EFFECTS OF MONETIZED FOOD AID ON LOCAL MAIZE PRICES IN MOZAMBIQUE

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ABSTRACT

EFFECTS OF MONETIZED FOOD AID ON LOCAL MAIZE PRICES IN MOZAMBIQUE

By

Cynthia Donovan

Yellow maize commercial (monetized) food aid has been a major policy instrument for meeting food security needs in Mozambique, particularly among the urban poor. This research studies the effects of this food aid on prices for Mozambique's domestic white maize in different locations, under current and likely future conditions.

Market studies, including a rapid appraisal of the white maize markets, were completed in Maputo and other provinces throughout the country. Then, time series analysis was conducted on weekly price data and weekly food aid deliveries data for the 1990-1995 period. Vector autoregressions were used to investigate the effects of unpredictable fluctuations in prices and quantities. War/drought and post-war/drought periods were determined and analyses conducted based on the separate time periods.

In the war/drought period, maize prices in Maputo were volatile and white maize supplies were highly limited. Heterogeneous preferences for white maize and yellow maize meant that white maize prices rose very high. The importance of yellow maize food aid in this period was as a cheaper consumption alternative, for those consumers willing to switch.
In the second period, however, the analysis showed white maize prices would have been 10-15 percent higher going into the harvest season of 1995, if food aid had not arrived.

With time, the markets in other parts of Mozambique have begun to recuperate. Market integration analysis based on separate war/drought and post-war/drought periods demonstrated that the effects of Maputo price shocks on Chimoio prices (in a maize production area) were significant. Producer and trader incentives were affected by such shocks.

Finally, the lessons for future food security and food aid policy are presented. As yellow maize food aid supplies diminish, policy analysts must evaluate the market supplies and price relationships, recognizing that domestic production may still be insufficient to meet demand and some imports required. Local purchases of white maize for use in the emergency distribution programs may provide incentives for market development, but must be undertaken with care to avoid generating high consumer prices. Without yellow maize food aid, white maize prices for both rural and urban consumers will be higher.
To my parents with many thanks from CXD
ACKNOWLEDGMENTS

This acknowledgment is designed to say thank you to those who helped to make this document reality, but in truth, I can never truly thank all of the people involved in the past four years and one-half years, and all the learning time before that. For those whose names do not appear here, remember that your ideas, questions, and smiles are still with me.

There are several names that cannot be absent here, however. I thank Mike Weber, with his years in the field, knowledge of markets, and drive for the work, encouraged and supported me through the work in Mozambique. Also thanks to Bob Myers, who contributed greatly to analysis in this work with ideas, corrections, and comments. He has said that this work is supposed to be enjoyable, and I find that it is, just not necessarily on a day to day basis. Dave Tscharly continually pushed me to think about what was happening and write about it clearly. John Strauss was under-utilized, but very much appreciated. Tom Reardon provided ideas and valuable suggestions on writing and publishing, along with friendship.

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CXD

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## ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADF</td>
<td>Augmented Dickey Fuller Tests for unit root</td>
</tr>
<tr>
<td>AGRICOM</td>
<td>Parastatal food crop marketing agency (replaced by ICM in 1994)</td>
</tr>
<tr>
<td>CIM</td>
<td>Companhia Industrial Matola (industrial grain mill)</td>
</tr>
<tr>
<td>CNP</td>
<td>National Planning Commission</td>
</tr>
<tr>
<td>CPI</td>
<td>Consumer Price Index</td>
</tr>
<tr>
<td>DEA</td>
<td>Directorate of Agricultural Economics, Ministry of Agriculture and Fisheries</td>
</tr>
<tr>
<td>DNE</td>
<td>National Directorate of Statistics</td>
</tr>
<tr>
<td>ERP</td>
<td>Economic Rehabilitation Program</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FRELIMO</td>
<td>Frente de Liberação de Moçambique (political party, currently majority in government)</td>
</tr>
<tr>
<td>FSP-M</td>
<td>Food Security Project-Mozambique</td>
</tr>
<tr>
<td>GOM</td>
<td>Government do Mozambique</td>
</tr>
<tr>
<td>GTZ</td>
<td>German Technical Assistance Agency</td>
</tr>
<tr>
<td>IASF</td>
<td>Agricultural Survey of the Family Sector</td>
</tr>
<tr>
<td>ICM</td>
<td>Cereals Institute of Mozambique (“Instituto de Cereais do Moçambique”)</td>
</tr>
<tr>
<td>iid</td>
<td>independently and identically distributed</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>KPSS</td>
<td>Kwiatkowski, Phillips, Schmidt, and Shin (tests for unit roots)</td>
</tr>
<tr>
<td>LM</td>
<td>Lagrange Multiplier (test statistic)</td>
</tr>
<tr>
<td>metical</td>
<td>Monetary unit of Mozambique (plural: meticais)</td>
</tr>
<tr>
<td>MAP</td>
<td>Ministry of Agriculture and Fisheries (Mozambique)</td>
</tr>
<tr>
<td>MSU</td>
<td>Michigan State University</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organizations</td>
</tr>
<tr>
<td>RA</td>
<td>Rapid Appraisal</td>
</tr>
<tr>
<td>RENAMO</td>
<td>National Resistance of Mozambique (political party/military organization)</td>
</tr>
<tr>
<td>S-C-P</td>
<td>Structure-Conduct-Performance (analytical paradigm)</td>
</tr>
<tr>
<td>SEMOC</td>
<td>Seed Company of Moçambique</td>
</tr>
<tr>
<td>SIMA</td>
<td>Market Information System (“Sistema de Informação de Mercados Agrícolas”)</td>
</tr>
<tr>
<td>WFP</td>
<td>World Food Programme</td>
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Chapter 1

Introduction

1.1. Issues

After years of civil war and a devastating regional drought, Mozambique is highly dependent upon foreign assistance both for government budgetary resources and for food supplies. Foreign aid makes up to 80 percent of GNP and food aid cereals were 30 percent of total cereals’ availability in 1994/95. The United States Agency for International Development (USAID) has been the principal donor to bring in yellow maize food aid to be monetized to provide budget resources for the government, while ameliorating food production deficits and import constraints that threaten the food security of many Mozambicans.\(^1\) However, in a market environment undergoing policy reform and recuperation from civil war, commercial food aid has the potential for undermining the market development which has been an objective of government policy.

