Food Aid for Market Development in Sub-Saharan Africa*

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Abstract

Food aid remains contentious, in part because of presumed producer dsignificant in adding to food availability in many low-income countries in sub-Saharan Africa, helping to reduce the gap between food consumption needs and supply from domestic production and inventories and commercial imports. Food aid remains a contentious subject, however, and there have been many recent pleas for more effective use of the resource. This study explores how food aid might be used for domestic food market development to facilitate poverty alleviation and economic growth.

There are obvious risks to using food aid for market development, just as there have been in using food aid to try to stimulate agricultural development. Because food aid necessarily expands local food supply, it needs to be well targeted if adverse producer price effects are to be avoided. In particular, if food aid can be targeted so as to relieve short-term working capital and transport capacity constraints to the development of downstream processing and distribution capacity in recipient country food marketing channels, for example by helping build farmer cooperative groups, then food aid could have salutary effects on sub-Saharan African agriculture.

1. Introduction

The importance of agricultural development for poverty reduction and economic growth in sub-Saharan Africa has been widely acknowledged and accepted (Abdulai and Delgado, 1995). There is likewise consensus on the need for continued improvements in rural factor and product markets so as to create incentives for African farmers to invest in the improved production technologies and natural resources management practices necessary for agricultural development and for non-farm businesses to invest in post-harvest processing and other value-adding activities necessary to stimulate the rural nonfarm economy in sub-Saharan Africa (Kherellah et al. 2002). Yet cash resources available to support agricultural and rural nonfarm economic development have declined precipitously over the past fifteen years (Barrett and Carter 2002). To what extent might food aid – which is often a more readily available resource for development programming – be useful in stimulating necessary market development in sub-Saharan Africa? That is the question we address in this paper.

Precipitous decline in per capita food production from the early 1970s through the mid-1980s (Figure 1) was both cause and consequence of generalized economic collapse on the continent. While there has been modest recovery over the past fifteen years, overall food production in sub-Saharan Africa remains almost 20 percent below the early 1970s' levels in per capita terms and has been trending down again for the past three years. Over the same period that food production per capita declined, food aid flows into sub-Saharan Africa increased nearly fivefold. Food aid flows then became extremely volatile, but remaining in the 2.0-4.0 million metric

tons per year range for the past decade (Figure 1). These patterns raise widespread concern among donors, government policymakers and development practitioners in the NGO community.

Some analysts might interpret these data as a sign that food aid flows are causally related to declining per capita food production in Africa. The logic behind this assertion is that food aid deliveries depress the food prices received by recipient country producers and storage providers, thereby discouraging domestic output. By this view, the seemingly ubiquitous empirical finding that food aid shipments increase recipient country food supply at less than a one-for-one rate indicates that food aid has adverse effects on local food prices, creating disincentives for producers to invest in improved technologies or for marketing intermediaries to invest in storage and transport capacity.[1]

There are a number of reasons to be concerned that sub-Saharan Africa may be particularly vulnerable to the adverse impacts mentioned above. First, relative to Asian governments, sub-Saharan African governments have historically placed low priority on improving agricultural performance. For instance, the share of government expenditure allocated to agriculture in Asia was 15% and 10% in 1980 and 1998, respectively, while the corresponding shares in Africa were only 6% and 5%, respectively (Fan and Rao, 2003). Second, as pointed out by Eicher (1988), the region's capacity to deal with food security and poverty is constrained by political instability and shortage of scientific expertise.

Other characteristics of production and marketing systems may diminish or overshadow the hypothesized disincentive effects of food aid. In particular, the semi-

arid areas of the Sahel and Eastern and Southern Africa rely on unimodal seasonal production with relatively little irrigation. As noted by Mellor (1985), the agroclimatic and technological conditions that dominate African agriculture tend to cause low labor productivity and labor scarcity in peak seasons. Under such conditions, the withdrawal of labor from food production tends to cause more rapid decline in food production in the region than in Asia (Lele, 1984). Given one planting season, the production pattern is more vulnerable to climatic and other disruption, resulting in a high variance in yield. Moreover, supporting services such as access to credit for farmers, ineffective seed distribution networks and poorly developed infrastructure contribute to low adoption of advanced technologies. These characteristics tend to dampen the responsiveness of food production to producer price incentives, calling into question the disincentive effects of food aid on sub-Saharan African agriculture.

This leads directly to an opposing perspective on the food aid – food productivity relationship, which holds that increased food aid has been and could prospectively be beneficial to African agriculture. The logic behind this line of argument emphasizes food aid's role in increasing poor households' access to and consumption of food in the face of exogenous climatic or political shocks, thereby improving human nutritional status, health, labor productivity and income earning capacity relative to what would transpire in the absence of food aid.

Whether rising food aid shipments to sub-Saharan Africa positively or negatively affect local agricultural development and poverty reduction turns largely on the effects of food aid on recipient country food production and downstream

[1] See Barrett (2002) for a review of this evidence.

processing and marketing patterns. These in turn depend to a large extent on how well donors and operational agencies manage food aid shipments in terms of targeting, timing, etc., and whether the domestic political, and institutional environment in recipient countries is conducive to efficient utilization of food aid as a development tool.

In the face of well-known impediments to African rural markets that restrict the timely flow of purchased inputs to African smallholders and limit value-added processing and the share of retail food prices received by farm producers (Kherellah et al. 2002), food aid targeted effectively at downstream market development might effectively stimulate food production, agricultural development, poverty alleviation and economic growth in recipient countries. This underscores the importance of factor market failures in limiting productivity in Africa as well as the centrality of food aid management modalities to making it an effective instrument. If food aid has had a positive effect on balance on aggregate food productivity in sub-Saharan Africa, in spite of the well-known producer price disincentive effects of food aid and plenty of horror stories in particular cases of poorly managed shipments,[2] then plainly food aid can and often does play a significant off-setting role in relieving constraints that otherwise limit productivity in smallholder systems. If those food aid management lessons can be learned and replicated more broadly (Barrett and Maxwell forthcoming), this then raises the intriguing prospect of putting food aid flows to use in support of broader agricultural market development objectives in sub-Saharan Africa.

[2] See Jackson and Eade (1982) for some especially egregious and oft-cited examples.

To date, most attention has focused on food aid's effects on primary agricultural production. This paper moves downstream, examining the potential for using food aid for domestic market development. We focus especially on the prospects for putting food aid to use in relieving factor market failures that similarly constrain investment and productivity in downstream value-added activities in food marketing and processing.

One way food aid for market development works is as follows. Food aid donors provide raw materials (e.g., maize, soybean oil, powdered milk) to recipient country governments or nongovernmental organizations (NGOs) for free or on heavily concessional terms. These raw commodities are then given or sold to local processors or traders who then process and/or sell the product, creating or expanding new markets in the process. If the commodities were sold – "monetized" in the jargon of food aid – the government or NGO then uses the counterpart funds generated by food aid monetization to support the development of the production, processing and marketing activities by smallholder farmers (e.g., through technical assistance projects or public infrastructure investments). The objective of this support is to improve the terms of trade (output prices relative to input prices) smallholders face, and/or to support adoption of improved production, storage or processing technologies designed to stimulate domestic production of the donated commodity. The long-term aim of food aid for market development is to use short-lived food aid to stimulate local production, processing and distribution capacity expansion with the objective of replacing food aid with domestic production or commercial imports within a few years, thereby creating sustainable value-added and output growth.

We explicitly set aside the issue of whether food aid is the best resource to use in promoting agricultural market development in recipient countries, particularly in sub-Saharan Africa. In the abstract, food aid seems an undeniably inferior resource because it is doubly tied, in the following sense. Food aid is inflexible in the form of the transfer – it comes only as food, not as cash or other useful goods or services – and it is typically inflexible in sourcing that food, relying on commodities procured in and shipped directly from the donor country.[3] However, if the volume of international transfers depends on the form in which donors provide it, particularly if donor country governments are willing to provide food aid in part because it supports their own farm and agribusiness constituencies, then food aid that is relatively inefficient per dollar transferred may nonetheless generate greater absolute transfers than less restricted cash appropriations. The question of the sensitivity of international development assistance budgets to the form in which donors provide aid falls well outside the scope of our study. We therefore only explore whether food aid can satisfy a necessary (but not sufficient) condition for its use in promoting recipient country agricultural development: does it or might it reasonably be expected to stimulate increased productivity and value-added in recipient countries in sub-Saharan Africa?

We investigate that question over the next five sections. In section 2 we present an overview of trends in the volume of food aid shipments to sub-Saharan Africa. Section 3 briefly reviews the conceptual issues of the potential impact of food

[3] Local purchases (i.e., international cash donations for the purchase of food on open markets in the recipient country) and triangular transactions (i.e., international cash donations for the purchase of food on open markets in one low-income country for shipment to another, recipient country) represented

aid on recipient country production and downstream value-adding activities. Section 4 discusses a few key characteristics of food markets and food aid, and presents a summary of the results of an empirical analysis of the impact of food aid on food production in the region in sub-Saharan Africa. Section 5 discusses how to use future food aid most effectively, reflecting in particular on possible uses for development of downstream processing and distribution capacity. Section 6 concludes.

