A consensus has emerged over the past decade regarding the appropriate use of food aid in developing countries. In brief, this view argues that countries should be given priority in food aid programming based on need rather than geopolitical considerations, and that food aid should be used as a development tool, attacking "the very conditions and causes that justify its existence." (Hopkins, 1989; see also Shaw, 1993). This approach to food aid was incorporated into US legislation with the passage of the Agricultural Development and Trade Act of 1990, which established improved food security in recipient countries as the core objective against which US food aid programs are evaluated.

Both the general view and the specific US legislation acknowledge the importance of short-run considerations while emphasizing that food aid policy must be driven by a long-run, developmental perspective. Yet it has long been clear that short- and long-run objectives of food aid may be in conflict. The continuing controversy regarding the disincentive effects of food aid on local production reflects this fundamental tension between the two sets of objectives. An important and closely-related question, which has received less explicit attention in the
literature, is the effect of food aid on local food markets in the short- and long-run. Given the complexity of the issues involved, it is not surprising that progress has been slow in developing operational means of reconciling the objectives and evaluating food aid's contribution to each.2

The tension between short- and long-run food aid objectives stands in high relief in Mozambique. Over a decade of civil war and highly centralized economic policies, combined most recently with the 1992/1993 drought in southern Africa, have made it one of the most food aid-dependent countries in the world. During the war, which devastated rural areas and greatly limited internal trade, policy makers and donors understandably focused more on short-run food availability than on long-run developmental goals. The drought accentuated this tendency. Yet the country has been at peace since late 1992, and democratic elections were held successfully in October 1994. Rains since the drought have been good.3 Abundant agroclimatic resources in the northern two-thirds of the country suggest that, with continued peace and appropriate economic policy, Mozambique could feed itself and possibly be an important food exporter in regional markets. The country's extreme dependence on food aid means that the management of commercial and emergency aid over the next several years will have a role to play in this transition to a more prosperous economy.

Mozambique is not alone in this regard. Several countries in sub-Saharan Africa (SSA) are chronically or periodically dependent on large volumes of food aid.4 Each faces the challenge of managing its food aid program to meet short-run needs while minimizing negative effects on the long-run development of the country. In light of the world-wide trend toward greater economic liberalization, this requires explicit attention to the effects of food aid on food markets. In countries of Southern and Eastern Africa where white maize is the staple (as it is in Mozambique), yellow maize food aid presents special challenges for policy makers and analysts. The conditions under which this aid might create disincentives to the domestic production and marketing of white maize is a crucial policy issue in Mozambique and throughout the region.

This paper evaluates the extent to which yellow maize food aid has contributed to or hindered the development of an efficient and low-cost maize production and marketing system in Mozambique. It suggests reforms in the commercial and emergency food aid programs to make them contribute more effectively to this goal. Much of the data come from an Agricultural Market Information System (SIMA) which has been collecting price and qualitative market supply data from selected points in the country since April 1991.5

This paper is organized as follows: first, historical background on food aid programs and food aid's role in Mozambique's food supply is presented; next, a

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1For an influential early view see Isenman and Singer (1977). More recently, see Shaw (1993).
2See, for example, United States General Accounting Office (1993).
3Since writing (August, 1995), production throughout southern Africa had been reduced by a drought less serious than that in 1992.
5The SIMA resides in the Ministry of Agriculture of Mozambique and was created with collaborative assistance from Michigan State University Department of Agricultural Economics and financing from USAID/Mozambique. In December 1992, the product and market coverage of SIMA was significantly broadened. Thus, some data used in this paper have been available only since that time.
conceptual section identifies those factors that determine the effects of yellow maize food aid on prices of yellow and white maize; building on this analysis, these factors are evaluated from the empirical record of yellow maize food aid arrivals and yellow and white maize prices; finally, conclusions and policy recommendations are presented.

**Historical background**

Maize is the principal staple food in Mozambique, and yellow maize from food aid has been a very significant component of total cereals availability since at least 1989/1990 (Table 1). The latter typically fluctuates between 20 and 35% of total cereals availability, surging to 61% during the drought year of 1992/1993. Commercial (monetized) food aid has averaged 34% of total food aid during this time. Officially, all commercial food aid prior to 1992 was channelled to large millers producing a refined maize meal, which was sold at controlled prices in ration shops in Maputo, the national capital, and Beira, the principal commercial city (Fig. 1; Alderman et al., 1991). This system initially provided a subsistence ration of basic staples to a large proportion of urban and peri-urban residents. Beginning in the mid-1980s, the role of the large millers and ration shops diminished substantially as more grain was diverted to the emerging informal marketing and small-scale milling sectors. Since the early 1990s, the large millers and ration shops have been essentially inoperative.

Concurrent with the disintegration of the ration shop and large mill system, donors (especially the European Community and the US Agency for International Development, USAID) were looking for more market-oriented means of distributing monetized food aid. Beginning with shipments in mid-1991, both donors negotiated with the Government of Mozambique (GOM) for the grain to be sold directly to private wholesalers (called “consignees”) at fixed prices. Consignees were chosen by the Ministry of Commerce, which required candidates to prove access to minimal levels of storage capacity and transport, and to be able to meet down payment requirements. USAID encouraged Commerce to include many consignees to ensure a competitive system, and available evidence indicates that they succeeded. Between August 1992 and January 1993, USAID brought to Maputo port nearly 169,000 Mt of yellow maize in seven shipments for monetization. The number of consignees on these shipments ranged from a low of 18 to a high of 46. Over all seven shipments, a total of 91 different consignees received grain, none more than 9% of the total. The Four Firm Concentration Ratio (CR4) for the seven shipments was only 28%, typically taken to indicate a lack of concentration. Thus, evidence suggests that during this period sufficient consignees received yellow maize food aid to ensure a competitive system at this level. In the absence of a functioning ration shop system, these consignees were then allowed to resell in highly competitive informal markets at uncontrolled

