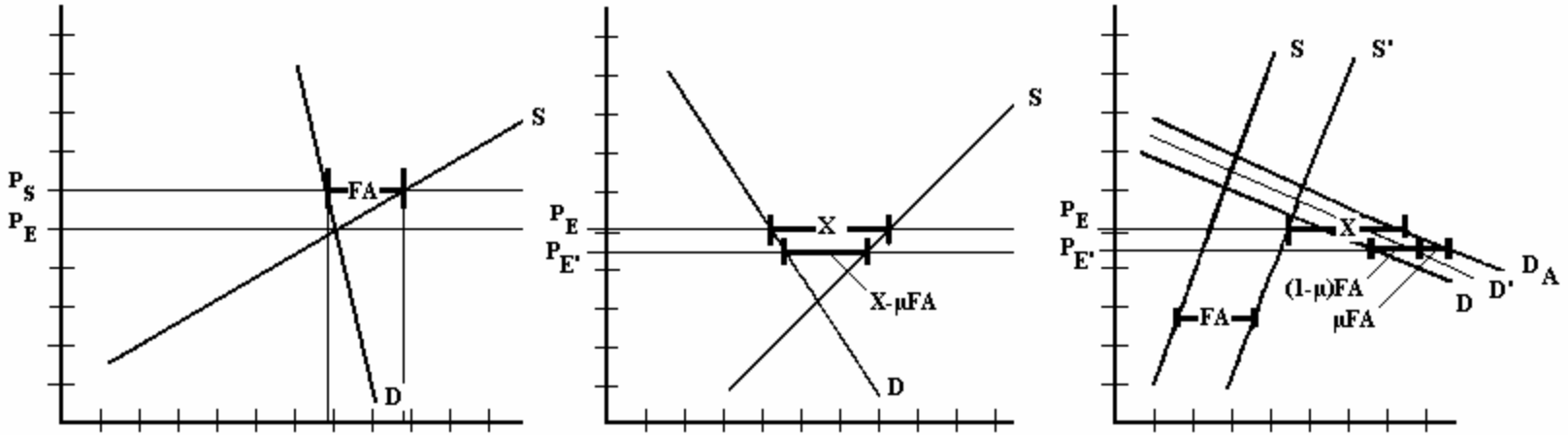


Figure 2.4: Impact of Targeted Food Aid

2.1.2.4 Hypotheses Resulting from the Theoretical Analysis About the Effect of Food Aid on Production and Imports

For the purposes of this study, the theoretical analysis is used to advance hypotheses regarding the data at hand, which are limited to quantities of cereal grain production, cereal imports, cereal exports, program and targeted cereal food aid. The effect of each type of food aid on production and imports may be summarized as in Table 2.2 below. Program food aid will cause a larger disincentive to local production given the UMR is enforced than it will cause when the UMR is not enforced. When the UMR is enforced, program food aid will not displace imports and when it is not enforced import displacement will occur. Targeted food aid causes import displacement for the most part, but when leakage of targeted food aid exceeds the quantity that would have been imported had food aid not been distributed, then production disincentives may result. The degree of import displacement and possible production disincentives caused by targeted food aid is inversely proportional to the effectiveness of targeting.

Effect of:	**On Local Production**	**On Imports**
Program Food Aid	• UMR enforced: Large Disincentive • UMR not enforced: Smaller Disincentive	• UMR enforced: No displacement • UMR not enforced: Displacement
Targeted Food Aid	Production disincentives only if the quantity of non additional food aid exceeds the amount of food that would have been imported had no food aid been distributed.	Import displacement (inversely proportional to the degree to which targeting is successful)

Table 2.2: Condensed Results of the Theoretical Analysis

One may test these theoretical conjectures using empirical methods, but only to a limited extent due to data constraints. Country- level data on cereal grains is limited to imports, exports, production and various types of food aid; there is a lack of data on prices, the enforcement of UMRs and the effectiveness of targeting. This means that we are able to test all aspects of the hypotheses suggested by the above theoretical framework, with the exception of the price, UMR and effectiveness of targeting dimensions. The following hypotheses result from our theoretical analysis:

1. Program food aid discourages cereal production in recipient countries.
2. Program food aid displaces imports to recipient countries.
3. Targeted food aid discourages imports.
4. Targeted food aid does not affect production.

2.2 Determinants of Food Aid Allocation: Evidence from Existing Literature and Preliminary Inspection of Data

The issues surrounding the impact of food aid on non-concessional food sources (imports and domestic production) are made more complex by the fact that the impacts are likely not unidirectional; just as food aid may influence levels of production and imports, production and import levels may determine the levels of food aid. The literature examining the determinants of food aid allocation becomes relevant here.

2.2.1 Impact of Local Production on Food Aid Allocation

Program food aid is largely driven by donors' political motivations and trade strategies as well as the international price of food; one would expect that per capita

levels of production (hereafter referred to as production levels for simplicity) in recipient countries are not a large determinant of program food aid allocation (Singer *et al*., 1987; Ballenger *et al*., 1992; Gabbert *et al.*, 2000). In contrast, targeted food aid is directed towards more needy countries (and to vulnerable groups within those countries) subject to any donor-imposed constraints (eg., donors are often eager to send targeted food aid through the WFP to high profile countries rather than countries with lower profile emergencies in order to receive positive media attention). In this sense, countries with low production levels are considered needier and receive more targeted food aid; domestic production drives targeted food aid (Ruttan, 1993; Ball *et al*., 1996). In a study of 33 countries in Sub Saharan Africa, Lavy finds evidence that low production Granger causes increased food aid receipts (defined as the sum of emergency and program food aid) (1990). Barrett (2002) uses a measure of non-concessional availability to identify the role of non-concessional food availability (imports plus production) in determining food aid allocation. He finds that both targeted and program food aid are allocated to the countries with lower levels of non-concessional food availability. Otherwise stated, both types of food aid are progressive; they are sent to more needy countries (where need is measured by low levels of production or import ability per capita). However, program food aid is destabilizing (it tends to arrive in countries when food is more available than is usually available in that country), whereas targeted food aid is stabilizing (it tends to arrive in countries when food is less available than usual). Production levels are not the only determinant of food aid allocation; imports also play a role. Our preliminary examination of the average quantity of each type of food aid distributed to countries by region (see Chapter 4) supports the idea that allocation of targeted food aid seems to be

more a response to low non-concessional food availability than is allocation of program food aid.

2.2.2 Impact of Imports on Food Aid Allocation

Import levels are likely correlated with the amount of food aid allocated by donors. When the international price of cereals is low, surplus grain is most abundant in donor countries; it is also at this moment that surplus grain will be donated as program food aid. This is consistent with the inverse relationship between the US price of wheat and maize and donations of cereals from the US (see section 1.2 Figure 1.4). The result is that a low price of cereals means that countries enjoy a strong ability to import at the same time that they receive large levels of program food aid. In this sense, imports and program food aid are positively correlated since program food aid is abundant when imports are affordable. Because targeted food aid is allocated more on the basis of need, countries with a poor ability to import food (low purchasing power) are more likely to receive targeted food aid. Thus imports and targeted food aid are negatively correlated (Barrett, 1998).

In conclusion, the relation of food aid to imports and production remains unresolved. The literature on food aid allocation may be summarized as in Table 2.3. While some studies find that levels of domestic production have little effect on program food aid, other studies show that low levels of domestic production result in allocation of larger quantities of program food aid. Most of the literature shows that low levels of domestic production result in larger quantities of targeted food aid. There is also a general consensus that program food aid and imports are procyclical; countries receive

large amounts of program food aid when food prices are low and they can therefore afford imports. The literature shows that in contrast to program food aid, more targeted food aid is allocated when imports are scarce. In summary, it would seem that targeted food aid tends towards more of a need based allocation than does program food aid.

Effect of:	On Program Food Aid Allocation	On Targeted Food Aid
Domestic Production	• Not a large factor in allocation (Singer et al., 1987; Gabbert et al., 2000; Ballenger et al., 1992) • Program food aid is allocated to countries that tend to have low production (progressive), but it arrives in years of abundant production (destabilizing) (Barrett, 2002)	• Significant factor in allocation decision (Ball et al., 1996; Ruttan, 1993; Lavy, 1990) • Targeted food aid is progressive and stabilizing (Barrett, 2002)
Imports	• Program food aid is progressive, but not stabilizing (Barrett, 2002) • When Imports are abundant program food aid is too (Barrett, 1998)	• Targeted food aid is progressive and stabilizing (Barrett, 2002)

Table 2.3: Effects of Production and Imports on Food Aid Allocation

2.2.3: Hypotheses about Food Aid's Relationship to Imports and Production

We may test the following hypotheses about food aid allocation which result from our literature review.

1. Low levels of domestic production lead to large quantities of program food aid.
2. Small amounts of domestic production cause large allocations of targeted food aid.
3. Large quantities of imports are associated with abundant program food aid allocation.
4. Small quantities of imports lead to large quantities of targeted food aid.

CHAPTER 3

AN EMPIRICAL MODEL OF THE RELATIONSHIP BETWEEN PRODUCTION, IMPORTS AND FOOD AID

3.1 Introduction: Methodology Used in Other Studies

Most studies relating food aid to production and imports involve the use of market-level data from a single country. Such studies afford researchers the distinct advantage of measuring the impacts of food aid on specific markets proximate to the food aid distribution. In developing countries where transport systems are inadequate and other infrastructure and trade networks are underdeveloped, market fragmentation is pervasive, that is, prices for the same good vary substantially among markets (McKinnon, 1973). By studying food aid using market-level data, one may account for such fragmentation, whereas one does not have that luxury when using data common to multi-country analyses since it is usually aggregated at the national level (Maxwell, 1991). Most single-country studies use non-econometric methods, single equation models, computable general equilibrium (CGE) or vector autoregression (VAR) (Maxwell and Singer, 1979; Shaw and Clay, 1993). The more promising methods are likely those using CGE or VAR. Although the study of food aid's impact on food production and imports within a single country may be more feasible than the study of many countries using national level data (due to fragmented markets), the results from a study of one

country are not as interesting as are the results from a global study. The results of global investigations may contain lessons applicable to many potential recipient countries, whereas the results of a study on a single country are not necessarily generalizable to other dissimilar countries (Barrett, 2002).

The dearth of multi-country empirical studies of food aid is likely due to the significant challenges of doing an econometric study of global food aid. Isenman and Singer wrote in 1977 that these challenges include the large amounts of time and high cost involved in undertaking a multi-country study, the lack of reliable data, the likely misspecification of any model of food aid, and the changes over time and discrepancies between different governments' agricultural policies (marketing boards and other pricing policies add another dimension to a model of food aid) (1993). Since 1977 available data on food aid have improved dramatically; this addresses the first two concerns of Isenman and Singer. The latter two may be irrelevant given proper econometric techniques are employed (controlling for country specific effects and using time specific intercepts).