2. Trends in Food Aid Shipments to sub-Saharan Africa

At the global level, food aid has become a marginal component of aid, constituting only 1-3 percent of overseas development assistance flows in any year 1995-1999, down sharply from 22 percent in 1965 and 11 percent in 1985 (OECD 2003, ODI, 2000). While food aid comprised 30 to 40 percent of U.S. economic assistance, on average, between 1954 and the mid-1970s, the share has declined gradually, falling to only 8 percent in 2002 (Barrett and Maxwell forthcoming).

In volume terms, global food aid flows declined sharply in the last decade, from a high of 15 million metric tons in 1992-93 to less than 7 million metric tons in 1996-97, before recovering to around 10 million metric tons in 2000-2002. Food aid therefore accounts for a small and declining share of cross-border food flows and an even smaller share of food availability (Barrett, 2002). The European Union insists that anything other than emergency food aid should be considered an export subsidy. If the next trade agreement under the World Trade Organization moves in this direction, food aid volumes will likely decline further.

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only 11 percent of global food aid flows in 2000. The vast majority of food aid flows involve direct donor-to-recipient shipment.

The volume of food aid to sub-Saharan Africa has varied sharply over the last three decades. From a low of only 0.62 kg per person per year in the early 1960s, food aid deliveries to the region increased almost tenfold from the early 1970s to the mid-1980s, more than tripling from an average of just over one million metric tons per year in the 1970s to more than 3.3 million metric tons in the 1990s (Table 1). The region's share world food aid receipts has also risen significantly as African recipients have generally overtaken the south Asian states that received most food aid in the 1960s (Barrett and Maxwell, forthcoming). Bangladesh became the largest recipient of food aid in the 1990s and remains consistently among the top food aid recipients worldwide. But several sub-Saharan African countries now feature prominently among the top five year after year. Ethiopia (6.2 percent of global flows in the 1990s), Mozambique, Kenya, Sudan and Eritrea, in particular, have become leading food aid recipients, with the region as a whole receiving more than 30 percent of global food aid flows (Barrett, 2002).

The composition of food aid shipments to Sub-Saharan Africa has also fluctuated considerably in the last three decades. As is the pattern worldwide, wheat and wheat flour constitute by far the largest share of food aid flows, more than 85 percent of which are cereals (Table 1). Nonetheless, the proportion of wheat and wheat flour in food aid flows to Africa declined from 49 percent in 1980s to only 37 percent in the 1990s, before recovering a bit to 43 percent in 2000-2002, as the share of coarse grains and non-cereals increased. The distribution between countries has likewise varied greatly in recent years (see Table 2 for figures on selected countries).

During 1985-2000, the volume of food aid grew at an annual rate of 21.2 percent in Ethiopia, 8.1 percent in Sudan, and 6.2 percent in Mozambique.

Figure 2 shows that food aid shipments to Sub-Saharan Africa have increasingly shifted from program to emergency aid. The share of emergency food aid increased from an annual average of 41 percent in 1988-1990 to 67 percent in 2000-2002, while the share of program food aid declined from an annual average of 37 percent 1988-1990 to only 8 percent in 2000-2002. The share of project food aid has remained relatively stable within the entire period, increasing only slightly from an annual average of 22 percent in 1988-1990 to 24 percent in 2000-2002. The observed pattern reflects the fact that much of food aid shipments have become tied to acute humanitarian emergencies.

It is however important to note that as program food aid has declined, monetization of non-emergency project food aid by NGOs has grown sharply. As Figure 3 demonstrates, PL480 Title II nonemergency monetization rates have skyrocketed in recent years. The implication is that although the food aid category has changed, the basic effects on markets continue, because food aid that is monetized by NGOs operates just like that monetized by recipient governments; it inherently adds to supply, putting downward pressure on market food prices. In so far as the targeting of directly distributed food aid has improved over time, however, food price effects may have nonetheless diminished.

The increased share of emergency food aid has been accompanied by a shift in food aid distribution channels. Since the late 1980s, one-quarter to one-third of global food aid has been channeled through the World Food Programme (WFP). The WFP's

share of food aid flows to Sub-Saharan Africa has increased from 45 percent in 2000 to 68 percent in 2002.

In summary, although food aid flows have declined sharply relative to overall development assistance and in volume terms globally, they have increased in sub-Saharan Africa over the past generation. During this time, food aid has become increasingly tied to emergency relief and more varied in its commodity composition and geographic coverage within the continent. Thus food aid and its uses remain a significant issue in African agricultural policy and in donor programming for sub-Saharan Africa.

3. Conceptual Issues Regarding the Potential Impact of Food Aid

A persistent objection to non-emergency food aid arises from its potential disincentive effects on domestic food production and marketing. These disincentive effects could emerge in any of several ways, which we enumerate momentarily. It is important, however, to take a broader perspective on the problems facing small farmers in sub-Saharan Africa. Some criticisms of food aid unhelpfully restrict the range of effects under consideration, excessively emphasizing product market price effects without paying attention to factor market price effects that equally influence production patterns. As we emphasize in this section, food aid can influence both the product and factor market incentives faced by food producers in food aid recipient countries. How these countervailing effects net out depends on the design and efficacy of a given food aid action. The net effects are ultimately an empirical question. To the degree that food aid can prove stimulative to the recipient country's

domestic food economy, some intriguing options emerge, to which we turn in subsequent sections of the paper.

3.1 Food Price Impacts

Food aid will normally boost aggregate demand in the recipient country. The resulting income boost will tend to increase recipient country demand for food. However, the basic commodities provided in food aid shipments are normal goods. Demand for them increases more slowly than income grows, even when the income transfers come in as the form of food. As a consequence, the addition of food aid to domestic food supply will tend to expand supply more than it stimulates demand. That is why food prices typically fall in response to food aid inflows into developing countries (Gabre-Madhin et al., 2003). Since increased food consumption is less than the volume of food aid received, there must be some commercial food sales displaced, whether from domestic producers and processors or commercial imports. The extent of the displacement – equivalently, the degree to which food aid flows add to recipient consumption volumes – turns fundamentally on the efficacy of targeting. Because income elasticities of demand for food are highest among the poorest subpopulations, food aid distributed exclusively to poor recipients generates minimal food market distortions relative to untargeted food aid monetized in an open market (Barrett 2003).

The division of commercial food sales displacement between domestic producers and foreign suppliers turns on several factors. First, it matters how well-integrated the recipient country market is with broader international food markets. In

a fictive small open economy, food aid simply substitutes for commercial imports, with prices and domestic production unaltered, but with increased consumption. However, poor infrastructure and high transport and marketing costs in much of rural Africa typically cause food markets to exhibit poor spatial market integration, violating the small open economy assumption of frictionless international market access. The release of food aid can therefore have significant local price effects, leading to displacement of local production. These problems are far less significant in areas well-integrated into broader national and international markets that can readily absorb excess local supply resulting from food aid inflows.

The second big factor that determines the division of displaced commercial food sales among suppliers concerns product differentiation. Food aid transfers tend to decrease the demand for substitute commodities, such as maize and rice in the case of wheat food aid, and to increase demand for complements, such as meat and vegetables in the case of vegetable oil food aid. Combined with the transfer's positive income effects on demand for both substitute and complementary foods, the net cross-price effect of food aid therefore depends on the relative magnitudes of the substitution and income effects. Producers of complementary foods tend to benefit from food aid while the market prices of substitute foods can either rise or fall, depending on how income and substitution effects net out (Gabre-Madhin et al., 2003). This seems a primary reason for apparent international trade externalities in food aid shipments, wherein U.S. food aid flows tend to stimulate recipient country demand for third country food exports more quickly than for U.S. commercial food exports, because the products are typically not identical (Barrett et al. 1999).

In sum, longstanding concerns about product market price effects of food aid deliveries – which date at least from Schultz (1960) – are well-founded in many settings in which food aid shipments of locally produced commodities are distributed in poorly integrated recipient markets with ineffective targeting to the poor. But the problem is perhaps less general than is commonly believed. Product market price effects may not be adverse for all producers, indeed they can even be favorable in well-integrated markets for producers of complementary or some substitute foods.

3.2. *Factor Market Effects*

The effect of food aid on food producers' incentives in recipient markets turns not only on induced changes (if any) on product prices, but also on factor market effects. Even if the producer price of a food falls, producers may expand production if input prices fall even more. There are several different mechanisms through which food aid can affect the shadow price[4] of inputs and thereby affect agricultural productivity and rural incomes.

The most researched factor market effects relate to the value of labor. If households value leisure, then income transfers, even in kind transfers associated with the receipt of food aid, will induce increased demand for leisure and reduced supply of labor. All else held constant, reduced labor supply will reduce farmers' output and cash incomes. Labor productivity thus increases while yields per unit area cultivated

[4] The shadow price of a good or service differs from the local market price in the presence of any sort of binding constraint (e.g., cash liquidity, subsistence, availability) that makes the good or service relatively more scarce for a particular decision-maker. In areas where market imperfections are widespread, search and transactions costs, credit constraints, etc. common drive a significant wedge

fall. Available evidence shows that labor supply becomes more responsive to changes in income as people grow wealthier. This implies that poorly targeted food aid may magnify inevitable labor market disincentive effects by providing benefits to those who are most likely to turn transfers into leisure instead of increased consumption.