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6These requirements varied widely during this time.
7This period was selected because it is when AID and other donors brought the largest quantities of commercial yellow maize food aid in response to the drought. From January through October 1993, only two very small shipments arrived.
8See Marion (1985, pp. 211–212) for a discussion of the use of CR4s. CR4s for individual shipments were higher, ranging from a low of 31% to a high of 63%. Yet these individual measures overstate concentration, because the large shipments of maize meant that few if any of the large consignees were able to sell all their quota prior to the arrival of another ship. Thus, many of these 91 consignees were competing with each other to sell products throughout this period and beyond.
Table 1  Cereal supplies and sources in Mozambique: 1989/90 through 1994/95

<table>
<thead>
<tr>
<th>Marketing year (April to March)</th>
<th>Production</th>
<th>Food Aid</th>
<th>Total maize as % of total cereals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>White maize</td>
<td>Rice</td>
<td>Sorghum/millet</td>
</tr>
<tr>
<td>1989/90</td>
<td>330,000</td>
<td>95,000</td>
<td>177,000</td>
</tr>
<tr>
<td>1990/91</td>
<td>452,900</td>
<td>96,400</td>
<td>181,000</td>
</tr>
<tr>
<td>1991/92</td>
<td>327,100</td>
<td>56,300</td>
<td>154,900</td>
</tr>
<tr>
<td>1992/93</td>
<td>133,000</td>
<td>33,000</td>
<td>71,000</td>
</tr>
<tr>
<td>1993/94</td>
<td>533,100</td>
<td>49,000</td>
<td>165,000</td>
</tr>
<tr>
<td>1994/95</td>
<td>527,000</td>
<td>97,000</td>
<td>193,000</td>
</tr>
</tbody>
</table>

1Marketing year: April–March for Ministry of Commerce and MSU sources (May–April for some sources); production refers to the relevant production for that marketing year. Based on the 1994 Early Warning Unit/Ministry of Agriculture database, approximately 90% of total maize production is destined for human consumption, with the remaining 10% for seed and losses; for the other cereal crops, 88% for human consumption, and 12% for seed, animal feed, and losses. The Early Warning Unit estimates that 23% of maize produced for human consumption is marketed, the rest is consumed on farms.
2Includes white maize imports for emergency program of 15,000 Mt in 1992/93 and 70,900 in 1994/95. Local purchase of white maize for food aid distribution was not included as food aid since it is included in the production estimates.
31994/95 data is projected for full marketing year.
4Entirely rice and wheat flour except 1994/95, when 12,000 metric tons of white maize were imported from South Africa. Informal imports are unrecorded and so are not included here.

Sources: Ministry of Commerce, Department of Food Security, Boletin de Segurança Alimentar (issues: Bol 4, 1991/92; Bol 3, 1992/93; Bol 3, 1993/94); Ministry of Commerce, Department of Food Security, Food Aid Pledges and Shipments, 1990/91 to 1994/95 (November 1994); FAO Production Yearbook, 1989/90-1991/92 issues; World Food Programme Interfais database; Famine Early Warning Unit, Ministry of Agriculture production database; and MOA/MSU Food aid arrivals database (see MOA/MSU, 1993, WP#13 for further information).
prices. This encouragement of a competitive trading system, and the related growth of the small-scale maize milling industry, have been important accomplishments of the commercial food aid program.

For a more detailed analysis of the informal food marketing sector, see Tschirley et al., 1993a.
Prices charged to consignees were set in an *ad hoc* fashion. Domestic and world market prices were not used in any consistent way in the price setting. Starting in October 1992, consignees were charged 329 Mt/kg\(^1\) (US $100/metric ton at that time), and this price remained in effect until nearly the end of 1994. As a result, prices charged to consignees fell increasingly below world price levels, being less than one-third of import parity by late 1994.

Emergency and commercial food aid quantities were determined on the basis of food needs assessments conducted by the GOM, donors, and non-Governmental organizations. Given the lack of reliable data on domestic production and population, such assessments yielded approximate figures at best. Domestic market prices were not used in initial programming, even of quantities for monetization, nor were they used in subsequent distribution decisions. Market demand was projected in only the most rudimentary manner. Furthermore, participating consignees had no formal input on the amounts initially programmed nor on the size and timing of commercial arrivals.

Agricultural production had fallen in Mozambique throughout the 1980s and the deficits were increasingly covered by food aid.\(^1\) The southern Africa drought of 1992/1993 further reduced production in Mozambique and throughout the region.\(^1\) In response, donors shipped 374,000 metric tons of yellow maize for emergency distribution and nearly 272,000 metric tons for monetization during 1992/1993.\(^1\) Emergency grain was meant for free distribution to displaced populations in rural areas, and undoubtedly prevented widespread starvation. Consignees were the only traders with the right to buy grain for monetization at the fixed price. Most of this monetized grain was unloaded in Maputo and Beira but spread throughout the south and center of the country through informal market channels. The volumes shipped during this period were nearly twice those shipped during any previous year. Volumes arriving between August and December 1992, the period of heaviest arrivals, were approximately four times that during any typical five months since early 1990.