Various models are available for a multi-country study of food aid. The most pervasive and compelling models utilize methods of CGE trade analysis (Tyers and Anderson, 1992; Hertel, 1997). Other models have the advantage that they explore the dynamics of food aid, production and imports without requiring data on prices or other commodities; these studies use vector autoregression, as first proposed by Lavy (1990) and later utilized by Barrett *et al*. (1998, 1999). Vector autoregression (VAR) involves a system of simultaneous equations; the dependent variable for each equation is regressed

upon lags of itself and lagged values of each of the other dependent variables in the system of equations.

In "The Dynamic Effects of U.S. Food Aid" Christopher Barrett *et al*. perform one of the first published global studies of the dynamics of food aid using empirical methods (1999). The study uses VAR on food aid, production and imports; VAR allows the authors the opportunity to examine the dynamic relationships among the three variables. Conclusions on causation are restricted to causation in the sense of Granger causality. An independent variable is said to exhibit Granger causality on a dependent variable if its inclusion in an equation results in better forecasting of the dependent variable than would be achieved were it excluded from the equation. Barrett *et al*. chose the method of VAR in order to minimize specification error since VAR techniques impose the fewest restrictions possible. VAR also gives researchers the opportunity to investigate the relationship between food aid, production and trade variables without requiring data on prices. The variables used in Barrett *et al.*'s study are food aid, production and imports. They use yearly data on USDA program cereal food aid per capita for the 18 most frequent recipients of U.S. food aid from 1961 to 1995. The Food and Agricultural Organization of the United Nations provided their data on commercial cereal imports per capita and cereal production per capita. The unrestricted VAR in Barrett's study was the following system of equations. F_{it} represents per capita U.S. program cereal food aid to country i at time t, P_{it} per capita cereal production in country i at time t, and M_{it} per capita imports of cereals to country i at time t.

$$F_{it} = \mu_0 + \sum_{j=1}^{5} \mu_j F_{it-j} + \sum_{j=1}^{5} \delta_j M_{it-j} + \sum_{j=1}^{5} \lambda_j P_{it-j} + \varepsilon_{1it}$$

$$M_{it} = \gamma_0 + \sum_{j=1}^{5} \gamma_j F_{it-j} + \sum_{j=1}^{5} \theta_j M_{it-j} + \sum_{j=1}^{5} \psi_j P_{it-j} + \varepsilon_{2it}$$

$$P_{it} = \lambda_0 + \sum_{j=1}^{5} \pi_j F_{it-j} + \sum_{j=1}^{5} \vartheta_j M_{it-j} + \sum_{j=1}^{5} \beta_j P_{it-j} + \varepsilon_{3it}$$

After calculating the Akaike Information Criterion for each equation and implementing a block exogeneity test, the authors identify a statistically equivalent system that requires the estimation of fewer parameters. The purpose of the AIC and block exogeneity testing is to identify how many lags of which variables exhibit Granger causality in relation to the other variables in the system. The restricted model that resulted was:

$$F_{it} = \mu_0 + \sum_{j=1}^{5} \mu_j F_{it-j} + \sum_{j=1}^{4} \delta_j M_{it-j}$$

$$M_{it} = \gamma_0 + \sum_{j=1}^{5} \gamma_j F_{it-j} + \sum_{j=1}^{5} \theta_j M_{it-j} + \sum_{j=1}^{3} \psi_j P_{it-j}$$

$$P_{it} = \lambda_0 + \sum_{j=1}^{5} \lambda_j P_{it-j} + \sum_{j=1}^{5} \pi_j F_{it-j} + \sum_{j=1}^{2} \vartheta_j M_{it-j}$$

Seemingly unrelated regression is used to estimate the model and some of the results are statistically significant. Food aid clearly violates additionality; statistically significant results show that it substitutes contemporaneously for imports. Using an impulse response function, the authors investigate the dynamic results of an increase in food aid on future trading volumes. In the first four years, an additional kilogram of food aid per capita is expected to decrease commercial food imports. Four years after the increase in food aid, imports increase; trade appears to have been stimulated by food aid. Production decreases and remains slightly lower after the increase in food aid. Contemporaneous

correlations of food aid and production are negative, though negligible and not statistically significant.

There are many possible reasons for the statistical insignificance of the results related to program food aid and production. One reason is, of course, misspecification of the model, but the authors took precautions to avoid this. Another plausible reason is that inappropriate data were used. The authors chose to use data on U.S. program cereal food aid. They write that cereal food aid is an appropriate proxy for overall food aid (Barrett, 1999). However, U.S. program food aid is not an appropriate proxy for food aid at the country level. Quick inspection of global food aid data at the country level shows that U.S. cereal program food aid, as a percentage of total food aid to any of the eighteen countries included in Barrett's study, varies from 0 to 100% (FAO, 1990; FAO, 1994). There is no consistent pattern in the data. It is unclear why U.S. program food aid alone could be used to describe the relationship between total food aid and imports and production levels in recipient countries. It seems clear that one must also consider food aid from donors other than the U.S. In all likelihood, the authors chose to use the USDA data in order to take advantage of the large number of years over which its observations span. An additional shortcoming of the data set is that FAOSTAT data on imports includes food aid from the US and other sources; it is unclear what methodology the authors used to disaggregate the import variable and food aid. Despite its shortcomings, the study by Barrett *et al*. is a pioneering one in that it was the first to examine the dynamics of food aid using multi-country data.

3.2 Methodology Used in This Study

No published multi-country empirical studies of food aid distinguish between the major types of food aid (targeted and program). We adapt the dynamic empirical model used by Barrett *et al*. (1998) in order to test the hypothesis that targeted food aid discourages local food production and displaces imports less than program food aid does. Our examination of the data is an improvement to the study by Barrett since it uses fixed effects to control for differences among countries. Introducing country-specific effects into an autoregressive model requires sophisticated econometric analysis, but the advantages of doing so prove beneficial. Another key difference between this study and that of Barrett is that since Barrett published his study, detailed data on food aid has become more available and we have been fortunate to gain access to a dataset that is likely to be more appropriate for this type of work. Quick inspection of global food aid data at the country level shows that U.S. cereal program food aid, which Barrett used as a proxy for global food aid, does not accurately reflect amounts of global food aid because it ignores shipments from countries other than the U.S. and it fails to account for targeted food aid.

Four variables (other than dummy variables) have been incorporated in the vector autoregression with fixed effects; they are per capita program cereal food aid (FP), per capita targeted cereal food aid (FT), per capita imported cereals (M), and per capita domestic cereal production (P). The equations for the unrestricted VAR with fixed effects are shown below, where C is a country specific dummy variable, D_t is a year specific dummy variable, m is the number of lags, and N is the number of countries.

$$P_{it} = \sum_{j=1}^{m} \theta_{5j} P_{it-j} + \sum_{j=1}^{m} \theta_{6j} M_{it-j} + \sum_{j=1}^{m} \theta_{7j} FT_{it-j} + \sum_{j=1}^{m} \theta_{8j} FP_{it-j} + \sum_{i=1}^{N} \delta_{1i} C_i + \sum_{t=1}^{T} \gamma_{5t} D_t + \varepsilon_{1it}$$

$$M_{it} = \sum_{j=1}^{m} \beta_{1j} P_{it-j} + \sum_{j=1}^{m} \beta_{2j} M_{it-j} + \sum_{j=1}^{m} \beta_{3j} FT_{it-j} + \sum_{j=1}^{m} \beta_{4j} FP_{it-j} + \sum_{i=1}^{N} \delta_{2i} C_i + \sum_{t=1}^{T} \gamma_{2t} D_t + \varepsilon_{2it}$$

$$FT_{it} = \sum_{j=1}^{m} \alpha_{1j} P_{it-j} + \sum_{j=1}^{m} \alpha_{2j} M_{it-j} + \sum_{j=1}^{m} \alpha_{3j} FT_{it-j} + \sum_{j=1}^{m} \alpha_{4j} FP_{it-j} + \sum_{i=1}^{N} \delta_{3i} C_i + \sum_{t=1}^{T} \gamma_{3t} D_t + \varepsilon_{3it}$$

$$FP_{it} = \sum_{j=1}^{m} \psi_{1j} P_{it-j} + \sum_{j=1}^{m} \psi_{2j} M_{it-j} + \sum_{j=1}^{m} \psi_{3j} FT_{it-j} + \sum_{j=1}^{m} \psi_{4j} FP_{it-j} + \sum_{i=1}^{N} \delta_{4i} C_{4i} + \sum_{t=1}^{T} \gamma_{4t} D_t + \varepsilon_{4it}$$

Controlling for country specific effects means the introduction of dummy variables that do not vary over time. The use of seemingly unrelated regression with the least squares dummy variables procedure when lagged endogenous variables are included would yield inconsistent estimates (Nickell, 1981). One must therefore eliminate the country specific effects through first differencing the equations; it is these first differences of each equation in the system, shown below that are estimated.

$$P_{it} - P_{it-1} = \sum_{j=1}^{m} \theta_{5j} (P_{it-j} - P_{it-j-1}) + \sum_{j=1}^{m} \theta_{6j} (M_{it-j} - M_{it-j-1}) + \sum_{j=1}^{m} \theta_{7j} (FT_{it-j} - FT_{it-j-1})$$
$$+ \sum_{j=1}^{m} \theta_{8j} (FP_{it-j} - FP_{it-j-1}) + \sum_{t=1}^{T} \gamma_{5t} (D_t - D_{t-1}) + \varepsilon_{1it} - \varepsilon_{1it-1}$$

$$M_{it} - M_{it-1} = \sum_{j=1}^{m} \beta_{5j} (P_{it-j} - P_{it-j-1}) + \sum_{j=1}^{m} \beta_{6j} (M_{it-j} - M_{it-j-1}) + \sum_{j=1}^{m} \beta_{7j} (FT_{it-j} - FT_{it-j-1})$$
$$+ \sum_{j=1}^{m} \beta_{8j} (FP_{it-j} - FP_{it-j-1}) + \sum_{t=1}^{T} \gamma_{6t} (D_t - D_{t-1}) + \varepsilon_{2it} - \varepsilon_{2it-1}$$

$$FT_{it} - FT_{it-1} = \sum_{j=1}^{m} \alpha_{5j} (P_{it-j} - P_{it-j-1}) + \sum_{j=1}^{m} \alpha_{6j} (M_{it-j} - M_{it-j-1}) + \sum_{j=1}^{m} \alpha_{7j} (FT_{it-j} - FT_{it-j-1})$$
$$+ \sum_{j=1}^{m} \alpha_{8j} (FP_{it-j} - FP_{it-j-1}) + \sum_{t=1}^{T} \gamma_{7t} (D_t - D_{t-1}) + \varepsilon_{1it} - \varepsilon_{1it-1}$$

$$FP_{it} - FP_{it-1} = \sum_{j=1}^{m} \psi_{5j}(P_{it-j} - P_{it-j-1}) + \sum_{j=1}^{m} \psi_{6j}(M_{it-j} - M_{it-j-1}) + \sum_{j=1}^{m} \psi_{7j}(FT_{it-j} - FT_{it-j-1})$$
$$+ \sum_{j=1}^{m} \psi_{8j}(FP_{it-j} - FP_{it-j-1}) + \sum_{t=1}^{T} \gamma_{8t}(D_t - D_{t-1}) + \varepsilon_{2it} - \varepsilon_{2it-1}$$