Special concerns have been voiced about the labor market effects of ill-conceived food-for-work (FFW) projects, which may distort local labor markets by attracting workers away from vital activities during the agricultural year, especially if the wages offered under FFW schemes are at or above prevailing market wage rates (Maxwell and Singer, 1979). However, FFW schemes can also create valuable inputs, perhaps especially public goods such as feeder roads and reforestation or soil and water conservation structures to reduce soil erosion. For example, von Braun et al. (1999) report on the multiplier effects of a FFW-built road in the Ethiopian lowlands, where improved market access directly attributable to that road led to the establishment of water mills and fruit plantations and the revival of traditional cotton spinning and weaving in the three years after the road was built. Moreover, well-conceived and managed FFW projects that invest in necessary materials to complement labor inputs clearly can 'crowd in' private investment, as Holden et al. (2003) find in the case of private investment in soil and water conservation structures in Tigray region of Ethiopia and Bezuneh et al. (1988) find in purchased farm inputs use in Baringo District, Kenya.

In so far as food aid provides timely transfers at times when recipients are cash-strapped, it can obviate binding seasonal liquidity constraints, enabling

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between observable market prices and the true economic valuation – shadow prices – that guide

smallholders to undertake productive investments. Many small farmers run short of the cash necessary to purchase food, pay hired workers and purchase inputs in the planting and growing season; hence the colloquial term 'hungry season' used for this period in many regions. Given rampant rural financial market failures, the marginal cost of capital can be quite high, sufficient to preclude purchase of high-return inputs such as chemical fertilizer or investment in capital improvements such as improved soil and water conservation structures or labor-intensive cultivation practices offering sharply increased expected crop yields (von Braun 1995, Barrett et al. 2002, Moser and Barrett 2003). The income transfer component of well-timed and well-targeted food aid can obviate binding liquidity constraints, stimulating smallholder productivity, as has been demonstrated in Kenya (Bezuneh et al. 1988, Barrett et al. 2001). The effect may be subtle, appearing not as increased investment, but rather as reduced disinvestment, whether of valuable natural capital through erosion-inducing deforestation (Barrett 1999) or sale of high return assets, such as livestock, to meet short-term cash requirements for food, medicines or school fees (Barrett et al. 2001).

At a subtle but important level, there is a fundamental inconsistency in arguments that because food aid expands local food supply, it must create producer disincentives. The inconsistency emerges because, as previously discussed, food demand inevitably increases less than food supply, causing some displacement of commercial imports. But displaced commercial food imports reduce demand for foreign currency, affecting the real exchange rate or freeing up foreign exchange to increase the local supply of imported inputs. Either way, adverse food product price effects are inextricably linked to favorable input price effects for food producers.

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resource allocation.

Either there is little displacement and no product or factor price effects, or there is commercial food market displacement, in which case product prices move against producers while tradable input prices adjust favorably for farmers. The net effects of food aid deliveries on domestic food productions are analytically ambiguous (Mohapatra et al. 1999). Hence the need for empirical investigation of this question, like that we offer in the next section.

The final inputs that can be affected by food aid are transport and storage equipment. Poorly timed and managed food aid can compete with local merchants for scarce transport capacity and commercial storage space, bidding up their cost and choking off investment in commercial market intermediation. By contrast, well timed and managed food aid can help stabilize capacity utilization for commercial storage and transport providers, thereby encouraging investment to benefit the broader agricultural marketing channel. Furthermore, food aid deliveries into relatively remote areas can temporarily relieve transport bottlenecks by creating new backhaul capacity, thereby reducing marketing costs for local producers through a *de facto* transport subsidy

3.3. Risk Management Effects

Beyond its prospective input and output price effects, food aid can also affect food production through changing the production risks faced by farmers. African food producers face considerable risk due to climate, disease, pests, civil unrest and other shocks. Underdeveloped rural financial markets leave most such risk uninsured. Uninsured risk causes net commodity sellers – all but the smallest

farmers, who are commonly net buyers of the products they grow – to reduce output, resulting in lower aggregate productivity (Finkelshtain and Chalfant 1991, Barrett 1996). Effective insurance can thus boost productivity by reducing farmers' practice of costly risk mitigation strategies.

Risk management instruments only generate desirable productivity and poverty reduction benefits if they are credible, however. Farmers do not drop costly risk mitigation strategies in response to unreliable insurance. Historically, food aid targeting and timeliness has been of mixed effectiveness at best, providing unreliable insurance against shocks. Moreover, much food aid appears to substitute to a considerable degree for informal social insurance flows, generating little net additional insurance coverage for smallholder producers.

On the other hand, were food aid more effective in providing insurance, it would have to be appropriately priced and linked to natural disasters in order to avoid creating perverse incentive problems for farmers. For example, if food aid were available to a farmer whenever he/she suffered a severe production shortfall, regardless of cause, then moral hazard problems could easily arise. This is a well known problem in insurance whereby the insured has reduced incentive to take all reasonable precaution to avoid or minimize losses once they know that the insurance will compensate regardless of the causes of their losses. Moral hazard can be avoided by linking food aid transfers to specific climate or other catastrophic events that lead to losses over which the farmer has no control. Another incentive problem can arise if the food aid is given free or on a subsidized basis. In this case farmers may take on too much risk, because they do not bear the full cost of any resulting losses although

they capture all of any windfall gains (Skees et al., 1999). This familiar result from the insurance literature carries important lessons for food aid: provide only what intended beneficiaries would be willing to pay for on their it if they had the necessary cash.

African farmers have evolved a wide array of traditional risk management strategies (e.g., kin support systems, intercropping, temporary migration) over the centuries. These systems generally work well except in catastrophic years of highly covariate risk (e.g., broad-scale drought or floods), when nearly everyone suffers losses at the same time, so that there are scant redistributable surpluses within the local system or off-farm employment opportunities. Once food aid begins to flow on a regular basis, then farmers may begin to take it for granted, reducing their incentive to practice traditional risk management strategies. This can induce farming practices that are more vulnerable to drought or flood, thereby increasing expected losses in bad years while undercutting traditional social insurance arrangements for which farmers have to pay implicitly. Of course, this merely reinforces the need for food aid. These problems can add enormously to the cost of government assistance over time in response to natural disasters.

Governments may also face similar incentive problems when receiving large amounts of subsidized or free food aid from abroad. If they can take food aid for granted in emergency situations, then they may not take reasonable precautionary actions, like investing in irrigation or in agricultural research and extension to reduce the risk of losses in national food production, or in stockpiling food or setting aside funds for emergency food imports in times of need. They may also underinvest in

long-term agricultural development, which otherwise could eventually eliminate a country's need for any food aid.

Such disincentives can not only lower productivity and incomes for African countries, they can also compel reallocation of scarce overseas development assistance budgets, leading to what Barrett and Carter (2002) term a "relief trap". Due to sharp increases in emergency spending on response to humanitarian emergencies, the share of global aid flows spent on proper development investments – education, health, economic infrastructure, agricultural production technologies, etc. – fell from 47 percent in 1993 to 31 percent in 1999. The United States' government's spending on international agricultural development has suffered disproportionately, falling from $900 million in 1990 to $300 million in 1999. For example, USAID spends $200-300 million per year (and growing) on food aid and only $4 million (and falling) on agricultural development in Ethiopia. A whole food aid distribution industry has grown up (international, public and NGOs) that now has a vested interest in the continuation of current high levels of food aid because food aid now accounts for much of their gross revenue.

To avoid these problems, stakeholders need to reflect seriously on when and where food aid is the most appropriate form in which to offer insurance. With the emergence of new and potentially more efficient climate risk management products, such as rainfall insurance and catastrophe bonds, and given the availability of emergency loan facilities at the International Monetary Fund, the World Bank and other international financial institutions, the default assumption that food aid is

necessarily an appropriate response to drought, flood or locust infestation may need revisiting (Skees et al., 1999, Barrett and Maxwell forthcoming).

3.4 Some Empirical Evidence on the Producer Incentives Effects

How do the data suggest the countervailing product market, factor market and risk effects of food aid net out in their effects on agricultural productivity? The empirical literature on the net producer incentive effects of food aid in sub-Saharan Africa is inconclusive. Several studies report positive effects on recipient country food production, while a somewhat smaller number show negative effects. For example, Grannell (1986) and Msuya (1986) both argue that considerable attention was paid to the risk of disincentive effects at the local market level in Ethiopia. Their findings suggest that food aid projects were reasonably successful in avoiding the disincentive effect. Bezuneh et al. (1988) and Barrett et al. (2001) found that food aid resulted in increased marketable surplus, labor demand and household savings among participants in a food-for-work scheme in Kenya. Dorosh et al. (1995), Barrett et al. (1999) and Barrett (2001) report very similar findings. While Tschirley et al. (1996) and Donovan et al. (1999) found that increased yellow maize food aid depressed prices for both yellow and white maize in Mozambique's Maputo market, they do not study the net effects on Mozambican producers. Jackson and Eade (1982) report significant labor market disincentives from food-for-work projects in a number of developing countries, but likewise do not study the net effects across all factor and product markets. Moreover, Maxwell et al. (1994) and von Braun et al. (1999) find

little support for the claim of labor market disincentive effects of food-for-work schemes.