These unprecedented volumes badly strained storage, transport, and distribution capacity within Mozambique, with three key results.\(^1\) First, large volumes of emergency grain were diverted to markets. Knowledgeable sources indicate that approximately one-third of all emergency grain entered commercial markets. Most of this leakage took place before the grain ever reached intended recipients. Second, market prices fell to historical lows. Throughout 1993, real prices of yellow maize grain at retail in Maputo were approximately one-half the levels of 1990 and 1991. In the central region, where data do not permit historical comparison, retail prices were less than half those in Maputo. White maize prices were also very low in the central region. As a point of comparison, the official minimum *producer* price for white maize grain during 1993 was 425 Mt/kg (US $104/metric ton during the 1993 harvest), nearly 70% above the mean *retail* market prices in rural areas of the

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\(^{10}\)The national currency is the metical (MT). Exchange rates in 1993 showed a steady upward trend from Mt3,400/$ to Mt4,800/$.

\(^{11}\)Throughout the 1980s, 85-90% of all marketed supplies of grain were imported, mostly as food aid. See Kyle (1991) who estimates that agricultural production fell 30% from 1980 to 1990.

\(^{12}\)For more detail on the production effects of the drought and donor response on a regional level, see Green (1992). See also Table A2-1 of Tschirley et al. (1993b).

\(^{13}\)See footnotes to Table 1 for sources.

\(^{14}\)Analysts, including the MSU food security project, have suggested that GOM and donors consider grain storage as part of the commercial food aid program. The European Union recently formed such a reserve.
Finally, the oversupply and low prices of yellow maize meant that consignees paying the official price (329 M/t/kg) for monetized food aid could sell the grain only at a loss. For the first time in Mozambique, some consignees refused to accept their full quotas from port storage and large volumes of grain accumulated and began to spoil.

The next section presents a conceptual analysis identifying factors which determine the effects of yellow maize food aid on prices of yellow and white maize in Mozambique. This will be followed by a section evaluating these factors in the empirical record.

**Effects on prices: conceptual views**

*Effects on yellow maize prices*

Figure 2 presents three simple models of price determination for a commodity such as yellow maize food aid in Mozambique. Each assumes that market structure is competitive and that commercial food aid arrivals in ports are exogenous. Both assumptions are reasonable for the Mozambican case (see above). The models distinguish between commercial food aid arrivals in ports, expected and unexpected leakages of emergency grain to the market, and total food aid supply to the market; the relationship between these variables is what differentiates the three models. Consignee demand is derived from retail trader demand (each identical in the three models) assuming a fixed marketing margin. Consignee willingness to pay for food aid is determined by the intersection of their demand curve with total supply to the market.

In case number one, the volume of commercial food aid arriving in a port is less than what consignees are willing to buy at the official price, and leakage of emergency food aid to markets is limited to expected volumes, insufficient to reduce market prices below consignee willingness to pay. Under these circumstances, consignees accept all commercial food aid arriving in a port and sell it onto the market. Since demand exceeds supply, consignees earn a rent (returns beyond a competitive profit). Note here that the official consignee price has no effect on market prices. This describes the situation which prevailed prior to late 1992, when both commercial and emergency food aid volumes were relatively stable.

In case number two, leakage of emergency grain to the market continues to be limited to levels which consignees can correctly anticipate, yet this volume plus commercial food aid volumes exceed consignee demand at the official price they are being charged. As a result, consignees do not accept their full quotas, and not all food aid is supplied to the market. Since consignees correctly anticipate the volume of emergency leakage, the volume that consignees supply to the market equals their demand at the official price as long as the system is competitive at the consignee level (see above). As a result, consignees will earn a competitive return and rents will be eliminated. In this case, the official consignee price affects market prices by determining the quantity of food aid that consignees will accept and place onto the market from their quotas.

In case number three, we eliminate the assumption that leakages of emergency food aid to the market are limited to levels correctly anticipated by consignees. Here, commercial food aid arrivals plus expected emergency leakage are less than consignee demand at the official price, so consignees accept their full quotas. Yet

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15Nominal prices are used throughout this paper, due to the difficulty of obtaining a reliable price index. Estimates of inflation range between 30 and 50% per year.
Simple model of effects of food aid arrivals on market prices at wholesale and retail

Figure 2
unexpected leakage of emergency grain causes total supply to exceed consignee demand at the official price. Under these circumstances, consignees must sell their grain at a loss, being equal to the difference between their willingness to pay (now very low because of the large emergency leakage) and the official purchase price. This model reflects the situation from late 1992, when large food aid shipments began to arrive in response to the drought, until early 1994, when the oversupply of food aid in the market began to diminish.

Three implications emerge from this analysis. First, if food aid shipments are unstable and large relative to demand, market prices of yellow maize will be unstable. This is because prices are determined by the quantity of food aid on the market. Second, to eliminate rents, food aid prices to consignees must adjust to fixed supplies, or supplies must adjust to a fixed price. This feedback between prices and quantities is also necessary to avoid having excess food aid periodically left in port warehouses by consignees. Finally, emergency food aid programs can have important effects on the viability of the commercial food aid program if diversions to the market are not strictly controlled. Each of these issues will be revisited in the final section of this paper.

Effects on white maize prices

Economic theory suggests that the effects of yellow maize food aid on white maize prices in rural and urban areas are mediated by five key variables: (1) the substitutability between white and yellow maize; (2) the position of the country regarding international trade (is it an exporter, importer, or self-sufficient?, does it restrict international trade?, are its traders able to operate effectively in the world market?); (3) the elasticity and reliability of import supply of white maize; (4) the elasticity of domestic supply; and (5) the size of the urban market relative to the rural market. If the two goods are not substitutes in consumption, the arrival of yellow maize food aid has no direct effect on the white maize market. If the goods are substitutes, a food aid arrival of yellow maize will decrease the price of white maize as consumers substitute away from it.