Estimation of the first differences of each equation introduces a simultaneity problem, which is resolved by employing instrumental variables. (Holtz-Eakin, 1989) The list of available instrumental variables changes for each period and in period t it is:

$$Z_t = \{FT_{t-2}, FT_{t-3}, ...FT_{1988}, FP_{t-2}, FP_{t-3}, ...FP_{1988}, M_{t-2}, M_{t-3}, ...M_{1988}, P_{t-2}, P_{t-3}, ...P_{1988}\}$$

Ideally all of the available instruments would be used to estimate each equation; however, as the size of the instrument matrix increases it becomes more difficult to solve the model using standard mathematical techniques for inverting matrices. The instrument matrix is therefore restricted to include only the lagged values of the dependent variable. In order to limit the size of the instrument matrix we must also reduce either the number of lags in our estimation or the number of years used in the estimation. After preliminary testing to determine whether 4 lags are necessary, we choose a 3 lag structure and are able to estimate it using observations for years 1991 through 2000. Unfortunately using more than ten years of data leads to near singular matrices which are not invertible. The estimation is carried out for each equation separately; estimating each equation separately is simpler computationally than is estimating the system employing cross equation constraints. Such an approach does not come without cost, however; the resulting estimates are consistent but less efficient than the estimates that would result from estimation of the system employing relevant cross equation constraints (Holtz-Eakin,

1991). Let us illustrate the procedure using the production equation; the instrument matrix for the production equation and the ith country is as follows:

$$Z_i = \begin{bmatrix} P_{93-91}\, \mathrm{d}_{95} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & P_{94-91}\, \mathrm{d}_{96} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & P_{95-91}\, \mathrm{d}_{97} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & P_{96-91}\, \mathrm{d}_{98} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & P_{97-91}\, \mathrm{d}_{99} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & P_{98-91}\, \mathrm{d}_{00} & 0 \end{bmatrix}$$

The first row provides the instruments for the year 1995: per capita production for 1993, 1992 and 1991 (abbreviated $P_{93\text{-}91}$) and a dummy variable for 1995 (denoted d_{95}). The estimation is achieved in two stages. The first stage is unweighted instrumental variables estimation which amounts to a Generalized Method of Moments (GMM) estimation using Z'Z as the weighting matrix. The parameter estimates for the production equation are calculated as shown below where X is the matrix of independent variables and Y is the dependent variable (per capita production in this case).

$$\theta_{1stStage} = \left[X'Z(Z'Z)^{-1}(Z'X)\right]^{-1} X'Z(Z'Z)^{-1}(Z'Y)$$

The residuals from the first step ($\hat{u}_i$) are used to create a weighting matrix that is used in the second stage, a weighted GMM estimation of the parameters. The weighting matrix for the second step, which we will refer to as omega, must be calculated for each country and summed over the countries; the formula is below.

$$\Omega = \sum_{i=1}^{N} Z_i'\hat{u}_i\hat{u}_i'Z_i$$

Finally, the parameters are estimated using GMM and the weighting matrix omega. The parameter estimates are calculated as shown below.

$$\theta_{2ndStage} = \left[X'Z(\Omega)^{-1}(Z'X)\right]^{-1} X'Z(\Omega)^{-1}(Z'Y)$$

This methodology follows that used by Greene (2003) and Dahlberg and Johansson (1998), both of whom cite Holtz-Eakin *et al.*'s 1988 article on VAR with fixed effects as the source of the formulae.

3.3: Hypothesis Testing

Hypothesis tests advanced by the preceding chapter's theoretical analysis may be conducted using a variety of statistics. Again I follow the guidelines set forth by Holtz-Eakin (1988) and use the Sargan statistic, also known as the GMM criterion function, to carry out nested hypothesis testing. The Sargan statistic (denoted as q) is calculated as shown below.

$$q = \hat{u}'Z(\Omega)^{-1}Z'\hat{u}$$

The order of hypothesis testing is critical; various authors have shown that initial tests for model specification and validity of instruments should be followed by tests for lag length and finally tests for the exclusion of particular variables (Dahlberg and Johansson, 1988).

To test the model specification and validity of the instruments q is compared to the critical value given by the chi squared distribution at degrees of freedom equal to the number of instruments minus the number of parameters. Should q be smaller than the critical value than one can not reject the null hypothesis of correct model specification and valid instruments.

Each equation in the system is estimated using a lag length equal to m and then using a lag length equal to m-1 until the lag length is equal to zero. In testing the null

hypothesis that a lag length of m-1 is superior to a lag length of m, the difference between q (the Sargan statistic) given m and q given m-1 lags is calculated as the test statistic; it is distributed according to the chi square distribution with m degrees of freedom. Should the test statistic be larger than the critical value for the chi squared distribution at m degrees of freedom then the null hypothesis is rejected and the lag length is set as m.

After the model is determined to be correctly specified and the proper lag length is established Granger causality testing is carried out. Conditional upon a given lag length the appropriate independent variables will be chosen using the criterion of Granger causality. Should inclusion of a particular independent variable lead to better forecasting of the dependent variable than would be accomplished were that particular independent variable excluded, the independent variable exhibits Granger causality toward the dependent variable and is therefore included in the equation. For example, in order to test the null hypothesis that targeted food aid should be excluded from the production equation, I estimate the production equation using all independent variables and then estimate it using all independent variables except for targeted food aid. The difference in the Sargan statistic for the two estimations is distributed according to the chi squared distribution with m degrees of freedom. Should the test statistic be larger than the relevant critical value, I reject the null hypothesis that targeted food aid does not Granger cause production (Holtz-Eakin, 1988).

CHAPTER 4

DATA

4.1. Description of Data on Food Aid

Sources of food aid data have improved considerably over what they used to be. In 1987 the World Food Programme formed the International Food Aid Information System (INTERFAIS), in an effort to collect and disseminate accurate data on global food aid shipments. The INTERFAIS data set records all food aid transactions made by donor, recipient and type of food aid on a monthly basis. The data begin with the year 1988; they do not cover nearly as long a period as the data used by Barrett *et al*., but they do span a period long enough for them to be used to conduct a preliminary examination of the short term dynamics of different types of global food aid. Furthermore, they are the single most detailed and complete data set ever compiled on food aid, even though they have not to date been used in a rigorous empirical study using econometric methods. The data were generously made available by WFP for this research. The data are annual observations (based on the July – June year) spanning from 1988 to 2001; they describe cereal food aid transactions on the basis of the quantity (measured in metric tons), cereal type, the recipient country, the donor country, delivery mode and type of food aid.

There are sixty two different descriptions of cereal types listed in the data base[1]. In turn, 145 different recipients are included in the INTERFAIS data set; most recipients are independent countries, but a few are territories belonging to another country. The majority (forty eight countries) are located in Sub Saharan Africa, the next most common geographic location of the recipient is South and Southeast Asia and the Pacific (twenty seven countries), followed by Central America and the Caribbean (twenty countries), Eastern Europe and Russia (seventeen countries), North Africa and the Middle East (fifteen countries), South America (eleven countries), and West Asia (seven countries)[2]. There are twenty seven different donors of food aid included in the data set; most donors are countries, but three of them are groups of countries or organizations (European Economic Commision (EEC), Non Governmental Organizations (NGO), or other

[1] They are listed in footnote four together with conversion factors.

[2] The forty eight recipients located in Sub Saharan Africa are Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Republic of the Congo, Cote d'Ivoire, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe. Twenty seven countries represent South and Southeast Asia and the Pacific. They are American Samoa, Bangladesh, Bhutan, Cambodia, China, East Timor, Fiji, Hong Kong, India, Indonesia, Kyrgyzstan, Laos, Malaysia, Maldives, Mongolia, Myanmar, Nepal, North Korea, Pakistan, Papua New Guinea, Philippines, Solomon Islands, Sri Lanka, Suriname, Thailand, Vanuatu, and Vietnam. Twenty of the recipients are located in Central America or the Caribbean; they are Antigua and Barbuda, Belize, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Montserrat, Nicaragua, Panama, Saint Lucia, St. Kitts and Nevis, Saint Vincent and the Grenadines, and Trinidad and Tobago. Recipient countries from Eastern Europe and Russia number seventeen and they are Albania, Belarus, Bosnia Herzegovina, Bulgaria, Croatia, Estonia, Georgia, Latvia, Lithuania, Macedonia, Moldova, Poland, Romania, Russian Federation, Slovenia, Ukraine, and Yugoslavia. Fifteen countries from North Africa and the Middle East received food aid over the time period; they are Algeria, Cyprus, Egypt, Gaza West Bank, Iran, Iraq, Israel, Jordan, Lebanon, Morocco, O.Palestinia, Syria, Tunisia, Turkey, and Yemen. Eleven recipient countries (Bolivia, Brazil, Chile, Colombia, Ecuador, French Guyana, Guyana, Paraguay, Peru, Uruguay, and Venezuela) are located in South America. Lastly, seven West Asian countries received food aid; they are Afghanistan, Armenia, Azerbaijan, Kazakhstan, Tajikistan, Turkmenistan, and Uzbekistan.

countries). A majority (sixteen) of the donor countries, are European[3]. The remaining six donors are countries in North America (Canada and the United States), Southeast Asia (China, Japan, and South Korea) or the Pacific (Australia and New Zealand).

The delivery mode is either direct transfer (sent from a donor country directly to a recipient country), local purchase (food purchased in the recipient country), triangular purchase (food purchased by a donor country in a supplier country and delivered to the recipient country) or triangular swap (food produced in the donor country that is traded for food produced in another country, then shipped to the recipient country). The type of food aid is either program (untargeted aid through which donated food, or food purchased through concessional sales is sold by the government of a recipient country to its citizenry), emergency (targeted aid that is at least intended for distribution to the hungry poor), or project (targeted aid that is distributed typically as payment for work or as an incentive for regular school attendance).

4.2 Description of Data on Production, Imports and Population

The INTERFAIS data are used together with data on cereal production, imports and population by country; such data are available through the FAOSTAT database provided online to the public by the Food and Agriculture Organization of the United Nations. The FAOSTAT offers several different measures of total cereals. The only one of these which uses a methodology for aggregating cereal commodities that remains consistent between imports, exports and production is the commodity balances measure

[3] These are Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

of total cereals excluding beer (2905); this category aggregates cereals in terms of their primary commodity equivalents. The period of time used is the calendar year or January through December (http://www.fao.org/DOCREP/). Variations in methodology across countries and over the years are unfortunately an inevitable problem with any data set as large and international in scope as the FAOSTAT.