As pointed out by Barrett (2002), there does not seem to be a mass of empirical evidence in support of the hypothesis that food aid significantly displaces domestically produced food on recipient country markets. Particularly in sub-Saharan African countries, where balance of payments constraints bind at the macroeconomic level and working capital constraints bind at the household level, it seems reasonable to believe the empirical evidence suggesting that food aid's contemporaneous displacement of food purchases might foster productive investments that generate significant dynamic income gains from food aid. This reinforces Singer's (1987) argument that critics of food aid have unduly used a narrow framework for the disincentive debate. He points out that the immediate price disincentive may be only the left hook of the J curve with a cumulative expansion of income and output that follows.

4. Food Aid and Agricultural Development in Sub-Saharan Africa

Generally, the producer disincentive effects discussed in section 3 will be greater the less well integrated the food aid destination market is into broader national, regional or global markets. This stems from the fact that a given volume of food aid represents a larger share of aggregate supply the more segmented the market into which it is delivered, thus exerting greater downward pressure on producer prices. Because food markets conditions matter to net production incentives, we briefly examine the salient features of food markets in the region in the next

subsection before proceeding to briefly discuss the results of an empirical analysis of the impact of food aid on food production in sub-Saharan Africa to date.

4.1 Food Markets in sub-Saharan Africa

Although several countries in sub-Saharan Africa have undertaken major market reforms during the last two decades, food markets in the region still appear highly inefficient (Kherellah et al. 2002). In particular, inefficient parastatal marketing boards, high transaction costs from poor infrastructure, dispersed populations and problems with physical security and contract enforcement, lead to relatively wide margins between producer and consumer prices, up to 70 percent of product values (Ahmed and Rustagi, 1987).

Markets can be inefficient either because trader behavior appears noncompetitive or because the costs of commerce are high. The best way to distinguish between these is by testing for spatial equilibrium. Markets are in spatial equilibrium if prices differ between them only by the costs of arbitrage between the markets (e.g., transport, handling, taxes), implying that competition among traders extinguishes profit for the least efficient arbitrageurs. While earlier empirical evidence appeared inconclusive, more recent and methodologically sophisticated work suggests that markets are commonly in spatial equilibrium, although extraordinarily high costs of commerce often preclude profitable product flows between spatially distinct markets, leading to high inter-market margins and

significant geographic market segmentation.[5] This raises the prospect that costs constrain commerce and that producer price effects should be relatively more pronounced in sub-Saharan Africa than elsewhere in the developing world. Put differently, the analysis that follows in no way denies the adverse producer price effects of food aid. Rather, it underscores the importance of factor market constraints to agricultural productivity growth on the continent. As we argue in section 5, these effects are likely present especially in post-harvest processing and distribution, raising the prospect that food aid might be employed productively to address the very food market inefficiencies that presently give rise to adverse producer price effects.

4.2. Analysis of relationship between food aid and food production

The relationship between food aid flows and food production in sub-Saharan African is investigated within a vector autoregressive (VAR) framework for the period 1970-2000 for 42 Sub-Saharan African countries that received food aid.[6] Annual food aid flows data were obtained from the World Food Programme and food production data from the FAO's *Production Yearbook*. Because cereals food aid accounts for more than 90% of total food aid shipments to sub-Saharan Africa, cereals serve as a reasonable proxy for overall trends in food aid and production. All volume figures were converted to a per capita basis using annual population data reported in the FAO's *Production Yearbook*. Country-level annual rainfall data were

[5] Examples include Golletti and Babu (1994), who studied maize markets in Malawi, Barrett (1995), who studied multiple food markets in Madagascar, Negassa (1998), who explored different markets in Ethiopia, and Abdulai (2000)' s research on maize markets in Ghana.

[6] The countries include: Angola, Burundi, Benin, Burkina Faso, Botswana, Cape Verde, Central African Republic, Chad, Cameroon, Comoros, Congo, Cote d'Ivoire, Djibouti, Ethiopia, Equatorial Guinea, Guinea-Bissau, Gambia, Ghana, Kenya, Lesotho, Liberia, Madagascar, Mauritius, Mauritania,

obtained from Tyndall Centre for Climate Change (Mitchell et al., 2003). Given that the impact of rainfall volume varies between different geographic areas based on agroecology, altitude, etc., we measure rainfall in standardized deviations from country-specific means, obtained by subtracting a country's mean annual rainfall from rainfall and dividing by the country-specific standard deviation. Yearly dummies for disasters were constructed from data obtained from the Center for Research on the Epidemiology of Disasters (CRED) in Belgium. The CRED data base contains detailed information on natural disasters and conflicts on annual basis for all countries.

The model was first estimated for the entire 1970-2000 sample, and then for two sub-samples, 1970-85 and 1986-2000, to capture significant shifts in food aid procurement and distribution modalities in sub-Saharan Africa in the latter period. The technical details of the VAR model and estimation techniques are explained in the Technical Appendix.

Our VAR estimation results reveal that, on average, food aid exerts a positive impact on food production. Food aid does not appear to depress food production out to a horizon of four years, by which point the effects have dampened to near zero. This positive net effect of food aid on food production indicates that any disincentive effects due to depressed product prices induced by food aid shipments must be more than offset, on average, by positive risk management and factor price effects. This is not to say that food aid is necessarily the best possible resource to use for rural development interventions, just that rural sub-Saharan Africa is so starved for

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Mali, Malawi, Mozambique, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, Sudan, Swaziland, Tanzania, Togo, Uganda, Zaire, Zambia, and Zimbabwe.

investible resources of any sort that any reasonably well-managed aid program can have net beneficial effects, even in spite of the well-known product market disincentive effects associated with food aid. Even an imperfect resource can prove valuable when resources of any sort are so scarce.

Estimates for the impact of food production on food aid flows also indicate that past values of food output negatively affect current levels of food aid. Specifically, the negative and significant coefficients of lagged food production indicate that increases in food production tend to reduce food aid shipments in subsequent periods, while declines in food production are accompanied by increased supplies of food aid. The results for the two sub-periods, 1970-1984 and 1985-2000, appear qualitatively similar, although the coefficient estimates relating food aid to subsequent food production are slightly higher in the second period, perhaps reflecting some improvement in food aid programming due to advances in early warning systems and targeting methods.[7]

In order to make the net effects clearer, we compute impulse response functions to depict the time path of food production responses to a one-year increase in food aid shipments of one kilogram per capita. Figure 4 depicts the impulse response functions of both food aid and food production to a food aid shock over the whole period. In contrast to comparable impulse response function estimates Barrett et al. (1999) reported using a smaller and more geographically diverse set of countries and only PL 480 food aid flows from the United States, food aid (the dashed line) exhibits little persistence over time. This is consistent with the observation that the overwhelming

[7] See Barrett and Maxwell (forthcoming) for detailed explanation of changes in food aid targeting, procurement and distribution modalities since the mid-1980s.

majority of food aid shipments into Africa have been emergency flows and with the claim that these flows respond, albeit with a significant lag, to local production shocks. Of more immediate interest to this analysis, the effects of food aid on per capita food production (the solid line in Figure 4) appear positive and persistent for three years, with negative effects in the fourth year and negligible impact thereafter. In the 1986-2000 period shown in Figure 5, the negative lagged effects vanish entirely. Food aid has only positive lagged effects on food production per capita in the more current period, in the wake of significant reforms in food aid programming. It would appear that development resources of any sort are sufficiently scarce and food aid has been sufficiently well targeted overall in sub-Saharan Africa over the past thirty years that it has effectively relieved factor market constraints so as to overcome the product price disincentives that naturally arise from food aid shipments.

5. Implications for Future Food Aid Policies

The discussions presented in the preceding sections indicate that food aid can help and has helped promote agricultural development and poverty alleviation where donors and operational agencies program, target and employ food aid so as to relieve uninsured risk and binding factor availability constraints facing small farmers. However, some of the reported evidence of the negative impact of food aid on food production reflects inconsistency in food aid programming, targeting and uses. This underscores the need for renewed focus on how best to employ food aid so as to stimulate agricultural development and poverty reduction in sub-Saharan Africa. In this section, we explore some alternatives, emphasizing in particular the possibilities

of using food aid to stimulate smallholder and trader investment in marketing and processing capacity at the downstream end of the food marketing channel. We emphasize throughout a core principle in effective food aid management: reasonably accurate targeting is necessary to relieve binding constraints on productivity improvements and to minimize adverse product market price disincentive effects.

5.1 Food Aid for Market Development

Notwithstanding market reforms over the last decade, food markets in sub-Saharan Africa remain poorly developed and highly inefficient, with smallholders still finding it difficult to participate in these markets (Kherellah et al. 2002). Market participation is analytically akin to technology adoption. Both typically involve fixed costs and risk that can discourage very poor farmers from taking advantage of seemingly remunerative options. To the extent that food aid can be directed toward helping cash-strapped smallholders cover such fixed costs and reduce, at least temporarily, their risk, it can prove stimulative.