However, this effect depends on the country’s position with regard to international trade, and on the nature of the world market for white maize. Domestic production will absorb all the negative effects of substitution away from white maize if the country is self-sufficient (domestic equilibrium price between import and export parity), or if it is a potential importer or exporter but restricts trade. Unreliable access to imports (caused by highly fluctuating world market supplies and prices) will also tend to isolate a country from international trade and force domestic production to absorb the effects of price changes. If trade is unrestricted and access to imports is reliable, effects on domestic production will be inversely related to the elasticity of import supply; less elastic supply will force domestic production to absorb the effects of substitution away from white maize as consumers substitute away from it.

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16 This scenario assumes imperfect information on the part of consignees regarding current and future emergency leakages. This was clearly the case during 1993 in Mozambique.
17 There are two exceptions to this statement. First, some consignees began to refuse to accept their full quotas once they realized the extent of emergency leakage. Yet this response was very late, such that total market supplies still exceeded consignee demand at the official price. The proof is that retail market grain prices fell nearly to the same level as consignee purchase prices, implying large losses for consignees who paid the full official price. The second exception is that some consignees may not have paid the full price. Ministry of Finance data on three commercial food aid arrivals between mid-October and the end of November 1992 (when most commercial food aid arrived in response to the drought) show that, as of July 1993, 26 out of 61 consignees had not yet paid their full debt to the treasury. Yet a majority did pay their full debt, implying significant losses at market prices prevailing in late 1992 and throughout 1993.
production to absorb the effects of a price decrease. This negative effect increases with the elasticity of supply in domestic white maize markets. Finally, urban demand that is large relative to rural production and marketing means that the negative effects in rural areas will be greater for a given price decrease in the urban area.

In addition to these parameters, an assessment of the effects of yellow maize food aid on the production of white maize in Mozambique must evaluate the spatial integration of Mozambican markets, and the degree to which retail prices are transmitted to lower levels in the system. If markets are not integrated, or if retail price signals are not transmitted to lower levels, producers will be insulated from the potentially negative effects of food aid. We turn to these issues in the next section.

The empirical record

Figure 3 tells much of the story of the maize food aid program in the capital city of Maputo from March 1990 to January 1995. It presents monthly arrivals of commercial and emergency food aid and monthly average retail market prices of yellow and white maize grain in the city, along with prices charged consignees. These data help shed empirical light on the issues treated theoretically in the previous section.

Effects on yellow maize prices in Maputo

Comparison of two 13 month periods (July 1990–July 1991, and July 1991–July 1992) provides evidence of the strong relationship between food aid arrivals and prices for yellow maize. It also suggests that consignee prices had little if any effect on consumer prices during these periods. This result is consistent with predictions from case number one of Figure 2, where consignee willingness to pay exceeds the official price they are charged. Without question, retail prices fluctuate over the short term independently of consignee prices, which are fixed for long stretches of time. This retail price fluctuation is driven by commercial food aid shipments. During the first period, shipments were evenly spaced over the months and there were no large fluctuations in the market price of yellow maize. The second period was quite different. From August 1991 through October 1991, no commercial food aid arrived and prices rose 54% in only two months. In November and December of the same year, almost 60,000 metric tons of yellow maize food aid arrived and prices fell below their previous low. Another hiatus in arrivals from January through April 1992 resulted in a price climb of 126%. The arrival of approximately 30,000 metric tons in May once again cut off a price rise.

From late 1992 through to the end of 1993, the previous pattern of sharp price rises associated with interruptions in commercial food aid arrivals did not repeat itself, despite no significant commercial food aid arrivals for nearly all of 1993. In fact, the yellow maize price trended slowly downward throughout the year to below 400 Mt/kg (US $98/metric ton). To understand this difference in behavior between the two periods, recall the very large amounts of emergency and commercial food aid which arrived late 1992 and early 1993. Large food aid stocks combined with unprecedented leakages of emergency grain are the key reason that prices remained so low for so long. 18 Note that the last time Maputo had sustained prices

18Production in 1993 was larger than during any year since at least 1980, but it was still insufficient to meet internal demand.
Table 2  Detrended pairwise correlation coefficients between retail prices of yellow and white maize and between yellow maize and rice in Maputo, March 1990–April 1994

<table>
<thead>
<tr>
<th>Time period</th>
<th>Yellow maize/White maize</th>
<th>Yellow maize/Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weekly data</td>
<td>Monthly data</td>
</tr>
<tr>
<td>Pre-drought (March 1990–July 1992)</td>
<td>0.60&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.62&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Drought (August 1992–March 1993)</td>
<td>-0.11&lt;sup&gt;c&lt;/sup&gt;</td>
<td>-0.11&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Post-drought (April 1993–April 1994)</td>
<td>0.49&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.56&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Significant at 0.001.  
<sup>b</sup>Significant at 0.01.  
<sup>c</sup>Insignificant at 0.01 or higher.

of around 400 Mt/kg was from mid-1990 through mid-1991. Since that time, accumulated inflation has reached or exceeded 100%. Thus, in real terms, yellow grain prices have not been this low since data collection first began in March 1990.

These results are consistent with the theoretical analyses above. Since demand for commercial food aid grain was not satisfied until late 1992, consignee price should have had no effect on retail prices. From late 1992 through late 1993, market prices fell further than they otherwise would have, due to large leakage of emergency grain into markets. If this emergency grain had not come onto the market in such large volumes, the consignee price during this time would have placed a floor on retail prices.