4.3 Combining the Data Sets

In using INTERFAIS data on various cereal commodities together with FAO data on total cereals one encounters many challenges. First, the year used for INTERFAIS data (July – June) does not correspond to the year used by the FAOSTAT (January-December). Repeated attempts to obtain INTERFAIS data aggregated from January to December were unsuccessful.

Second, it is not possible to aggregate the INTERFAIS data across cereal types in order to construct a measure of total cereals that is comparable to that used by the FAO. I tried to replicate the methodology used by the FAO when constructing the measure of total cereals excluding beer (#2905 in the FAOSTAT). However, the weights used by the FAO to convert cereals into their primary commodity equivalent often vary across countries and time periods; FAO documents only provide the average of the weights used by all countries for each cereal commodity (www.fao.org/WAICENT/). One is therefore restricted to using this average weight. Furthermore, WFP descriptions of cereal commodities do not always correspond to FAO cereal commodity classifications; for this reason it is not always clear what weights must be used with each type of cereal

commodity. To aggregate the data, the average weight is applied to those WFP cereal commodities that correspond to FAO classification, but in those cases where the WFP cereal commodity does not obviously correspond to a FAO classification a weight of one is used[4]. Indeed, conversations with individuals in the FAOSTAT offices confirmed that the difficulties associated with aggregating commodities using descriptions by INTERFAIS are not trivial and remain an issue they have yet to resolve for their own calculations (Campenau, 2004).

An additional problem arises in that the FAOSTAT data on cereal imports includes both non-concessional imports and some types of concessional imports (food aid). Countries are supposed to report total imports including food aid; some countries comply with this guideline whereas others do not. When a country sends in its records of imports without including food aid, the FAO uses INTERFAIS data together with its own system of conversion to aggregate the two. Unfortunately FAO has no records of the methodology used in each country year case (Campenau, 2004). When we deduct

[4] BULGUR WHEAT is multiplied by 1.05 to correspond to FAO's Bulgur category, COMMON WHEAT, D.SPR.WHT, DUR.WHT.FL, DURUM WHEAT, H.DUR.WHT, H.R.W.WHT, H.SPR.RD.WHE, HARD WHEAT, HD. SPR. WHE, ROL.WHEAT, SFT.WH.WHT, SFT.WHT.FL, SOFT WHEAT, SYF BUL WHE, SYF WHE FLR, , WHEAT, and WHEAT FLOUR are multiplied by 1.27 as we presume they fit in FAO's category for Wheat flour, WHE SOYA BLD, WHE SOYA MLK and W-MIX are multiplied by 1.18 since they likely fit in the FAO category of Cereal Preparations. MAIZEFLOUR and MAIZEGRITS are multiplied by 1.22 since they correspond to the flour of maize category. CORN SOY BLD, CORN SOY MLK, CORN-MILK, CSB INSTANT, CSM INSTANT, MAIZE, MAIZE MEAL, and SYF MAIZE ML are all multiplied by one since their appurtenance to a particular FAO category is either not obvious or they belong to a category that is assigned a weight of 1 on average by the FAO when it constructs its measure of cereals 2905. RICE, RICE MEAL, and SF.RICE are multiplied by 1 since they seem to correspond to milled rice and RICEFLOUR is multiplied by 1.11 since it corresponds to the FAO category by the same name. BURGHOL is multiplied by 1.05, CANNED MAIZE is multiplied by 0 since the FAO considers it a vegetable, PASTA has a weight of 1.27, ROLLED OAT and SYF ROL OAT are multiplied by 1.89, and SYF SOR GRTS has a weight of 1.25. BARLEY, BLENDED FOOD, CER & GRAINS, FAFFA, FAFFA TEMFA, FAMIX DRINK, INDIA MIX, LIKUNI PHALA, MILLET, MUSALAC, OAT, OAT FLOUR, OATMEAL, RISON, RYE, RYE FLOUR, SOR GRITS, SORGHUM, SOY MAS.FL.I, SOY MASA FL., and TEFF are all multiplied by 1 since they do not obviously correspond to any of the FAO categories.

program food aid from imports some of the observations at the country year level are negative; this clearly indicates a failure in our efforts to disaggregate food aid data from the FAO measure of imports; the problem is likely due in large part to INTERFAIS data spanning from July through June and FAOSTAT data spanning January to December. In order to address the uncertainty of the true nature of the dataset, we run two sets of regressions; the first uses data from FAO with program food aid deducted from imports whereas the second attempt uses data that has not been adjusted and that clearly introduce problems of double counting.

Once both data sets are combined, the number of years for which observations is available is reduced to thirteen (values of some FAOSTAT variables had yet to be released for the year 2001 when we compiled the dataset). The number of countries for which observations are available also drops to 120. Because the model does not allow for unbalanced panels I eliminated countries for which data is only available for less than twelve years; the end result is a data set that includes 64 countries. In creating a balanced panel data set many newer countries, including several in Eastern Europe and all of the West Asian countries, drop out; these countries are frequent recipients of food aid and merit additional research in the future using a data set for the time period 1992 through 2000. In the 64 country balanced panel data set, 22 of the countries are in Sub-Saharan Africa, thirteen countries are located in Southeast Asia and the Pacific, eleven countries are Central American or Caribbean; there are three Eastern European countries, five countries in North Africa and the Middle East, and nine in South America.[5]

[5] Sub Saharan African countries included in the final dataset are Benin, Burkina Faso, Cameroon, Comoros, Djibouti, Gabon, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mauritania, Mauritius,

In order to compare cereal quantities across countries with varying population bases we divide the various quantities by the population. The variables used in our study are therefore domestic production of cereals in kilograms per capita, cereal imports in kilograms per capita, targeted food aid in kilograms per capita, and program food aid in kilograms per capita.

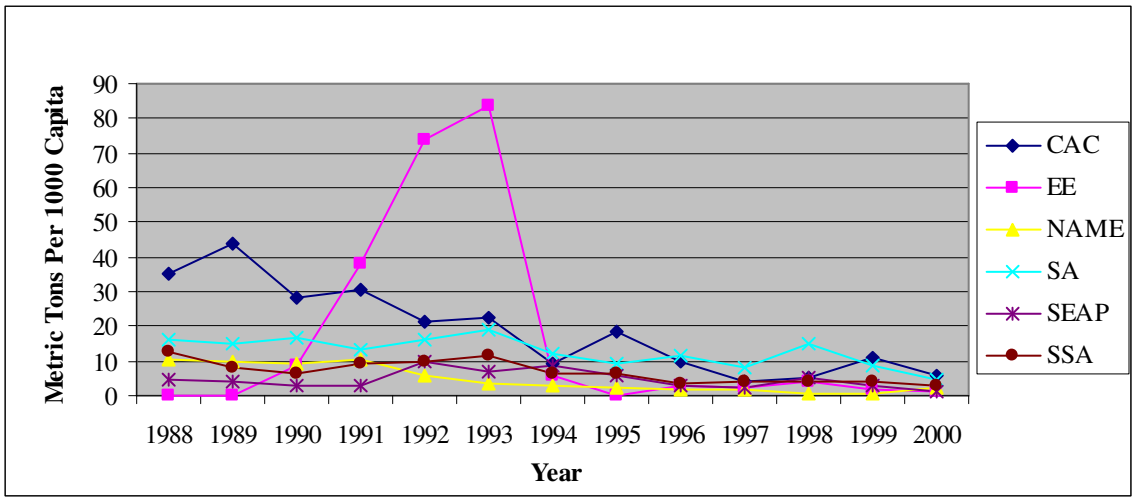
4.4 Trends in the Data

We look at levels of each of the variables grouped by region and averaged across countries within each region. Although the regions certainly are not groupings of homogenous countries, the countries in each region are in large part similar in terms of temperate zone and level of economic development. The regions are Sub Saharan Africa (SSA), Central America and the Caribbean (CAC), Eastern Europe (EE), North Africa and the Middle East (NAME), Southeast Asia and the Pacific (SEAP), West Asia (WA) and South America (SA). Such an exercise shows differences in the way targeted and program food aid are allocated on the regional level. I concentrate on the balanced panel dataset (sixty four countries) but mention any differences between it and the extended one hundred twenty country data set as relevant.

Niger, Nigeria, Senegal, South Africa, Sudan, Swaziland, Togo, and Uganda. Southeast Asia and the Pacific is represented by Bangladesh, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Suriname, Thailand, and Vietnam. Central American or Caribbean countries are Belize, Costa Rica, Dominica, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, and Panama. Recipient countries from Eastern Europe are Albania, Bulgaria, and Romania. North Africa and the Middle East is represented by Algeria, Egypt, Iraq, Morocco, and Turkey. South American countries included are Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru and Uruguay.

4.4.1 Total Cereal Food Aid

First let us examine the per capita levels of total food aid by region; unless otherwise stated the results are from the sixty four country balanced panel data set. As shown in Figure 4.1, Eastern Europe received the largest amount of total cereal food aid per capita in 1992 and 1993. Other outstanding years of food aid receipts were seen by Central America and the Caribbean in 1988 and 1989. A ranking of regions in descending order of average annual total food aid receipts per capita puts countries in Central America and the Caribbean first (18.7 kg per capita), followed by those in Eastern Europe (17.13 kg per capita), South America (12.74 kg per capita), Sub Saharan Africa (6.83 kg per capita), North Africa and the Middle East (4.69 kg per capita), and Southeast Asia and the Pacific (4.64 kg per capita). The ranking for the extended one hundred twenty country data set is similar; in descending order of magnitude it is: Eastern Europe and Russia (14.4 kg per capita), Western Asia (13.8 kg per capita), Central America and the Caribbean (13.3 kg per capita), South America (8.7 kg per capita), Sub Saharan Africa (8.4 kg per capita), North Africa and the Middle East (7.6 kg per capita), and Southeast Asia and the Pacific (5.8 kg per capita). If we look at the data disaggregated according to whether the food aid was of the program or targeted variety we see that the allocation according to region is quite different for each type of food aid.



Source: INTERFAIS

Figure 4.1: Regional Averages of Total Cereal Food Aid 1988 - 2000

4.4.2 Program Cereal Food Aid

Figure 4.2 shows the per capita program cereal food aid donations by region from 1988 to 2000. I do not consider ten of the countries in the original sixty four country data set since they were not recipients of program cereal food aid in any of the years 1988 through 2000; these are Chile, Dominica, Gabon, Malaysia, Myanmar, Panama, Paraguay, South Africa, Thailand and Turkey. The outlier observations for Eastern Europe discussed in relation to Figure 4.1 were a result of large shipments of program food aid to Eastern European countries. Eastern European countries receive the largest quantities of program food aid (16.55 kg per capita) followed by those in Central America and the Caribbean (15.23 kg per capita), South America (13.23 kg per capita), Southeast Asia and the Pacific (4.54 kg per capita), North Africa and the Middle East (4.19 kg per capita) and Sub Saharan Africa (2.97 kg per capita). The ranking is

essentially the same for the extended dataset, with countries in Western Asia receiving large amounts of program food aid. It is noteworthy that countries in Sub Saharan Africa, the region with the most pronounced food shortage and highest level of poverty, received the smallest quantities of program food aid on average.