A. Dairy Sector Potential: Perhaps one of the best examples is in the dairy sector. In many parts of sub-Saharan Africa, dairy products remain a traditional consumption item with strong demand. The best available research predicts that growth in demand for dairy products in sub-Saharan Africa will increase almost 4 percent annually through 2020 due to population and income growth (Delgado et al., 1999). Despite the potential for the dairy sector to generate income and employment – and the potential spillover benefits for crop production due to improved nutrient

cycling for cultivated soils – dairy development has not taken off in sub-Saharan Africa.

Smallholders face many barriers that make it difficult for them to gain access to markets and productive assets. In particular, the relatively high marketing costs for fluid milk in the region, the scattered nature of fluid milk markets and the risk attached to marketing of perishables in the tropics create significant transaction costs that limit market-oriented dairy production and marketing (Staal et al., 1997). Dairy producers often have to deal with seasonal variation in milk production and in dairy product consumption (Jaffee, 1995). Holloway et al (2000) argue that institutional innovations are necessary to deal with these market failures. Low population density and poor infrastructure in many parts of rural Africa make effective institutions for sharing risk and achieving economies of scale in milk collection, cooling, storage, transport and processing – as well as related agricultural services such as equipment maintenance, extension and veterinary services – all the more important. Improved access to remunerative markets for high-value to weight products is absolutely essential for promoting smallholder agriculture.

In areas with good infrastructure and expertise in dairy processing, smallholders are able to participate in the agro-industrial sub-sector and potentially in the regional export markets (Holloway, 2000). Income growth, child nutritional improvement, and stabilized or improving soil fertility have all been shown to result from the emergence of viable smallholder commercial dairying in rural Africa (Staal et al. 2000, Nicholson et al. 2003). Development of the dairy industry therefore has the potential in many parts of sub-Saharan Africa to generate additional income and

employment and thereby improve the welfare of rural populations (Delgado, 1995). Food aid in the form of nonfat dried milk (NFDM) could perhaps be put to good use in helping to develop remunerative domestic food production, processing and marketing channels that would benefit poorer rural producers.[8]

Food aid has been employed previously to advance agricultural markets for the benefits of smallholders and consumers. Of particular note is the Indian experience with Operation Flood. Operation Flood, launched in 1970, was instrumental in helping Indian dairy farmers shape their own development. The scheme involved the establishment of milk producers' cooperatives in the villages and the provision of modern technology. The objectives included: an increase in milk production ("a flood of milk", hence the name), an increase in rural incomes, and the transfer to milk producers of an increased share of the profits of milk marketing, which had previously been perceived to benefit mainly middlemen. The project was carried out in three phases.

The first phase of Operation Flood was financed by the sale within India of skimmed milk powder and butter oil donated by the European Community via the WFP. During this phase, the program aimed at linking India's 18 best milksheds with the milk markets of the four main cities: Delhi, Mumbai, Calcutta and Madras. Two

[8] More targeted use of NFDM food aid flows to help stimulate local dairy market development in recipient countries could also help relieve tensions among dairy exporters. For example, in three successive meetings (September-November 2002) of the Consultative Committee on Surplus Disposal, the international regulatory body established to oversee global food aid flows, Australia and the European Community registered concerns about sharp growth in U.S. nonfat NFDM donations, which more than doubled from U.S. fiscal year 2001 to 2002, to more than 57,000 metric tons, with an expected further expansion beyond 200,000 tons in fiscal year 2003 under the U.S.'s new Food for Education program, representing an astonishing 20 percent of total NFDM traded in the global marketplace (Barrett and Maxwell forthcoming). The Australian delegation pointed out, however, that much of the expanded NFDM distribution runs through U.S.-based NGOs that are subsidiaries of commercial entities that also sell NFDM under Section 416(b) and PL480 Title I programs.

main policy changes that played a role in this phase were the provision of direct financial assistance to the cooperatives to develop the dairy industry and the decision to sell dairy food aid at commercial prices within India. These changes reduced the price risks for farmers, small-scale traders and private processors (Candler and Kumar, 1998).

The second phase of the project was implemented during 1981-85. The number of milksheds was increased to 136 and was linked to more than 290 urban markets. By the end of 1985, the capital raised from the sale of food aid from the European Community and from a World Bank loan, had created a self-sustaining system of 43,000 village cooperatives covering 4.25 million milk producers.[9] Milk powder production increased from 22,000 tons in 1970 to 140,000 tonnes in 1989, as a result of dairies set up under Operation Flood. The European Community food aid thus helped to promote enhanced value-added in upstream production and processing by smallholder producers and therefore greater self-reliance. Direct marketing of milk by newly formed producers' cooperatives resulted in an increasing share of the profits from milk marketing contracts accruing to poor producers (Candler and Kumar, 1998).

The third phase of the project, carried out during 1985-86, enabled the dairy cooperatives to build up the basic infrastructure necessary to procure and market the increasing amount of milk they were producing. Moreover, facilities were created by the cooperatives to provide better veterinary care services to member producers.

[9] In the second phase of Operation Flood, the European Community decided to use a significant portion of its dairy surplus to support the project directly, rather than indirectly through the World Food Program. Operation Flood II was therefore funded by the National Dairy Development Board

Although Operation Flood was not designed as a production or poverty project, by virtue of facilitating small milk producers' entrance into a higher value-added segment of the food marketing chain, it had a significant impact on both poverty and broader agricultural production (Candler and Kumar, 1998). The project did not exclude the better-off, but a majority of the beneficiaries were poor, mostly landless, tribal and marginal farmers. It is estimated that 40 million tons more milk were produced in 1995 than would have been produced if the pre-1971 growth rate had continued (Candler and Kumar, 1998).[10] Under the new policy, per capita milk consumption increased from 107 grams/head/day in 1970 to 193 grams/head/day in 1994 (Candler and Kumar, 1998).[11] Due to high income elasticity of demand for education in Indian villages, the project indirectly contributed to an increase in the number of children attending school. Thus, by raising incomes, Operation Flood had multiple benefits, including nutrition, education (especially girls) and job creation.

We hypothesize that similar, positive results are attainable in sub-Saharan Africa. Food aid flows could temporarily facilitate uptake of improved dairy cattle breeds, formation of effective producer marketing cooperatives, investment in necessary storage, processing and transport equipment, and introduction of new value-added dairy products, thereby increasing efficiency in production, processing, and distribution and increasing and stabilizing smallholder producer incomes and improving dairy product availability to lower-income rural and urban consumers.

(NDDB), the government of India, the World Bank, and the European Community through food aid, and the farmer-owners of the village dairy cooperative societies (Candler and Kumar, 1998).

[10] Alderman's (1987) study on cooperative dairy development in Karnataka found that milk production per family was from one and a half times to twice as high in Operation Flood as in non-Operation Flood villages.

[11] However, critics rightly argue that this increase in milk production should not be attributed exclusively to Operation Flood (Doornbos et et., 1990).

Consider three countries in which food aid for dairy market development might be especially promising.

Although Kenya has more smallholder dairy producers selling milk off-farm than any other African country, commercialization in 1990 ranged only from 43-48 percent (Jaffe, 1995).[12] As a result of the high transaction cost faced by smallholders in marketing their milk, they consume a higher proportion of the milk they produce at home than do larger farmers (Staal et al., 1997). Prior to 1992, the Kenya Cooperative Creameries (KCC) possessed monopoly power over the dairy sector in the country. The 1992 dairy market liberalization revoked KCC's monopoly on urban milk sales and led to a rapid innovation in milk marketing, especially for raw milk. Most notably, a variety of "self-help groups" and other private marketing intermediaries that emerged after the liberalization and established dairy cooperatives that were once an integral part of the KCC milk collection system began marketing milk directly to urban centers. The liberalization has also resulted in the emergence of several dairy processing units producing pasteurized milk, butter, cheese, yoghurt, ice cream and ghee. A recent study by Ouma et al (2000) indicates that consumption of dairy products has increased significantly since liberalization.

However, seasonality in production and consumption – due in part to limited use of modern inputs such as feed concentrates, veterinary services and artificial insemination – leads to temporal variation in prices and output volumes, creating disincentives to investment in productivity-enhancing capital equipment. Many smallholder cooperatives and their individual members lack the financial liquidity

[12] Estimates for several other countries in West and Central Africa range from 25-40% of milk sold off the farm (Staal et al., 1997).

necessary to buy cooling or transportation equipment to store and market milk profitably. Kenya, a net dairy product importer, could likely benefit from a program akin to Operation Flood, giving or selling nonfat dried milk powder food aid to smallholder cooperatives and local processors in the dry season, when milk production is low and prices typically peak, so as to help stabilize the market and enable investment in productivity enhancing equipment and institutional improvements that are otherwise unaffordable.