Effects on white maize prices in Maputo

As explained in the conceptual section, the effects of yellow maize food aid on white maize prices in Maputo turn on the substitutability in consumption of the two grains. This section argues that the two are substitutes in consumption, based on (1) strong co-movement of prices and possible reasons for it, (2) survey results on consumer behavior in Maputo, and (3) interviews with traders.<sup>19</sup> Table 2 shows that, during the pre-drought period of March 1990–July 1992, the detrended correlation coefficient between white and yellow grain prices was relatively high and significant at 0.001, regardless of the data frequency. <sup>20</sup> During the drought (August 1992–March 1993), yellow maize supplies from food aid increased dramatically and white maize became extremely scarce. The two price series in Maputo ceased to move together during this time. With the ending of the drought in April 1993, the two series have resumed their close relationship. It is noteworthy that the correlations between yellow maize and rice (which are logically expected to be weaker substitutes) are uniformly small and are significant in only one of the

<sup>19</sup>Using an Almost Ideal Demand System linked with a Multi-Market Model, Dorosh et al. (1994) concluded that white and yellow grain are not substitutes in consumption in Maputo. While not attempting a critique of their model in this paper, we reiterate that the close co-movement of white and yellow maize prices both before and after the southern African drought cannot be plausibly explained without recourse to substitution in consumption.

<sup>20</sup>Detrended series are the difference between actual observations and the series' linear trend from a simple linear regression. The purpose of such an approach is to remove from each series the effects of macroeconomic (e.g. inflation) or other exogenous factors (e.g. long-term trends in the supply/demand balance of each) that could also contribute to co-movement.
Figure 3 Commercial and emergency food aid arrivals and maize grain prices in Maputo, March 1990-January 1995

Source: Food Security Project, Ministry of Agriculture, Maputo.

The Maize prices are nominal. From 1991 - Dec 1992, all data collected in Mucorama market (USAID).
From Jan 1993 - present, data collected in Xipamanine market by SIMA enumerators.
four non-drought cases, while all four non-drought cases are significant for yellow and white maize.

This strong correlation over a 29 month period prior to the drought and for the 21 months since the end of the drought is striking. The pattern could in theory be explained by highly correlated supply shifts of each product, by strong substitution between the two, or by some combination of both factors.21 Evidence is strong that supply shifts were not correlated during the first period. White maize supply to Maputo is determined by the seasonality of production in South Africa, Swaziland and Mozambique, yellow maize supply by food aid arrivals. The latter have shown no stable relationship to the seasonal white maize production pattern. Thus, prior to the southern African drought, the evidence is compelling that yellow and white maize have behaved as substitutes in consumption in Maputo; there is no other satisfactory explanation for the strong correlation of price movements between the two series.

The lack of correlation during the drought is to be expected, given the extreme scarcity of white maize and the overabundance of yellow. First, thin markets are widely known to be unstable and to provide opportunities for sellers to exercise market power (Marion, 1985; Hayenga, 1979). Second, Tomek (1980) found evidence that prices in thinly traded markets tend to become disassociated from prices in related markets. Finally, heterogeneous consumer preferences mean that prices of white and yellow maize will become less associated as white maize becomes scarce. In April 1994, primary food purchasers (generally female) from 400 randomly selected households in Maputo were surveyed regarding maize supply sources, past market purchase behavior, and stated behavior under alternative price scenarios. The survey showed that 96% of consumers prefer white maize if it carries the same price as yellow. Table 3 presents further results from the survey, broken-down by the price discount they required to switch from white to yellow maize. One-quarter of sample households indicate that they would switch to yellow if it were discounted a modest 14% relative to white maize, and these had incomes well below the mean.22 Of this first group, over 90% had in fact purchased either yellow grain or whole yellow maize meal during the past year. Yet another quarter, with incomes above the mean, indicate that they would never switch to yellow grain from white at any conceivable price discount. Actual market behavior of this last group shows that, while over 50% did in fact purchase yellow maize products during the past year (despite their earlier statements), they did so in very small quantities. Thus, demand for white maize by this segment of the population for the extremely small quantities available during the drought would have been sufficient to maintain high prices for this product despite the oversupply and low prices of yellow grain.

During the post-drought period, common supply movements may explain some

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21Policy or market structure effects may also cause co-movement of prices. Each can be rejected in this case. Both retail price series were generated within a highly competitive informal marketing system where government price controls had at best a negligible effect.

22For more detail, see Tschirley and Santos (1994). Note that the yellow maize available to consumers was a dent variety, while Maputo consumers have traditionally processed and consumed flint varieties. In addition, yellow maize often had much higher proportions of broken kernels and foreign matter than domestically produced white maize. Finally, long storage during 1992/1993 meant that some of the yellow maize on the market was badly deteriorated. As a result, yellow grain, and especially whole yellow meal, developed a reputation for poor quality. These facts suggest that the proportion of households switching to yellow maize might be higher, and the price discounts needed to do so lower, if the yellow maize were of better quality.
Table 3 Percent switching from white grain to yellow grain with price discounts on yellow grain, Maputo, Mozambique, 1994

<table>
<thead>
<tr>
<th>% discount on yellow grain relative to white</th>
<th>% indicating they would switch at each price discount on yellow grain</th>
<th>Actual market behavior of those indicating they would switch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% switching to yellow</td>
<td>% actually consuming during past year&lt;sup&gt;1,2&lt;/sup&gt;</td>
</tr>
<tr>
<td>14</td>
<td>25.1</td>
<td>90.2</td>
</tr>
<tr>
<td>29</td>
<td>14.4</td>
<td>83.0</td>
</tr>
<tr>
<td>43</td>
<td>31.3</td>
<td>67.0</td>
</tr>
<tr>
<td>&gt;43</td>
<td>4.4</td>
<td>62.4</td>
</tr>
<tr>
<td>Would not switch</td>
<td>24.8</td>
<td>50.6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>69.3</td>
<td>54.0</td>
</tr>
</tbody>
</table>

<sup>1</sup> Includes any yellow maize product: yellow grain plus whole yellow meal.
<sup>2</sup> Percent is of those who indicated that they would switch to yellow maize at the indicated price discount.
<sup>3</sup> "AE" is consumption adult equivalent.

of the co-movement of the two series. However, the decrease in both white and yellow prices in late 1994, coincident with the arrival of more commercial food aid, cannot be ascribed to common supply movements. White maize was becoming seasonally scarce and markets showed no presence of imported white grain. Yet white prices fell (then stabilized) along with yellow prices with the arrival of a food aid shipment. Thus, price behavior and potential explanations for it during the post-drought period continue to lend support to the hypothesis that white and yellow grain are substitutes in consumption.