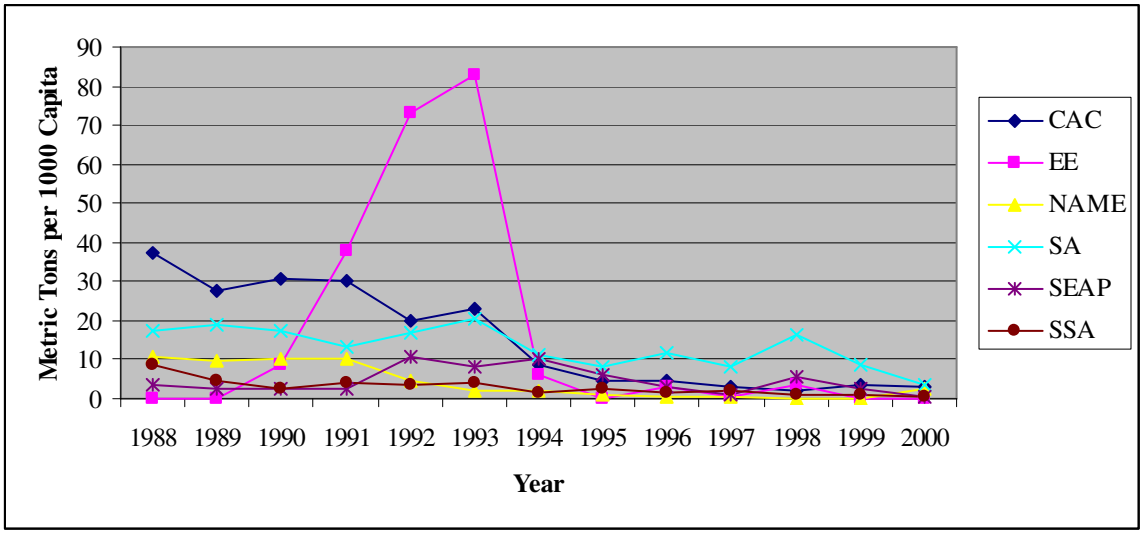


Figure 4.2: Regional Averages of Program Cereal Food Aid 1988 – 2000

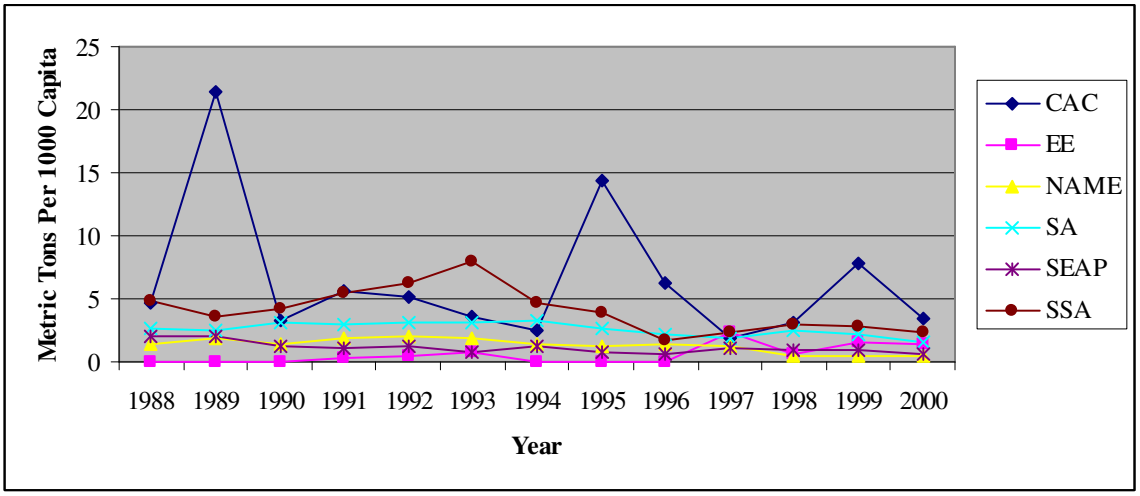
4.4.3 Targeted Cereal Food Aid

Figure 4.3 below shows regional levels of targeted cereal food aid per capita from 1988 to 2000; all countries in the balanced panel dataset with the exception of Surinam were recipients of targeted cereal food aid and are therefore included in this analysis. Central America and the Caribbean exhibit great volatility in food aid shipments from year to year; it is the only region that shows observations which may be considered outliers. It is likely the case that, due to geographical proximity, the United States is the most frequent donor to Central America. If the United States is a major donor for

countries in Central America and the Caribbean, then the volatility could be explained by the shipments being determined as a function of farm surpluses in the United States rather than need for food in the recipient countries. In any case, recipient countries in Central America and the Caribbean receive the largest donations; they receive an average of 6.4 kg per capita annually. Donations to Sub Saharan Africa are the second most abundant; they average 4.10 kg per capita per country annually. If outliers were removed, the two most important recipients would switch ranking. The other largest recipient regions in descending order are: South America (2.61 kg per capita), North Africa and the Middle East (1.23 kg per capita), Southeast Asia and the Pacific (1.11 kg per capita), and Eastern Europe (0.55 kg per capita). The extended data also show countries in Central America and the Caribbean followed by those in Sub Saharan Africa as receiving the most targeted cereal food aid on average and Eastern European countries and Russia receiving the smallest quantities of targeted food aid per capita. In contrast to the abridged data set, the extended data allow us to look at West Asian countries; they receive the third largest shipments (3.3 kg per capita). The ranking of the fourth through sixth most abundant donations for a given region is also different when using the extended data set; Southeast Asia and the Pacific (2.3 kg per capita) is followed by North Africa and the Middle East (2.0 kg per capita) and South America (2.0 kg per capita).

The noteworthy trend in the allocation of targeted food aid is the persistent delivery of targeted food aid to countries in Central America and the Caribbean and to countries in Sub Saharan Africa; both regions, especially the latter, exhibit more need for food aid than other areas of the world (if one accepts high levels of poverty and

malnutrition as evidence of need for food aid). The high priority of Sub Saharan Africa in targeted food aid allocation suggests that a goal of such food aid is reaching countries where a large percentage of the population is the hungry poor. The large allocation of program food aid to countries in Central America and the Caribbean may be a reflection of both the region's poverty and proximity to the United States, a country with abundant grain surpluses due to its combination of comparative advantage in and subsidization of wheat, corn and rice production.



Source: INTERFAIS

Figure 4.3: Regional Averages of Targeted Cereal Food Aid 1988 – 2000

4.4.4 Trends in Allocation of the Two Types of Food Aid

This simple comparison reveals that the two types of cereal food aid are allocated quite differently on a regional level. Perhaps the most striking difference in the allocation is that Sub Saharan Africa, the region of the world facing the greatest challenges related to poverty and low food availability (see the next section for more on

non-concessional food availability), receives the least program food aid per capita compared to any of the other regions, but it is the second most frequent recipient of targeted food aid. This seems to support the findings of Ruttan (1993) and Ball *et al*., (1996) that targeted food aid is allocated in response to low production in recipient countries. Eastern Europe is the most frequent recipient region for program food aid, but the least frequent recipient of targeted food aid. Large shipments of program food aid to Eastern Europe despite abundant cereal availability in those countries likely reflects strategic political motivations on the behalf of donors; this is consistent with the findings of Singer *et al*. (1987), Ballenger *et al*. (1992), and Gabbert *et al.* (2000). At the regional level the two types of food aid are clearly allocated according to different criteria; this would support the idea that our study should test hypotheses contrasting the relationship of targeted food aid to production and trade with the relationship of program food aid to production and trade.

4.4.5 Non-concessional Cereal Availability

Inspection of trends in cereal production and trade allows us to make inferences about some factors influencing the allocation of food aid. In order to appreciate the availability of food in a given region we construct a measure of non-concessional cereal food availability per capita (equal to domestic production of cereals plus net imports). Comparing the average value of this variable for the 13 year time period across regions reveals that per capita non-concessional cereal food availability is typically lowest in countries in Sub Saharan Africa (174.39 kg per capita on average), Central America and

the Caribbean (184.7 kg per capita), and South America (199.9 kg per capita). Regions with more abundant cereals are, in order of increasing availability, Southeast Asia and the Pacific (228.8 kg per capita), North Africa and the Middle East (344.5 kg per capita) and Eastern Europe (585.3 kg per capita). The ranking for the extended data set is essentially the same, but since the unbalanced nature of the extended panel allows us to examine younger countries, the West Asian region joins the sample and ranks third for most abundant non-concessional cereals (276.1 kg per capita).

If one considers low non-concessional food availability an appropriate criterion for a country's need for food aid, targeted food aid seems to be doing a better job of filling the gap than does program food aid. Program food aid is more abundant to countries in Eastern Europe than other regions even though these countries exhibit the highest level of non-concessional food availability and it is least available to countries in Sub Saharan Africa which is the region exhibiting the smallest amount of non-concessional cereals. In contrast, targeted food aid was distributed in very small quantities to countries in Eastern Europe, the region with the highest availability of non-concessional cereals. Countries in Central America and the Caribbean, Sub Saharan Africa and South America, the areas receiving the largest amount of targeted food aid, are also the countries with the lowest availability of cereals.