Ethiopia similarly embarked on market-oriented policy reforms in 1992, although no clearly defined dairy policy exists. Privatization of state enterprises, removal of input market controls, the emergence of private processors and distributors in urban and peri-urban milksheds and increased adoption of improved livestock breeds through producer cooperatives and state farms have led to increased milk production (Ahmed et al., 2003). The state Dairy Development Enterprise (DDE) still processes milk from various sources – including food aid – into pasteurized milk, butter, soft cheese, yoghurt, cream milk, cheese and ice cream. But smallholder marketing cooperatives have increased substantially as a result of promotion by the Finish International Development Association, FAO Technical Cooperation Program and the World Food Programme. The cooperatives purchase milk from both members and non-members, process it into fresh milk, cream, skim milk, sour milk, butter and cottage cheese, and sell the products to traders and local consumers. The value-added from processing is then returned as a semi-annual, lump-sum payment to group members and others who supplied milk to the group during the period. Holloway et al (2000) find that the groups mitigate some of the transactions

costs that otherwise impede smallholder entry into commercial milk production. As in the "Operation Flood" example in India, food aid in the form of milk powder could be used to support the development of more dairy processing units serving a larger number of poorer producers. Instead of supplying the DDE with untargeted free food aid that may create market disincentives, food aid could be sold or given to private processing units and the proceeds used to develop the smallholder dairy industry

Rwanda's entire dairy industry was destroyed during the 1990-94 civil war. Milk production fell to only 40,000 liters a day in 1999, resulting in a shortfall of 1,835,000 liters a day (Kanuma, 1999). The country continues to import large quantities of milk, including powdered milk for domestic sale. The demand for NFDM is particularly high in the country. In recent years, an ACDI/VOCA project has sold NFDM Title II PL 480 food aid shipments from the United States and used the proceeds to support natural resource management and other projects. But food aid in the form of NFDM could perhaps be better used to develop Rwanda's dairy industry. Emphasis could be placed on the production of value-added products like yoghurt, ice cream, and pastries, on organizing smallholders into cooperatives following the relatively successful Ethiopian and Kenyan models, and in facilitating acquisition of necessary storage, transport and processing equipment, higher yielding breeds and veterinary supplies, thus sustainably improving smallholder dairy productivity and sowing the seeds for eliminating over time the need for NFDM food aid flows (and perhaps even commercial dairy imports).

B. Grains Processing Sector: Food aid has affected consumption patterns in some developing countries. The classic example is West Africa, where massive wheat and

rice food aid shipments in the 1970s, along with rapid urbanization, have changed eating and food preparation habits, reducing reliance on indigenous coarse grains such as millet, sorghum and maize (Delgado and Miller, 1985). While the shift towards imported "superior" cereals supplied by aid and away from domestically produced "inferior" coarse grains created disincentives for domestic grain producers, it helped stimulate commercial grain processing in both urban and rural areas. In particular, the increase in demand for bread and other wheat products resulted in investments in bakeries and other wheat processing units in several areas in the region, leading to increased employment and non-farm incomes in both rural and urban areas. Prior to the entry of food aid shipments, there was insufficient business to justify investment in equipment and training by commercial processors and bakers. Food aid helped to make such businesses viable, with multiplier effects that suggest similar possibilities elsewhere on the continent.

The possibilities of using food aid to stimulate the development of improved grains processing and bakery industries are intriguing. The increased use of blended and micronutrient fortified foods in refugee and school feeding programs opens up possibilities for contracting with recipient country processors, perhaps using raw commodity to help pay for the processing costs, thereby providing a minimum efficient scale of operation to justify initial investment in equipment and training. The political sensitivity of importing whole grain genetically modified (GM) maize similarly raises the possibility of establishing local mills to grind GM maize into flour, paying part of these costs in kind with commodities the mill can process and sell.

5.2 Food Aid For Smallholder Productivity Enhancement

Just as food aid can be used to stimulate smallholder and trader investment in post-harvest marketing and processing capacity, so can it be used to stimulate uptake of improved natural resources management and production technologies by producers. The basic principle is simple: target food aid by recipients and by season so as to relieve smallholders' seasonal liquidity constraints, permitting them to reallocate their labor time from wage labor employment to productive labor-intensive activities on their own farms (e.g., constructing soil and water conservation structures) or to purchase productivity-enhancing inputs (e.g., inorganic fertilizer and other chemicals, hybrid seed, artificial insemination services for dairy livestock, mechanical traction during field preparation). Great care has to be taken during the design of such programs in order to ensure they do not crowd out private investment. In particular, good knowledge about local farming systems, local market characteristics and prices, and distribution of resources and welfare, can preempt design failures and generate significant and sustainable gains in private on-farm investment and in productivity and aggregate output. For example, Holden et al. (2003) found that the success of FFW investments in stimulating on-farm soil conservation, sustainable agricultural productivity increases, and income growth depends crucially on a number of conditioning factors, including careful identification of relevant investment projects and of appropriate technology design, local involvement in implementation and maintenance of investments after the project, clear specification of property rights to the investments, implementation only

where private capacity or willingness to invest are limited, and timing of projects so as to minimize labor crowding out. The demands on food aid programmers are indisputably great, but it is plainly feasible to deploy food aid effectively to help stimulate agricultural productivity, as is apparent from the national-scale empirical results reported in section 4.

5.3 Conditions for Success

In order for food aid to be effective in developing recipient country food markets and stimulating agricultural productivity, a number of accompanying conditions must be met. First, food aid must increase demand for the final product(s) by enough to sustain or increase farm incomes. For example, in the case of dairy products, demand comes mainly from consumers who earn income from non-agricultural activities. Reducing dairy prices by increasing production would in general help to increase market demand for dairy products. The demand for dairy products is generally elastic with respect to income and prices. Hence, even increases in supply could still lead to higher incomes for producers because the additional revenue gained from greater supply will more than compensate for the reduction in price. Given the strong growth linkages between agriculture and non-agriculture, investment and productivity gains outside agriculture, especially improvements in productivity of the sectors highly linked with agriculture, such as post-harvest processing, are needed to maximize growth linkages and thereby to advance agricultural market development goals.

Second, a substantial supply response needs to be achieved. Besides demand side constraints discussed above, the supply side response is also necessary for successful food aid for market development. One important prerequisite is that constraints on supply are identified in advance and that it is feasible to relax these constraints through investments or other program activities. Here, it is important to understand and alleviate constraints throughout the production and marketing chain to enable a significant increase in supply and producer incomes. For example, the use of local processors to make blended/fortified products and to mill genetically modified foods can perhaps help to build up domestic processing capacity, with long-term benefits to the local agricultural sector.

In addition to considering the above conditions, food aid for market development must satisfy an *opportunity cost* criterion. That is, not only must the conditions described above be sufficiently favorable that this modality has a beneficial impact, but also this beneficial impact must be greater than that which could be achieved by disbursing this aid using other approaches. This opportunity cost criterion turns fundamentally on the ultimate objective underlying the transfer. For example, if the primary objective is to help the poor, then food aid for market development may not stack up well against some more conventional targeted assistance programs. Food aid for market development will only help the poor if it links some of the smallest farms or even the landless to new markets (as in India's Operation Flood) or if it creates lots of new employment for poor people.

6. Conclusions

Although annual food aid shipments to sub-Saharan Africa have fallen back to the 3-4 million metric tons per year range of the mid-to-late 1970s, global food aid increasingly focuses on this region of the world. As donors, governments and development agencies all struggle with problems of persistent poverty and low agricultural productivity in Africa, the role of food aid attracts ever more attention. There are widespread calls for improved and more creative use of food aid to promote sustainable rural development in a way that will also serve to wean countries from food aid naturally.

This paper examined the potential impacts of food aid on food production and the prospects for using food aid to stimulate downstream market development. In spite of well-known problems, food aid to Africa has typically had sufficient ameliorative effects through relief of those constraints and reduction of farmer risk exposure as to have made food production relatively more remunerative than it would otherwise have been. Put differently, it seems that the collapse of per capita food productivity in sub-Saharan Africa over the decade to the mid-1980s would have been still more severe without the sharp simultaneous increase in food aid flows to the region.

This core result – that food aid has indeed proved effective on average in relieving constraints to investment and productivity growth – opens the door to alternative, creative ways of using aid flows programmed in the form of food – due largely to donor domestic political pressures (Barrett and Maxwell forthcoming) – to advance the goals of agricultural and rural development and poverty reduction. There are obvious, familiar risks to using food aid for market development. Because it

expands local food supply, it creates adverse product price effects. These can be significantly attenuated through effective management, especially reasonably accurate targeting and timing of food aid to food deficit households with a high income elasticity of demand for food. But if food aid can be used to relieve short-term working capital, transport capacity and other constraints to investment and productivity growth, or if its distribution can be used effectively to help build farmer cooperative groups that can add value to raw commodities through processing and improved marketing, then food aid can and does have salutary effects. From a nutritional and overall development perspective, there is a strong case for using non-emergency food aid for seeding the emergence of agro-processing industries in selected sub-Saharan African countries, perhaps especially in the dairy subsector. The success of Operation Flood in India suggests the potential in such uses. More broadly, food aid's apparent historical success in stimulating food productivity in Africa suggests that the relatively unheralded factor market effects of food aid may trump the oft-repeated product market disincentive effects.