This conclusion is consistent with the evidence on consumer behavior in Mozambique presented in Table 3.<sup>23</sup> This table shows that substitution towards yellow maize from white maize occurs throughout the income spectrum, but is most pronounced among the lowest income households. It is important to note that each of these products has been present on the market on a continuous basis since at least the late 1980s. The resulting consumer familiarity with the products is important, as it reduces the hypothetical nature of the questions.

Traders confirm the substitutability of the two grains. In a series of interviews with six of the largest wholesalers in Maputo during November 1993, five indicated that they had in the past traded white maize but had not done so during 1993. This was despite very low white maize prices and abundant supplies in the center of the country. When asked the reason for staying out of the white maize market, each cited oversupply and low prices of yellow maize in Maputo and uncertainty regarding future food aid arrivals. Each perceived that these factors contributed to price risk in white maize markets. In contrast, informal traders have been quite active in the white maize trade. Yet these traders operate on a much smaller scale than the large wholesalers and have very rapid turnover of stock, minimizing the

<sup>23</sup> Similar results have been found in Zimbabwe and Zambia. See Rubey (1992), Jayne et al. (1995) and Rubey et al. (1995).
risk from unpredictable food aid arrivals. To date, this sector has made little or no physical investment in the maize marketing system.  

Price and production effects outside of Maputo

The conceptual section earlier in this paper argued that the effects of yellow maize food aid on prices and the production of white maize outside Maputo depend on the size of the Maputo market, the integration of Mozambican food markets over space and across marketing levels, the position of the country regarding international trade, and the elasticity of supply in world and domestic white maize markets. If the Maputo market is “large”, and if markets are integrated, then price effects in Maputo will be passed on to rural areas. In this case, the position of the country on trade (importer or exporter, level of trade barriers) and the relative supply elasticities in world and domestic markets will determine whether imports or domestic production are most affected by the price change.

Size of the Maputo market. By all accounts, the Maputo maize market is sufficiently large to influence rural market prices strongly. Dorosh et al. (1994) estimate total consumption of maize (white and yellow) of 115,000 Mt in Maputo, and 130,000 MT in rural areas of the southern three provinces. Marketed surplus in rural areas is a small proportion of total production and demand in Maputo as a proportion of this marketed surplus is certainly very large. As peace allows the nation’s marketing system to be rebuilt and marketing costs to fall, the importance of the Maputo market (and urban markets in general) for rural prices will increase.

Market integration. Analysis of market integration in any country is fraught with difficulties of data, method, and interpretation. One key point to be drawn from much of the literature is that correlation analysis or any other quantitative technique must be complemented by detailed knowledge of the marketing system being analyzed.

Price data available since December 1992, combined with careful and repeated observation of market behavior, indicate that many food markets of southern and central Mozambique are connected through trade flows that respond to price differences. In this sense, we will refer to these markets as integrated. In these regions, integration of selected markets has probably been strong since at least 1991. Though data are lacking, it is likely that a significant number of more isolated markets are not well integrated into the marketing system of these regions. In the north, evidence indicates that market integration is weaker and more recent, but improving in many areas.

Trader interviews in south, central, and northern regions indicate that there are four principal trade routes for white maize from domestic production. In descending order of importance, these routes are: (1) between the center and the south, from production areas of Sofala and Manica provinces to Maputo City; (2) in the center, from internal markets of Sofala and Manica provinces to the city of Beira, along the “Beira corridor”, (3) in the south, from production areas of Maputo, Gaza, and Inhambane provinces to Maputo City, and (4) within the north, from high potential but isolated production areas in western Nampula province to Nampula City, and from Cabo Delgado province to Nampula City. Trade from production areas of the north to Maputo City in the south occurs, but is infrequent.

\(^{24}\)See Tschirley et al. (1993a) for more detail on the structure and operation of this sector.

\(^{25}\)For an influential early critique of market integration analysis, see Harriss, 1979. For examples of alternative quantitative approaches, see Delgado, 1986; Heytens, 1986; Ravallion, 1986; Timmer, 1987.
Table 4  Pairwise correlation coefficients of detrended retail prices in selected markets of Mozambique, white and yellow maize grain, 1993