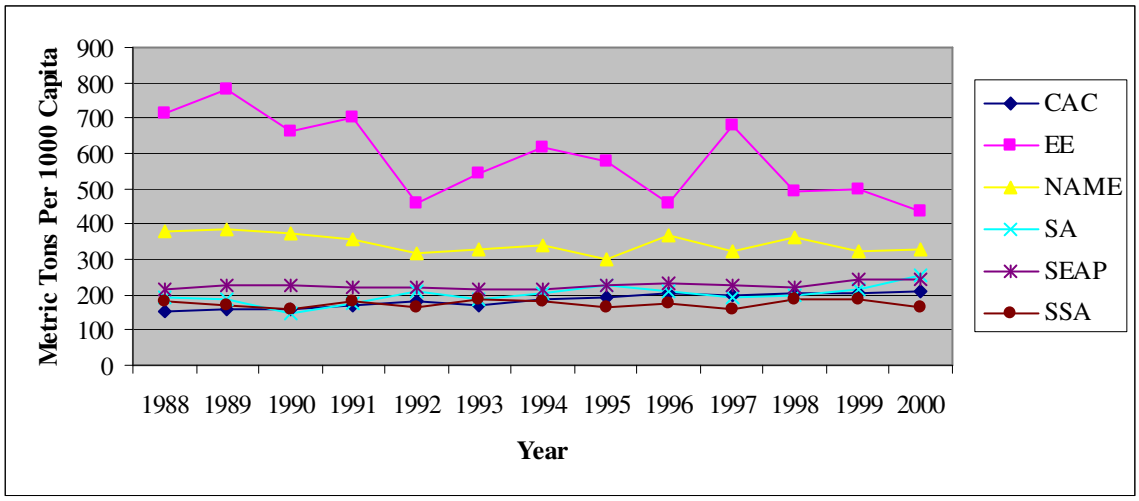


Figure 4.4: Non-Concessional Cereal Food Availability 1988 – 2000

4.4.6 Cereal Production

Let us now look at some of the components of non-concessional cereal food availability per capita by region. We will start with cereal production. Figure 4.5 shows that production is lowest in countries in Central America and the Caribbean (averaging 108.2 kg per capita), the more voluminous producers are, in increasing order, Sub Saharan Africa (124.2 kg per capita), South America (208.9 kg per capita), Southeast Asia and the Pacific (216.5 kg per capita), North Africa and the Middle East (228.2 kg per capita), and Eastern Europe (568.7 kg per capita). The ranking for the extended data set is the same, with West Asian countries entering just behind Eastern Europe as the second most voluminous producer on average (285.4 kg per capita). This ranking is similar to that for non-cereal availability, with the exception of the regions of Central America and the Caribbean and North Africa and the Middle East. Countries located in Central America and the Caribbean as well as in North Africa and the Middle East are not

major producers of cereals, but they manage to have high non-concessional cereal food availability. This is likely a reflection of the two regions (CAC and NAME) taking advantage of comparative advantages. They most likely pursue production activities other than cereal production and import a large portion of their cereals.

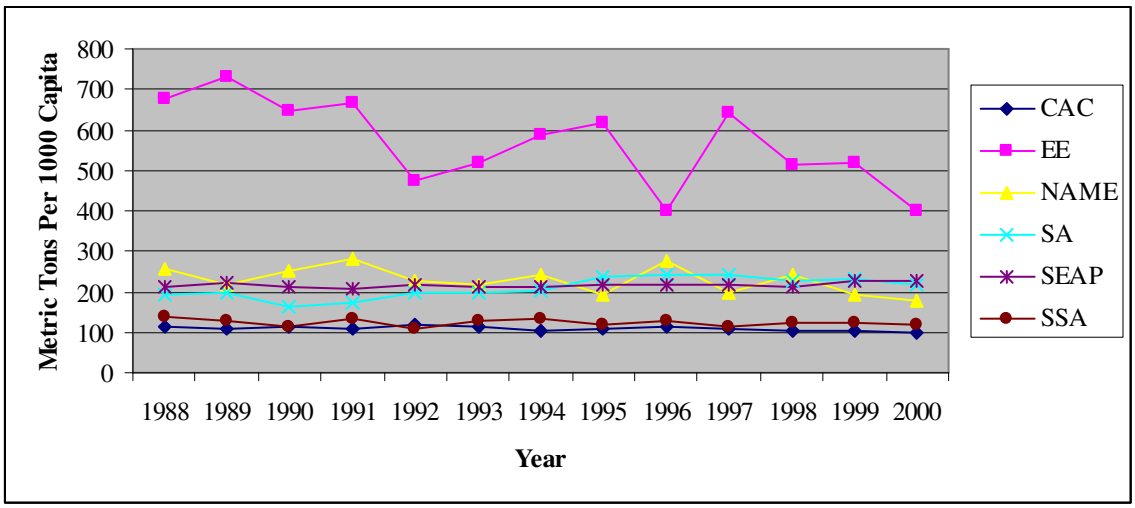


Figure 4.5: Cereal Production 1988 – 2000

4.4.7 Cereal Imports

Figure 4.6 shows average imports of cereals per capita by region. Indeed, the most significant importers are located in North Africa and the Middle East (averages 119.8 kg per capita over the 13 years) or in Central America and the Caribbean (79.0 kg per capita). The less frequent importers are in decreasing order of imports: countries in Sub Saharan Africa (54.5 kg per capita), Eastern Europe (47.4 kg per capita), South America (47.0 kg per capita) and Southeast Asia and the Pacific (33.4 kg per capita).

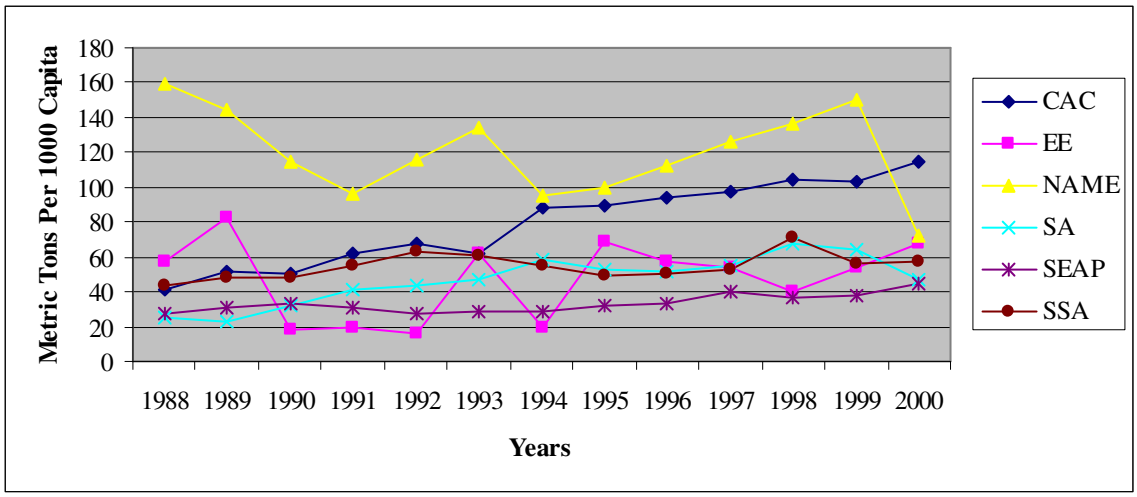


Figure 4.6: Cereal Imports Per Region 1988 – 2000

Inspection of the data at the country year observation level allows us to determine the extent to which the countries in our sample are net importers. Since our hypotheses are based on the theoretical framework advanced in Chapter 2 which is built on the assumption that recipient countries are cereal importers, it is important to verify that our observations are for cereal importing countries. Such inspection shows that indeed the majority (84%) of the net import observations are positive; regional breakdowns reveal that countries in both Southeast Asia and the Pacific and in Eastern Europe are net exporters in many years (about 40% of the observations for each region). Future work should consider omitting the countries for which exports are consistently larger than imports; they are Bulgaria, Romania, Turkey, Paraguay, Uruguay, Guyana, Colombia, Ecuador, Peru, Kenya and South Africa.

4.5 Relative Magnitudes of Variables

I now consider the relative magnitudes of each of the key variables in our study. Production per capita is by far the largest of the four variables. It has remained stagnant, fluctuating between 170 and 192 kilograms per capita. Imports are about twenty five to forty percent of the size of production ranging from 45 to 72 kilograms per capita; they have increased from 1988 to 2000. Program food aid has decreased from 12 kilograms per capita in the late 1980s declining towards 2 kilograms in more recent years. Targeted food aid fluctuates between 2 and 6 kilograms per capita. Since imports are smaller in quantity than production is, food aid is a much larger percentage of imports than it is of production. Cereal food aid per capita has decreased from about 30% of imports in the late 1980s to 5% in recent years. Cereal food aid per capita has decreased from about 7% of production in the late 1980s to 2% in recent years.

4.6 Limitations of the Data

In proposing to study the relationship between cereal food aid, production and trade, the form of the study is largely determined by what data are available. Unfortunately, data on food aid and cereals are far from precise and comprehensive. Under ideal circumstances a household and market level data set would be available which details quantities of food aid distributed to individuals, production by individuals, purchases by individuals and the market and farm gate prices of cereals in the market relevant to each individual. Such detailed information would afford researchers the luxury of investigating the effect of food aid on price in markets where food aid

recipients may have been consumers. Looking at individual markets is crucial in understanding the impact of food aid in developing countries since prices vary greatly both spatially (due to underdeveloped trading networks) and temporally (post harvest and pre harvest prices are greatly different due to inadequate storage opportunities). Unfortunately, the only multi country data on food aid that is available is aggregate country level data on cereal production and trade (but not prices). Such data does not allow the study of the impact of food aid on individual markets. It also prevents observation of the direct impact of food aid on prices. Should I find that food aid discourages production, I may only speculate that the reason for such discouragement is the lowering of food prices as a result of food aid.

Among the multi country data sets on food aid, the INTERFAIS data set is unique in that it is the first data set on food aid from all donors to all recipients that has ever been compiled. Based on the criterion of completeness the INTERFAIS dataset can not be surpassed. There are however, fundamental problems with it. Perhaps the most troubling problem is the sheer lack of any documentation detailing the methods of data collection used in compiling INTERFAIS. Furthermore, the cereal classifications used by INTERFAIS do not correspond to those used by the FAO, so that difficulties arise in combining INTERFAIS and FAOSTAT data (see section 4.3).

Problems with the FAOSTAT data are also related to the enigmatic nature of the methodology used to collect and compile the data. Variations in methodology across countries such as those discussed earlier (again see section 4.3) will likely make it crucial to introduce country specific effects in the estimation; this will be accomplished using the

fixed effects method. This will alter the interpretation of the fixed effects model; the country specific intercepts will not only be capturing the differences between country's policies, but they will also reflect the differences in methodologies used by each country office in collecting data. Inclusion of time specific intercept terms allows some adjustment for variation in method of data collection and compilation over time; the adjustment is only effective in capturing differences that are common to all countries in a given year. Another problem arises since the FAO measure of imports includes food aid; if it were possible to identify the exact methodology used by the FAO in its aggregation over various cereal commodities, then the food aid could be subtracted from imports without any resulting complications. Unfortunately, it is not possible to replicate the methodology used by the FAO so we used an approximation and simply subtracted our aggregate measure of program food aid from the import variable. A further complication is related to the two data sets spanning different time periods; since INTERFAIS data runs from July to June and FAOSTAT data runs from January to December our disaggregation of food aid and imports is highly problematic.

CHAPTER 5

EMPIRICAL RESULTS

5.1 Introduction

In this chapter, the results of vector autoregression with fixed effects on the balanced panel dataset (64 countries) are presented and discussed. First, nested hypothesis testing is conducted to determine whether the model is correctly specified and the instruments are valid, then we investigate lag length and which variables should be included. Next the restricted model is estimated and parameter estimates are inspected. Lastly, findings based on the dataset with imports adjusted for program food aid are contrasted with those resulting from the original FAOSTAT measure of imports without adjusting for food aid.