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Table 1: Composition of Food Aid Shipments to Africa by Commodity (annual average, metric tons)

	1970-79	1980-89	1990-99	2000-02
Wheat and wheat flour	472,052	1,633,553	1,247,436	1,257,443
Coarse grains	332,962	883,496	1,214,905	759,089
Other cereals	126,286	590,739	515,178	527,501
Cereals	931,300	3,107,788	2,977,519	2,544,033
Noncereals	91,439	222,842	372,423	353,548
Total Food Aid	1,022,738	3,330,629	3,349,943	2,897,581

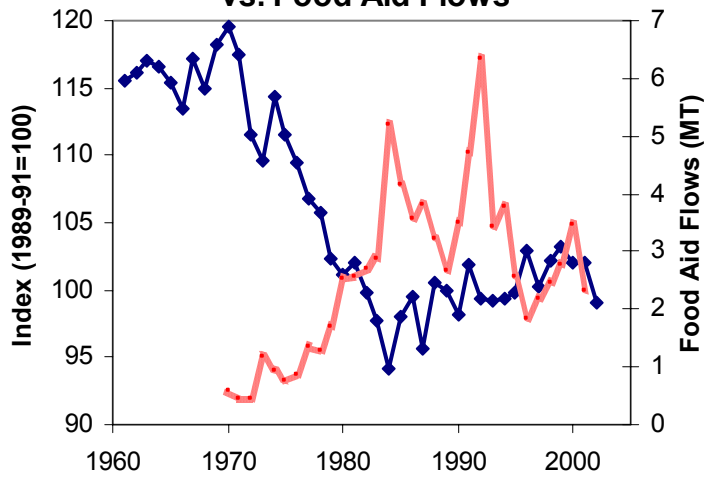
Source: World Food Programme

Table 2: Food Aid Shipments to Selected African Countries in 1990-2002 (1000 metric tons)

Year	Ethiopia	Kenya	Mozambique	Sudan	Rwanda	Angola
1990	933	77	489	513	11	114
1991	1,112	183	577	682	12	125
1992	943	306	990	397	92	134
1993	933	303	313	320	137	246
1994	630	132	347	180	405	281
1995	768	27	256	59	397	273
1996	510	52	97	98	472	235
1997	152	117	190	71	285	155
1998	567	99	177	257	226	172
1999	484	125	126	153	254	197
Average						
1990 - 1999	795	142	356	273	229	193
2002 - 2003	997	293	174	169	92	230

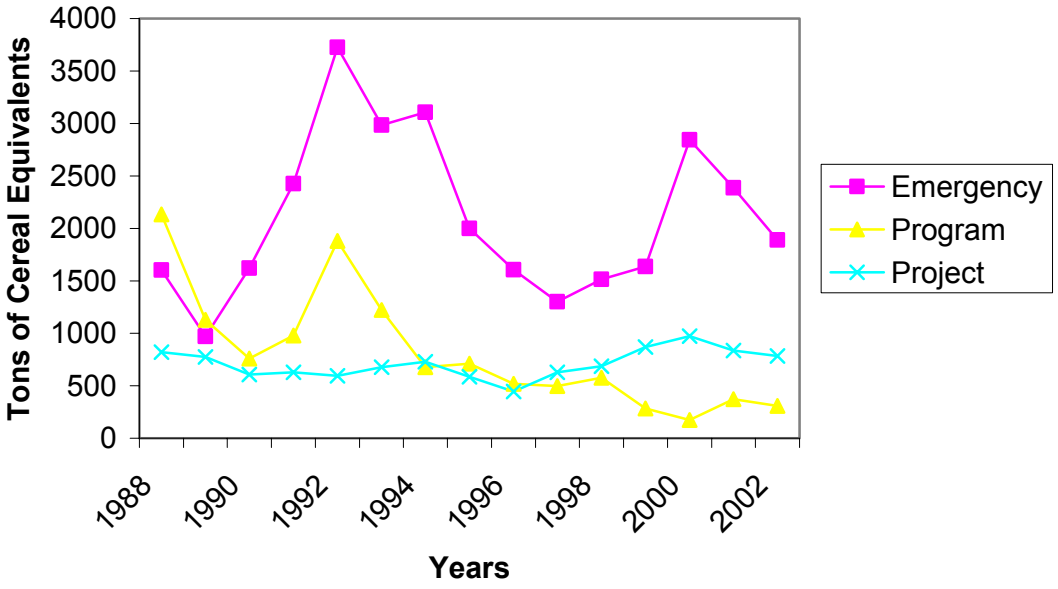
Source: World Food Programme

Figure 1: Sub-Saharan African Per Capita Food Production vs. Food Aid Flows



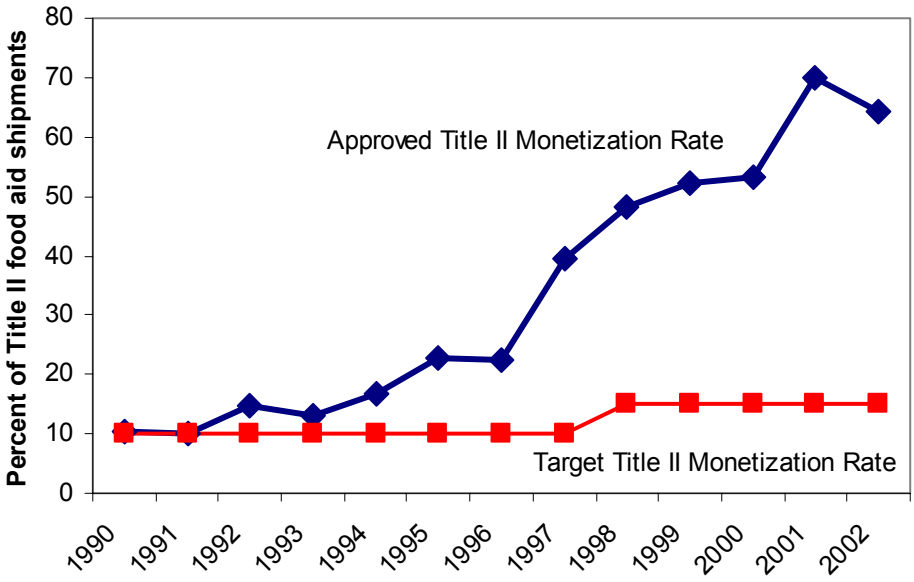
Data source: FAO

Figure 2: Food Aid Deliveries to Sub Saharan Africa by Type, 1988-2002



Data Souce: FAO

Figure 3: Monetization Rate of Title II PL480



Source: Barrett and Maxwell (forthcoming)

Figure 4: Estimated Impulse Response Functions

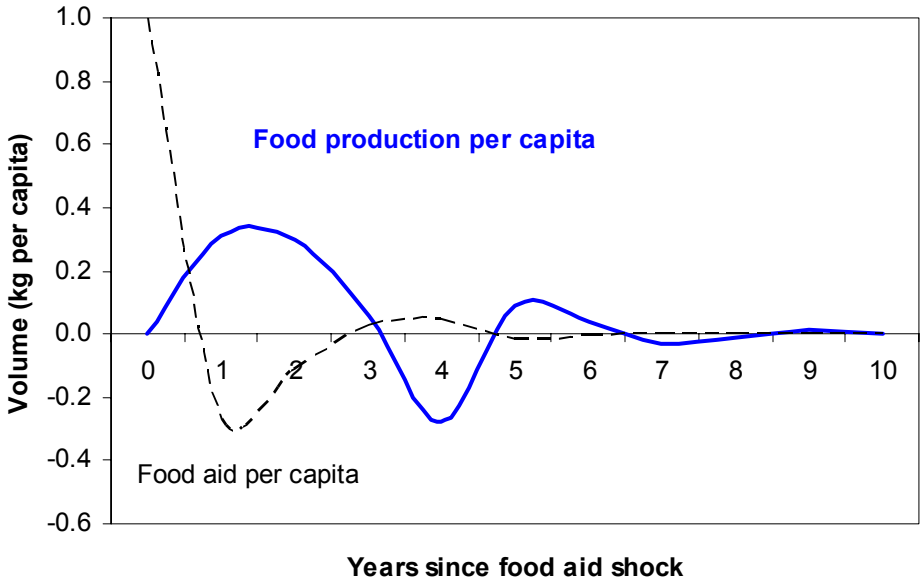
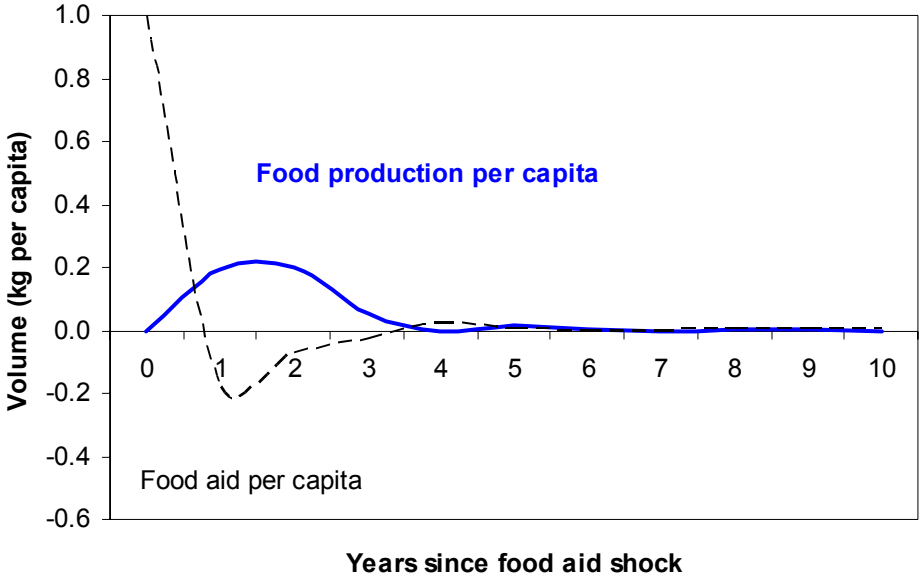