<table>
<thead>
<tr>
<th></th>
<th>White maize</th>
<th></th>
<th>Yellow maize</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Maputo</td>
<td>Beira</td>
<td>Nampula</td>
<td>Maputo</td>
</tr>
<tr>
<td></td>
<td>Simple correlation coefficient</td>
<td></td>
<td></td>
<td>Simple correlation coefficient</td>
</tr>
<tr>
<td>South</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xai-Xai</td>
<td>0.643\textsuperscript{a}</td>
<td></td>
<td>0.919\textsuperscript{a}</td>
<td>0.528\textsuperscript{a}</td>
</tr>
<tr>
<td>Chokwe</td>
<td>0.761\textsuperscript{a}</td>
<td></td>
<td>0.946\textsuperscript{a}</td>
<td>0.810\textsuperscript{a}</td>
</tr>
<tr>
<td>Inhambane</td>
<td>0.721\textsuperscript{a}</td>
<td></td>
<td>0.776\textsuperscript{a}</td>
<td>0.902\textsuperscript{a}</td>
</tr>
<tr>
<td>Massinga</td>
<td>0.756\textsuperscript{a}</td>
<td></td>
<td>0.910\textsuperscript{a}</td>
<td>0.850\textsuperscript{a}</td>
</tr>
<tr>
<td>Central</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manica</td>
<td>0.713\textsuperscript{a}</td>
<td></td>
<td>0.919\textsuperscript{a}</td>
<td>0.912\textsuperscript{a}</td>
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<tr>
<td>Chimoio</td>
<td>0.761\textsuperscript{a}</td>
<td>0.946\textsuperscript{a}</td>
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</tr>
<tr>
<td>North</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Ribau6</td>
<td></td>
<td></td>
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<tr>
<td>Monapo</td>
<td></td>
<td>0.327\textsuperscript{c}</td>
<td></td>
<td></td>
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<tr>
<td>Nacala</td>
<td></td>
<td>0.466\textsuperscript{b}</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>0.385\textsuperscript{b}</td>
<td></td>
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</tbody>
</table>

\textsuperscript{a}Significant at 0.001.
\textsuperscript{b}Significant at 0.01.
\textsuperscript{c}Insignificant at 0.01 or higher.
\textsuperscript{d}Data are weekly observations for 1993 and 1994.

due to high shipping rates, weak infrastructure in the north, and the inability of traders in the north to obtain an assured price for subsequent sales in the south. Yellow maize has also been traded actively in the south and center of the country. SIMA data indicate that yellow maize grain or meal has been present in all surveyed interior districts of the south and center during at least 75% of all weeks since data collection began in these districts in January 1993.\textsuperscript{26} The volume of yellow maize food aid arriving in Maputo and Beira played an important role in the development of the informal food marketing sector in these areas (Tschirley et al., 1993a).

Thus, market research leads one to expect prices within the south, within the center, and possibly between the south and center to show signs of market integration. This type of evidence should be less strong in the north. Pairwise correlation coefficients of detrended prices in Table 4 are consistent with these expectations.\textsuperscript{27} All coefficients are positive and significant at 0.001 in the 12 south and center market pairs. Coefficients are smaller and less significant (insignificant in one of the three cases) in Nampula province of the north.

Mozambique in the world white maize market. Conditions within Mozambique and characteristics of the world white maize market both suggest that this market cannot be relied upon for an elastic supply of imports to Mozambique. Foreign exchange scarcity and a continuing requirement of permits for large commercial imports of white maize make it difficult for Mozambican traders to access this market in a timely manner. Characteristics of the world white maize market reinforce this tendency. This market is very thin, with only a small proportion of

\textsuperscript{26}Past early 1993, some of the market supply of yellow maize in these districts can be explained by emergency grain distributed in rural areas which made its way to the market. Yet throughout this period, yellow grain was flowing through commercial channels from the ports of arrival (Maputo and Beira) to rural consumption points.

\textsuperscript{27}Correlations are between deviations of actual observations from each series’ linear trend.
total production entering the market during any year (Kingsbury, 1989). The volume of trade is also unstable due to the concentration of volume which comes from southern Africa (over 90%), and the high covariance of production across countries in this region (Jayne et al., 1994). The southern African drought of 1992, and the less serious drought of 1994/1995, are only the latest examples of region-wide weather problems which reduce supplies for all or most countries in the region. These characteristics of the world white maize market tend to make it an unreliable mechanism for smoothing domestic production fluctuations.

White maize imports to Mozambique have been almost entirely informal over the past several years. Prior to 1992, this trade was conducted primarily with Swaziland, a very small market which could not be expected to respond elastically to Mozambican demand. Since late 1994, Mozambican markets have enjoyed steady supplies of white maize products (primarily refined white meal) from South Africa. With South African production typically exceeding that in Mozambique by a factor of 18 to 20, this trade may have the potential to increase the elasticity of import supply to Mozambique. Yet, South Africa is strongly affected by the regional weather problems discussed above, meaning that it cannot be considered a reliable supplier of white maize to Mozambique during the years of greatest demand. Also, Jayne suggests that the entire southern Africa region may become structurally deficit as markets are liberalized and large production subsidies are eliminated or reduced (Jayne, 1995).

Thus, all three factors that determine the effects of urban price changes on prices and production in rural areas indicate that these effects can be strong. The Maputo market is large relative to rural areas in the south, market integration is effective in many areas, and import supplies are inelastic and unreliable. Furthermore, the importance of the Maputo market (and urban markets in general) and the integration of the food marketing system can both be expected to increase over time; these will tend to magnify the effects of yellow maize food aid on domestic markets.

Conclusions, policy implications, and further research

As a new democratic government struggles to unify and rebuild Mozambique after the war, it will be pulled in many directions at once. In urban areas, masses of poor consumers will require a stable supply of low-cost staple foods to ensure adequate consumption. In rural areas, even poorer producers will require a strong market for their food and cash crops if they are to escape the semi-subsistence poverty in which they have been caught. In the long run, the solution to both problems is increased and efficient food production in rural areas and low-cost marketing of that production. Yet yellow maize food aid will continue to play an important role in meeting urban consumption needs for some years to come; thus, the question is how to use this aid to facilitate the transition to a self-reliant agricultural economy.