5.2 Hypothesis Testing

Vector autoregressions with fixed effects become increasingly difficult to solve as the lag length, the number of variables and the time period of the data set increase (Holtz Eakin, 1988). Fewer lags are used in this study than in that of Barrett since the data for this study (see previous section) only cover a 13 year period, because more variables are used in this study than in that of Barrett and since the econometrics required for a vector autoregression with fixed effects become increasingly difficult as the number of variables

in the system increases. Preliminary estimation with a short time period suggested that 4 lags were unnecessary and 3 lags sufficient for most equations. We therefore chose to begin formal hypothesis testing using a 3 lag specification and we follow the nested hypothesis testing procedures.

Table 5.1 below shows the results of nested hypothesis testing on each equation using an initial lag length of 3 and using years 1991 through 2000. We may not reject the null hypothesis of correct model specification and valid instruments for any of the equations other than the program food aid equation since for the production, the imports and the targeted food aid equation q is less than X^2. The test statistic q for the program food aid equation just barely exceeds the asymptotic critical value of X^2 at 21 degrees of freedom; this would suggest that either the model is not correctly specified or the instruments chosen are inappropriate. Work by Dahlberg and Johannson (2000) using the same methodology for a three variable vector autoregression compares the results of hypothesis testing using asymptotic critical values to the results using bootstrap critical values. Their results indicate that asymptotic critical values tend to reject the null hypothesis too often. Because our use of asymptotic critical values of the X^2 distribution just barely leads to rejection of the null and because of the findings of Dahlberg and Johannson (2000), we do not reject the program food aid equation as mispecified. Future work should aim to increase the size of the instrumental variables matrix by including lagged values of the levels of the four key variables in the vector autoregression. Doing so would likely improve the results of the hypothesis testing for the validity of the instruments since the degrees of freedom would increase as the number of instrumental variables increases. Indeed, work by Arellano and Bond indicates that it is preferable to

use all of the variables as instruments for each equation rather than just the values of the dependent variable as instruments (1991). Unfortunately, our preliminary efforts to use all four variables as instruments led to problems of inversion when constructing the weighting matrix.

Turning to the question of lag length, only the production equation appears to require a lag length shorter than three. L for the production equation is equal to 5.72 which is less than the value of the chi squared test statistic at 4 degrees of freedom; this leads us to fail to reject the null that two lags is preferable to three for the production equation. Attempts to include only one lag in the production equation lead to rejection of the null hypothesis that one lag is preferable to two. We therefore conclude that the appropriate lag length for the production equation is two. For all other equations we may reject the null hypothesis that two lags are superior to three, since L for ii. is greater than the chi squared test statistic at four degrees of freedom.

We now turn to the question of which variables should be excluded. Interestingly, for the production equation we find that both targeted and program food aid should be excluded from the set of independent variables; this would suggest that neither targeted nor program food aid Granger causes production. This is inconsistent with our hypothesis that program food aid discourages production, but consistent with the findings of Barrett that program food aid does not affect production. The finding that targeted food aid does not affect production supports our hypothesis. Production is found irrelevant to the imports equation; it is unclear why production levels would not affect imports. Program food aid is excluded from the targeted food aid equation on the basis of Granger causality; this would indicate that levels of program food aid are not a factor

that is taken into consideration when targeted food aid is allocated. The other finding from Granger causality testing is that imports do not Granger cause program food aid allocation.

Production Equation					
Null Hypothesis:	***Q***	***Df*** $_Q$	***L***	***Df*** $_L$	X^2
i. Model Correctly Specified, Valid Instruments, m=3	21.98	21			29.62
ii. 2 lags are superior to 3 lags	**27.70**		**5.72**	**4**	**9.49**
iii. 1 lag is superior to 2 lags	45.03		17.33	4	9.49
v. Imports should be excluded given ii.	33.86		6.16	2	4.60
vi. Targeted Food Aid should be excluded given ii.	**28.30**		**0.60**	**2**	**4.60**
vii. Program Food Aid should be excluded given ii.	**31.62**		**3.92**	**2**	**4.60**
vii. Targeted and Program Food Aid should be excluded given i	**34.19**		**6.49**	**4**	**9.49**

Imports Equation					
Null Hypothesis:	***Q***	***Df*** $_Q$	***L***	***Df*** $_L$	X^2
i. Model Correctly Specified, Valid Instruments, m=3	**27.25**	**21**			**29.62**
ii. 2 lags are superior to 3 lags	37.29		10.04	4	9.49
v. Production should be excluded given i.	**28.70**		**1.45**	**3**	**6.25**
vi. Targeted Food Aid should be excluded given i.	34.08		6.83	3	6.25
vii. Program Food Aid should be excluded given i.	34.53		7.28	3	6.25

Targeted Food Aid Equation					
Null Hypothesis:	***Q***	***Df*** $_Q$	***L***	***Df*** $_L$	X^2
i. Model Correctly Specified, Valid Instruments, m=3	**15.42**	**21**			**29.61**
ii. 2 lags are superior to 3 lags	39.76		24.34	4	9.49
iii. Production should be excluded given i.	39.57		24.15	3	6.25
iv. Imports should be excluded given i.	29.41		13.99	3	6.25
v. Program Food Aid should be excluded given i.	**18.32**		**2.90**	**3**	**6.25**

Program Food Aid Equation					
Null Hypothesis:	***Q***	***Df*** $_Q$	***L***	***Df*** $_L$	X^2
i. Model Correctly Specified, Valid Instruments, m=3	**30.83**	**21**			**29.61**
ii. 2 lags are superior to 3 lags	45.60		14.77	4	9.49
iii. Production should be excluded given i.	37.72		6.89	3	6.25
iv. Imports should be excluded given i.	**33.44**		**2.61**	**3**	**6.25**
v. Targeted Food Aid should be excluded given i.	38.15		7.32	3	6.25

Table 5.1: Nested Hypothesis Testing Using 3 Lags and Years 1991 – 2000 (N=64)

5.3 Restricted System of Equations

The restricted VAR implied by our hypothesis testing is thus as follows. The first difference of production is a function of 2 lags each of the first difference of production, and imports as well as year specific dummy variables. The first difference of imports is a function of 3 lags each of the first difference of imports, targeted food aid and program food aid. The first difference of targeted food aid is a function of 3 lags each of the first difference of production, imports, and targeted food aid. Finally, the fourth equation expresses the first difference of program food aid as a function of 3 lags each of the first difference of production, imports, and targeted food aid. This restricted model is shown below.

$$P_{it} - P_{it-1} = \sum_{j=1}^{2} \theta_{5j}(P_{it-j} - P_{it-j-1}) + \sum_{j=1}^{2} \theta_{6j}(M_{it-j} - M_{it-j-1}) + \sum_{t=1}^{T} \gamma_{5t}(D_t - D_{t-1}) + \varepsilon_{1it} - \varepsilon_{1it-1}$$

$$M_{it} - M_{it-1} = \sum_{j=1}^{3} \beta_{5j}(M_{it-j} - M_{it-j-1}) + \sum_{j=1}^{3} \beta_{6j}(FT_{it-j} - FT_{it-j-1}) + \sum_{j=1}^{3} \beta_{7j}(FP_{it-j} - FP_{it-j-1})$$
$$+ \sum_{t=1}^{T} \gamma_{6t}(D_t - D_{t-1}) + \varepsilon_{2it} - \varepsilon_{2it-1}$$

$$FT_{it} - FT_{it-1} = \sum_{j=1}^{3} \alpha_{5j}(P_{it-j} - P_{it-j-1}) + \sum_{j=1}^{3} \alpha_{6j}(M_{it-j} - M_{it-j-1}) + \sum_{j=1}^{3} \alpha_{7j}(FT_{it-j} - FT_{it-j-1})$$
$$+ \sum_{t=1}^{T} \gamma_{7t}(D_t - D_{t-1}) + \varepsilon_{1it} - \varepsilon_{1it-1}$$

$$FP_{it} - FP_{it-1} = \sum_{j=1}^{3} \psi_{5j}(P_{it-j} - P_{it-j-1}) + \sum_{j=1}^{3} \psi_{6j}(FT_{it-j} - FT_{it-j-1}) + \sum_{j=1}^{3} \psi_{7j}(FP_{it-j} - FP_{it-j-1}) +$$
$$\sum_{t=1}^{T} \gamma_{8t}(D_t - D_{t-1}) + \varepsilon_{2it} - \varepsilon_{2it-1}$$

5.4 Parameter Estimates

Table 2 shows the parameter estimates for the restricted model. As shown by the standard errors in parentheses, and the asterisks indicating degrees of significance, the majority are statistically significant at the .05 or .01 level. The signs of some of the parameters are counter-intuitive, however the majority of articles treating this subject matter focus more on hypothesis testing than they do interpretation of parameter estimates. We therefore caution the reader from literal interpretation of the parameter estimates.

The production equation shows parameters associated with lagged differences of production as negative; this is not entirely inconsistent with the evidence at the regional level shown in Figure 4.5 which shows average production levels declining or remaining stagnant. Increased imports seem to result in increased production since the parameters for imports in the production equation are positive values; this would seem counter-intuitive, but it may simply reflect that production increases when opportunities for trade (as reflected by increased imports) are improved.

Inspection of the relative magnitudes of the variables in the system may shed light on the difference in the impact of food aid on production and on imports. Food aid as a percentage of production in recipient countries for the sixty four country sample was much smaller than food aid as a percentage of imports to recipient countries. The former decreased from 7% in the late 1980s to 2% in the late 1990s whereas the latter (food aid as a percent of imports) decreased from 30% to 5% (see section 4.5 for more details). Since food aid is so small compared to production it may be more difficult to isolate its

impact on that variable than it would be to detect its impact on imports in comparison to which it is of much larger magnitude.

Parameters associated with lagged values of imports in the imports equation are negative. The majority of parameters for both types of food aid are negative in the imports equation, which indicates that food aid displaces imports; the degree of displacement by program food aid is larger than that caused by targeted food aid since the magnitude of the estimates for the former exceed the magnitude of the estimates of the latter. Given the size of the parameters targeted food aid seems to partially displace imports at a rate of three to one whereas program food aid displaces imports on a nearly one to one basis.

Parameters for the targeted food aid equation may be interpreted as the effect of the independent variable on allocation of targeted food aid. Parameters for production are all positive and statistically significant, suggesting that increased cereal production would lead to the allocation of larger amounts of targeted food aid. This could be evidence of poor judgment in allocation decisions. The first and second lags of the first difference of imports are positively related to targeted food aid, whereas the third lag is negatively related, but none of the parameters are of large magnitude. Parameters for lagged differences of targeted food aid are all negative and statistically significant, indicating that targeted food aid is declining over time for a given country; to the extent that dependency is considered undesirable this decline in targeted food aid is an encouraging sign. The decline could also be a simple indication that population is growing faster than targeted food aid is increasing; this is not implausible given targeted

food aid is distributed in many poor countries that are in the midst of demographic transition. Program food aid does not enter in to the equation for targeted aid.