Figure 5: Estimated Impulse Response Functions
1986-2000 Subsample



Technical Appendix

Given that past levels of food production may help predict current level of food aid, and vice versa, the VAR relationship can be specified as:

$$FP_t = \alpha_0 + \sum_{k=1}^{n} \alpha_k FP_{t-k} + \sum_{k=1}^{n} \beta_k FA_{t-k} + \varepsilon_t \quad (1)$$

$$FA_t = \alpha'_0 + \sum_{k=1}^{m} \alpha'_k FA_{t-k} + \sum_{k=1}^{m} \beta'_k FP_{t-k} + \mu_t \quad (2)$$

where *FP* and *FA* are domestic food production and food aid inflows, respectively; α_0, α'_0, α_k, α'_k, β_k and β'_k are parameters to be estimated and ε_t and μ_t are error terms. The combination of time series of food production and food aid across countries in sub-Saharan Africa to obtain a panel data to estimate equations (1) and (2) imposes the assumption that the underlying structural relationship between food aid and food production is the same for each country in the sample (Lavy, 1990; Barrett et al., 1999). Time-invariant country specific effects in the equations (1) and (2) summarize the influence of unobserved variables such as infrastructure, period average climate, soils, elevation, history, and culture that might persistently affect the volatility of food production and food aid flows.

Thus, quations (1) and (2) can be rewritten as:

$$FP_{it} = \alpha_0 + \sum_{k=1}^{n} \alpha_k FP_{it-k} + \sum_{k=1}^{n} \beta_k FA_{it-k} + \eta_i + \varepsilon_{it} \quad (3)$$

$$FA_{it} = \alpha'_0 + \sum_{k=1}^{m} \alpha'_k FA_{it-k} + \sum_{k=1}^{m} \beta'_k FP_{it-k} + \xi_i + \mu_{it} \quad (4)$$

where η_i and ξ_i are the country-specific effects, which are assumed to be distributed independently across countries, with variance σ_η^2 and σ_ξ^2. In the presence of correlations between the country-specific effects and the lagged *FA* and *FP* variables, ordinary least squares (OLS) and generalized least squares (GLS) will yield biased estimates. The traditional technique to overcome this problem is to eliminate the individual effects in the sample by transforming the data into first differences or deviations from individual means, and then estimating by OLS.

However, if this first differences or "fixed effects" estimator is used, there may still be a simultaneity problem because past levels of food production or food aid may be correlated with the past error terms. This can be illustrated by considering the first difference versions of equations (3) and (4):

$$FP_{it} - FP_{it-1} = \sum_{k=1}^{n} \alpha_k (FP_{it-k} - FP_{it-k-1}) + \sum_{k=1}^{n} \beta_k (FA_{it-k} - FA_{it-k-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \quad (5)$$

$$FA_{it} - FA_{it-1} = \sum_{k=1}^{m} \alpha_k' (FA_{it-k} - FA_{it-k-1}) + \sum_{k=1}^{m} \beta_k' (FP_{it-k} - FP_{it-k-1}) + (\mu_{it} - \mu_{it-1}) \quad (6)$$

In equations (5) and (6), the lagged values of food production (FP_{t-1}) and food aid (FA_{t-1}) are correlated with the lagged error terms ε_{t-1} and μ_{t-1}, leading to correlation between the regressors and the error terms. An instrumental variables estimator or generalized method of moments (GMM) approach will, however, yield unbiased estimates. Holtz-Eakin et al. (1988) demonstrate that in the absence of cross-sectional heteroskedasticity in the errors, first differencing and instrumental variables estimator can be employed to obtain consistent parameter estimates.[13] Equations (5) and (6)

[13] Anderson and Hsiao (1982) have also suggested the use of this transformation for estimation of univariate autocorrelation models in panel data.

were estimated with the GMM approach, using annual rainfall and yearly dummies for disaster as control variables. The estimated equations are specified as:[14]

$$\Delta FP_{it} = \alpha_0 + \sum_{k=1}^{n} \alpha_k \Delta FP_{it-k} + \sum_{k=1}^{n} \beta_k \Delta FA_{it-k} + \sum_{k=1}^{s} \gamma_k RF_{it-k} + \delta Y_t + \Delta \eta_i \qquad (7)$$

$$\Delta FA_{it} = \alpha_0 + \sum_{k=1}^{m} \alpha_k \Delta FA_{it-k} + \sum_{k=1}^{m} \beta_k \Delta FP_{it-k} + \sum_{k=1}^{s} \gamma_k RF_{it-k} + \delta Y_t + \Delta \xi_i \qquad (8)$$

where *RF* and *Y* represent rainfall and yearly disaster dummies, respectively; γ and δ are parameters to be estimated. The yearly dummies for disasters are constructed such that *Y* takes the value of one in years where a country experienced a natural or human disaster, otherwise it takes the value of zero.

The specification employed does not include information on factors such as soil quality or production technology that may affect food production but for which we have no data. These factors must be treated as country-specific effects. However, given that the estimation approach employed here uses differencing, the time invariant component of these effects gets eliminated and thus cross-sectional differences in soil quality, irrigation infrastructure, etc. pose no problem in our estimation. Given controls for annual variation in rainfall and disasters, it is unlikely that there remain significant unobserved covariates that are correlated with both food aid and food production. After estimating the model using the entire 1970-2000 sample, it was re-estimated for two sub-samples, 1970-85 and 1986-2000 to capture the potential for structural change over time in the food aid-production relationship

[14] In a recent paper, Blundell and Bond (1998) demonstrate the importance of exploiting initial condition information in generating efficient estimators for dynamic panel data models where the number of time series observations is small. Our time series is over 30 years and therefore does not suffer from small number of observations.

due to significant shifts in food aid procurement and distribution modalities in sub-Saharan Africa in the latter period.

As stated by Holtz-Eakin et al. (1988), two important questions in this estimation are whether the data are consistent with a lag length *m* and whether food aid causes food production.[15] It therefore makes sense to think of testing for noncausality conditional upon the outcome of a test for the lag length. The appropriate lag length is determined by starting with an arbitrary but long lag, then reestimating the equation with successively shorter lag lengths. Varying the lag length can be considered a constraint that can be tested by considering the fact that the difference in the unconstrained and constrained sum of squared residuals has a chi-squared distribution.[16] For the estimations with the whole sample, a lag length of four ($m = 4$) was found to be appropriate for both food production and food aid, while a lag length of three ($m = 3$) was found to be suitable for each of the two subsamples.

Based on the $m = 4$, Granger causality tests to were carried out for the entire sample to establish the direction of causality between food aid and food production. The *F*-statistic for the null hypothesis that changes in food aid do not affect changes in food production – i.e., that $\beta_k^{'}(k = 1 \ldots m) = 0$ in equation (6) – was 6.51 with four degrees of freedom, against a critical value of 2.37. The *F*-statistic for the null hypothesis that changes in food production do not affect changes in food aid was 5.28 (against the same critical value of 2.37). We can reject both null hypotheses: that food

[15] The Im, Pesaran and Shin (1997) panel unit root test could not reject the null hypothesis of unit root in the food aid and food production variables. The two variables were therefore specified in first differences.

[16] If Q is the unrestricted sum of squared residuals and Q_R is the restricted sum of squared residuals, each of them will have a chi-square distribution. The appropriate test statistic is $L = Q_R - Q$. L has a

production does not Granger cause food aid flows and that food aid does not Granger cause food production, suggesting bidirectional causality between food aid and food production and reinforcing the use of the GMM approach.

To obtain consistent estimates, each regression employed instruments of one period lags. For example, in the first run (in the first column), with $n = 5$, the instrument is lagged from t-2 to t-6, while in the second column with $n = 4$, the instrument is lagged from t-2 to t-5. The parameters are estimated with the generalized method of moments (GMM) estimator developed by Hansen (1982) and White (1982). This estimator is efficient and allows for conditional heteroskedasticity in the errors.[17]

chi-squared distribution with degrees of freedom equal to the degrees of freedom of Q_R minus the degrees of freedom of Q.

[17] This estimation strategy is similar to that of approach proposed by Griliches and Hausman (1986) in the presence of endogeneity and measurement error.