The analysis in this paper suggests that large amounts of low-priced yellow maize can restrict the urban market for domestically produced white maize and have

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28Total annual production in Swaziland is less than total annual consumption in Maputo. Swaziland relies on South African imports to meet its demand, so that an increase in exports to Mozambique depends upon an increase in imports from South Africa. See Tschirley et al. (1993b) for more discussion of the Swaziland and other regional white maize markets.

29For more detail on the conditions of rural smallholders in Mozambique, see Tschirley and Weber (1994).
adverse effects on Mozambican producers. It also suggests that instability in yellow maize prices, caused by irregular food aid arrivals, has been transmitted to the white maize market. Finally, it showed that the management of commercial and emergency food aid created large rents for consignees prior to the southern Africa drought, and significant losses for at least a year after that time. These conditions are clearly not conducive to the development of an efficient and effective maize production and marketing system in the country.

On a more positive note, the food aid program’s emphasis beginning in 1992 on creating competitive marketing conditions for food aid facilitated the growth of the informal marketing system and the small-scale milling industry. Both now play key roles in linking Mozambican producers and consumers and providing consumers with affordable maize products. This is an important example of how food aid can be used to help develop markets, and represents a major accomplishment of the food aid program in Mozambique.

Mozambique’s experience carries important lessons for other food aid dependent countries, and for future design of its own program. These lessons pertain to the use of informal markets in commercial food aid distribution; the setting of the consignee price; the determination of quantities for the commercial program; and coordination across the commercial and emergency programs.

**Food aid and private food markets**

The Mozambican experience clearly shows that expanding access to commercial food aid by private traders can have positive effects on the development of competitive markets, with important benefits to consumers, especially those with the lowest incomes. Mozambique should maintain its commitment to competitive marketing of yellow maize food aid, and should especially ensure that this grain continues to be available for milling in small-scale mills. As it does this, several key changes in the current food aid program could redress the problems which this paper has identified.

**Determination of the consignee price**

Mozambican consumers throughout the south and center have demonstrated for several years their willingness to consume whole yellow grain and meal when priced at a moderate discount to white grain and meal. As the country regains its economic footing, this change in consumer behavior introduces the opportunity for using the world yellow maize market to meet import needs on a non-concessional basis. Greater price stability, product availability, and presence of risk management tools in the world yellow maize market mean that Mozambique would be able to cover its shortfalls more easily and at lower cost by using this market, as opposed to relying solely on the white maize market. Continued availability of yellow maize from food aid at prices well below import parity would make it difficult or impossible for such trade to develop, and would benefit primarily large consignees; since consumer demand at these prices would likely not be met (it typically hasn’t been in the past), these traders would capture the rent and consumers would see little if any benefit. Such availability would also reduce

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30See also Tschirley et al. (1993b) in this regard.
31In fact, a Maputo wholesaler in early 1995 paid approx. US $175/metric ton to import 5000 metric tons of yellow maize for human consumption.
32It may also open the possibility of domestic production of yellow maize for human consumption, and for animal consumption as that market grows. See Rubey (1992) for evidence from Zimbabwe.
incentives for producers and traders to invest in the white maize production and marketing system, thereby making it more difficult for both to adjust to a post-food aid environment. We therefore recommend that consignee prices for yellow maize food aid be set with explicit reference to world market import parity prices (IPPs). It is not imperative that consignee prices reach full import parity. It is imperative, however, that any subsidy be moderate, with consignee prices approximating and maintaining a systematic relationship to import parity.

**Determination of commercial food aid quantities**

A fundamental flaw in the current commercial food aid program is that it uses market mechanisms to distribute the commodity, while providing no feedback between quantities and prices. The result is consumer price instability accompanied by large rents or significant losses by participating consignees. We therefore propose that the GOM and donors devise a system that elicits demand for yellow maize food aid from consignees as a function of prices to be charged. Essential elements of the system are that (1) GOM announces on three or four occasions during the year food aid prices approximating import parity, and surveys a sufficiently large number of consignees for the volumes of aid they will purchase at that price, and (2) when conducting the survey, GOM and donors make available to consignees detailed information regarding the emergency food aid program (see below).

**Coordination across commercial and emergency programs**

A key lesson from Mozambique is that imperfect targeting and distribution of emergency food aid affects markets. These effects were exacerbated during the drought, but have likely been present in reduced scale since the food aid program began. As a result, consignees will be unable to make reasonable estimates of their demand for commercial food aid without accurate and timely information regarding the emergency program. As part of the process of eliciting demand from consignees, we recommend that they be provided with information on (1) planned emergency and commercial arrivals for one year, including regional allocations, (2) scheduled emergency and commercial arrivals over the next 3–6 months, with monthly updates, (3) status of ships in port, and (4) planned emergency distribution over the next 3–6 months, including volumes and distribution mechanisms (e.g. free or food for work) by geographical area.

**Further research**

Much of the effect of yellow maize food aid on producers of white maize will be mediated by the rural marketing system and its links with urban areas. This report provides indirect evidence on this issue, but much more needs to be learned. Subsector studies aimed at understanding the evolving structure, conduct, and performance of the rural food marketing system and its links with urban areas are urgently needed. Such studies would help inform food aid and more general rural investment policies.

**Acknowledgements**

Research reported in this paper was funded under the Food Security II Cooperative Agreement between the US Agency for International Development (Global Bureau, Economic Growth Center, Office of Agriculture and Food Security) and Michigan State University Department of Agricultural Economics. Resources for work in Mozambique
were contributed by USAID/Mozambique and the Ministry of Agriculture of Mozambique. All errors of fact and omission are the sole responsibility of the authors. In no case should the paper be interpreted to represent the official position of USAID or the Ministry of Agriculture of Mozambique. Data used in this paper were collected in collaboration with Mozambican team members. Special thanks to Rui Benfica for research assistance.

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