The equation for program food aid allows us to examine allocation for that type of aid. Parameters for lagged differences of production are positive on average over the three year period; they exhibit statistical significance, but are not large in magnitude. The combined effect suggested by the three parameters is that program food aid is delivered in the short term as a response to decreased production since the parameter for the first lag is negative, but over the longer term program food aid is actually allocated to countries that recently experienced slight increases in cereal production as evidenced by the positive parameter values for the second and third lag of the first difference. These effects are, however, minor in comparison with the effects of other variables in the system since the magnitude of the parameters is negligible. Import levels do not affect program food aid allocation. Targeted food aid enters into the program food aid equation with statistical significance, and seems to suggest that over the three year period its net effect is a decrease in program food aid allocation. That is, a country receiving targeted food aid is less likely to receive program food aid. This is consistent with our findings when examining the data on the regional level; we found several countries that were recipients of only targeted food aid and not program food aid. Parameters for the lagged first differences of program food aid are statistically significant, but very small in magnitude; the cumulative effect over the three year period is a slight decline in program food aid allocation over time.

	Production Equation	Imports Equation	Targeted Food Aid Equation	Program Food Aid Equation
Independent Variable:	**Θ (std error)**	**β (std error)**	**α (std error)**	**ψ (std error)**
P1	-0.895**	-	0.049**	-0.033**
	(0.013)		(0.009)	(0.003)
P2	-0.156**	-	0.091**	0.046**
	(0.012)		(0.015)	(0.004)
P3	-	-	0.103**	0.078**
			(0.014)	(0.003)
M1	0.217**	-0.603**	0.058**	
	(0.072)	(0.062)	(0.006)	
M2	1.189**	-0.402**	0.002	
	(0.064)	(0.043)	(0.007)	
M3	-	-0.247**	-0.028**	
		(0.028)	(0.007)	
TFA1	-	0.078	-0.388**	-0.166**
		(0.409)	(0.004)	(0.034)
TFA2	-	-0.310	-0.417**	0.279**
		(0.260)	(0.002)	(0.040)
TFA3	-	-0.688	-0.257**	-0.282**
		(0.440)	(0.003)	(0.050)
PFA1	-	-1.156**		-0.009*
		(0.139)		(0.003)
PFA2	-	-1.159**		0.008**
		(0.111)		(0.003)
PFA3	-	-0.788**		-0.034**
		(0.099)		(0.003)
D95	1.911	0.707	0.585	-0.640
	(2.189)	(1.928)	(0.469)	(0.411)
D96	-0.359	-4.560**	-2.835**	-0.158
	(2.346)	(1.477)	(0.344)	(0.151)
D97	-0.677	-1.868	-0.663*	-2.652**
	(2.225)	(1.225)	(0.314)	(0.309)
D98	-7.135**	6.677**	-0.407	2.041**
	(1.633)	(1.764)	(0.243)	(0.188)
D99	-5.699*	1.362	0.750*	-1.760**
	(2.485)	(1.937)	(0.319)	(0.201)
D00	-17.291**	2.738	-0.0361	-0.338
	(2.697)	(1.485)	(0.176)	(0.243)

* and ** indicate statistical significance at the .05 and .01 level respectively.

The empirical results discussed henceforth used FAO imports adjusted to exclude food aid (we simply subtracted program food aid from the import variable). If we run the same set of hypothesis testing and parameter estimation without adjusting the FAO import variable for its inclusion of food aid we get very different results. Hypothesis testing leads to the same lag specification (2 lags for the production equation and three lags for all other equations), but we find that targeted food aid should be excluded from both the production and imports equation. Program food aid need not be excluded from the production equation and program food aid is not excluded from the targeted food aid equation. Parameter estimates indicate that program food aid discourages production heavily, and it increases imports slightly. Such findings are inconsistent with the prevailing empirical literature on food aid. Given the enigmatic nature of our dataset it is not possible to determine which results are closer to reality, but we have chosen to focus on the results from the adjusted dataset since they are more plausible given the prevailing literature. In any case, both datasets support the exclusion of targeted food aid from the production equation, so that I am fairly confident in concluding that targeted food aid does not affect production at the country level.

5.5 Summary

These empirical results should be interpreted cautiously since they are based on a data set which is far from perfect. To summarize, the analysis provides evidence that neither targeted nor program food aid affects production in recipient countries. Both types of food aid displace imports, with program food aid displacing imports on a near one to one basis and targeted food aid displacing it at a rate of about three units of food

aid to every one unit of imports. The equation for targeted food aid shows targeted food aid increasing with production, not being affected largely by imports or program food aid and declining over time. The equation for program food aid indicates that program food aid increases slightly as production increases, is not affected by import levels, decreases in response to targeted food aid and is decreasing slightly over time.

CHAPTER 6

CONCLUSIONS

6.1 Introduction

The goal of this dissertation was to determine whether program and targeted food aid differ in the way they affect imports and production and to determine whether the two major types of food aid are allocated according to different criteria. To accomplish this goal, the first objective of this dissertation was to review the literature on this subject matter. The second objective was to develop a theoretical model which would advance hypotheses to be tested empirically. The last objective was to test the hypotheses empirically. The main conclusions from this effort follow.

6.2 Main Conclusions

The literature review revealed that the impact of food aid on production and imports remains largely undetermined. Most work focuses on program food aid; perhaps the most convincing pieces are theoretical work by Schultz (1960) and empirical work by Barrett *et al.* (1999). The former postulated that program food aid discourages production of food in the countries receiving it whereas the latter's empirical results show U.S. program food aid does not affect production in countries that are its most frequent recipients, but it does affect imports to recipient countries. Hypotheses resulting from

our theoretical model were that, if UMRs are not enforced, both types of food aid displace imports, and only when imports are completely displaced, aid will start to discourage domestic production. Program food aid displaces imports more rapidly than targeted food aid does and, as a consequence, the discouragement of domestic production will emerge at lower levels of aid than with targeted aid. If the UMR is enforced, however, then imports can not be displaced by program aid and such aid discourages domestic production right away. The extent to which targeted aid does not displace imports depends on how much of the extra income received by the beneficiary households is spent on food rather than non food items. That is, additionality reduces the displacement of imports and the possible discouragement of production by targeted aid.

Results of my empirical work lead to rejection of the hypothesis that either program or targeted food aid affect production. The findings of this study with regard to food aid's impact on production are therefore consistent with Barrett's study, but the results related to imports differ from the results of his study. I find that both types of food aid displace imports although at a different rate, whereas Barrett found that program food aid displaces imports in the short term, but actually encourages them in the longer term.

Literature review and comparison of FAOSTAT data with INTERFAIS data indicate that the allocation of targeted food aid between countries is based more on low non-concessional food availability than is the allocation of program food aid. Our findings actually refute the null hypothesis that either low production or low import levels lead to large allocation of program and targeted food aid. This may be a reflection

of our variables being in per capita terms for countries where populations are growing rapidly. Furthermore, our model is looking at observations at the country year level. Targeted food aid may very well be allocated to countries that tend to have lower availability of non-concessional food, but it may not arrive during a country's most needy periods.

6.3 Policy Implications

Before suggesting the implications of this work for policymakers it is crucial to note that our study ignores a fundamental question: is aid beneficial to developing countries and countries in transition and if so, is food aid the best type of aid for those countries? Indeed, economists question whether aid is even effective, especially if it is not distributed to countries with sound policy environments. With regard to food aid most economists would argue that aid in the form of food is no more than a second best solution. Amartya Sen, one of the foremost authors on poverty and development, argues that under certain conditions food aid is inferior to cash transfers (1990). I chose to focus on food aid as an inevitable form of transfer to the developing world from countries with agricultural surpluses. Decision makers in countries with the ability to produce agricultural surpluses will continue to advocate for food aid since doing so will earn them political capital with powerful farm lobbies. Therefore, taking the existence of food aid as a given, I asked the question: do program food aid and targeted food aid differ in their relation to production and trade?

The findings of this dissertation suggest that indeed there is a difference. First, the concern over the impact of food aid on production can not be substantiated given the empirical record. The real impact of both types of food aid is to displace imports. At the margin targeted food aid displaces imports far less than program food aid does. This would suggest that the Consultative Subcommitttee on Surplus Disposal's efforts to contain import displacement through the implementation of Usual Marketing Requirements are ineffective. The CSSD may do better to shift its focus from UMR enforcement to targeting food aid rather than distributing program food aid.

If one is concerned about the impact of food aid on production (even though our empirical results reveal it is not of concern) a switch in the food aid regime towards targeted food aid would, according to our theoretical results, impact production far less than it would impact imports. Both the theoretical and empirical results presented in this dissertation indicate that targeted food aid affects imports less than program food aid does. Considering all of these factors it seems that a move towards targeted food aid may lead to improved social welfare. There are indeed aspects of the issue not considered by this study, which might mean that such a change in policy would not improve social welfare; distribution of targeted food aid may be more costly than that of program food aid. Additionally, this work, with the exception of some of the theoretical analysis, is conducted in a partial equilibrium framework, but a holistic consideration of food aid should be conducted in a general equilibrium framework, since such aid has cost and benefit implications for all markets, not merely the food market. It would therefore seem that the logical direction for the research to take at this point would be to examine the

cost side of food aid distribution as well as the costs and benefits of food aid for markets other than merely the food market in an effort to determine what quantity of targeted food aid and what amount of program food aid should be distributed in order for the marginal costs to equal the marginal benefits of such a redistribution.

6.4 Directions for Additional Research

In addition to considering the costs of the two types of food aid and expanding the study to a general equilibrium framework, there are several ways in which future research may improve on the accomplishments of this dissertation. First and foremost it is crucial that data be obtained from INTERFAIS that is aggregated on a January to December basis. The study might be further improved if the countries included in the data set are limited to countries that are net importers; this would make the empirical study more relevant to the theoretical model since it was based on the assumption that the recipient country was an importer of cereals. Increasing the instrumental variable matrix to include lags of levels of all of the dependent variables would also improve the study, since such an instrumental variable matrix is considered more appropriate for this type of work (Arellano and Bond, 1991). Additional insight may be gained by testing the hypothesis that targeted food aid leads to decreased production if and only if targeted food aid exceeds the quantity that would have been imported had there been no food aid.

Lastly, the results of this dissertation do not explain the differences between countries. Ultimately one would like to decompose the fixed effects and present results that are contingent upon country types; such an exercise would lead to policy

prescriptions of the sort that in order to achieve such and such a result, in this type of country, this type of food aid should be used. Grouping countries according to certain attributes and running a separate regression for each country grouping would allow for this type of insight. Alternatively, one might choose to compare the residuals from the first difference equations resulting from the VAR with fixed effects to the forecasted residuals from first differences using the results from a VAR without fixed effects. Explaining the difference in the two residuals would allow researchers to decompose the fixed effects in an effort to identify the country attributes that are relevant to policy makers.

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