This research uses time series analysis to evaluate the price effects of food aid arrivals on Mozambican maize markets. There are two time periods for the analysis: 1) a war/drought period, from April 1990 to February 1993, when the destructive consequences of civil war limited movement and economic activity, and a devastating

\(^1\) The European Union has also imported commercial yellow maize food aid, but the in much smaller quantities than USAID.
regional drought decimated maize production; and 2) a postwar recuperation period, from April 1993 through November 1995, when production increased again and private markets were expanding.

Retail market prices provide the basis for the analysis, in combination with detailed information on the structure of markets and the food aid distribution system. The time series analysis allows an evaluation of the effects of food aid arrivals in Maputo on market price changes for white and yellow maize. The analysis also looks at issues of market integration by examining the effects of Maputo price shocks as they spread to Chimoio, an important market in the central maize production region.

1.2 Objectives of this research

The objectives of this research are the following:

1) to determine the key factors in the structure of Mozambican maize markets that mediate how commercial food aid affects those markets;

2) to analyze the relationship between yellow and white maize prices, and quantities of yellow maize commercial food aid arrivals in Maputo during the drought/war period and in the current environment of market development;

3) to evaluate the extent to which the Maputo maize markets are spatially integrated with production region markets by examining how price effects in Maputo are transmitted to producer prices;

4) to identify policy options available to mitigate potential negative effects of food aid while enhancing positive effects.
Four specific research questions arise from these objectives. First, given the market reforms and consequences of war, what are the key aspects of the market structure that influence how food aid deliveries affect prices? Second, how do the arrivals of yellow maize commercial food aid affect prices for white maize in urban and rural markets? Third, how do Maputo white maize price shocks affect the prices for white maize in maize producing areas in Mozambique? Fourth, are there differences in the effects of food aid deliveries and price shocks between the war/drought period in 1992 through early 1994 and the post-war recovery period in 1994 through late 1995? Finally, what lessons can be learned concerning the potential effects of various policy options for ensuring food security?

1.3 Background on food aid in Mozambique

Food aid has arrived in Mozambique since Independence in order to help supplement the nutrition of vulnerable sectors of the population and provide the government with budgetary support through the sales on the market. During the 1991/1992 drought and its aftermath, food aid was responsible for providing the means for survival of thousands, if not millions, of Mozambicans. There are two basic channels for food aid, termed “emergency food aid” and “commercial food aid.” Emergency food aid arrives in response to specific expressed needs, distributed for free or for work to targeted groups.

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2 The vocabulary used with food aid is not consistent across documents, with terms such as “program aid”, “project aid”, “monetized food aid” used to denote various types of food aid. Here, emergency food aid is defined as aid received by non-governmental organizations, government ministries, and international agencies in order to be given to people in need. “Commercial food aid” is used here to indicate food aid supplies that arrive specifically to be sold on the local markets, by non-governmental organizations or by the Mozambican government, not to be distributed for free.
(e.g., school children in poor areas, demobilized soldiers, recently returned refugees). In Mozambique, almost all of the free distribution and work projects have been in rural areas.

In contrast, commercial food aid is imported by the donor for delivery to the government of Mozambique. The government can either give or sell the commercial food aid. In the case of USAID, the government of Mozambique must deposit local currency funds equivalent to the free-alongside-ship (FAS) price in a special development account. Most commonly the government sells the maize either through government shops or through private traders in the major urban centers. Government ration shops ceased functioning by 1992, so that the informal sector has been responsible for most of the retail sales since 1991. USAID has used the commercial yellow maize food aid to promote the policy reform efforts towards private market development, requesting that the qualified list of consignees be expanded to ensure greater competition.

Commercial food aid has the dual purposes of providing budgetary supplements to the national government and alleviating food shortages. Food shortages often result in price spikes that threaten food security, particularly of the urban poor who have little or no savings to smooth consumption. However, reducing or eliminating these price spikes may be in conflict with development goals since lower prices diminish incentives to producers and traders, the so-called disincentive effect. The administration and regulations governing commercial food aid in Mozambique will be discussed further in Chapter 4.
In Mozambique, the majority of all food aid cereals have been in the form of yellow maize, as can be seen in Table 1.1. During the war and drought period, maize food aid was a significant portion of cereal availability in the country. By 1992/93, yellow maize food aid reached 60 percent of total cereals availability in the country; commercial yellow maize food aid alone was 25 percent of the total, whereas emergency yellow maize food aid was 35 percent of the total. In 1994 and 1995, domestic production of white maize and other staples began to increase, as did the domestic marketing opportunities for those crops, and food aid cereals became less important in the total. By the 1994/95 marketing year, yellow maize food aid (commercial and emergency) was only 15 percent of total cereals availability. Commercial yellow maize food aid contributed only 6 percent of the total cereals availability in the 1994/95 marketing year.

The 6 percent of total cereals availability arriving in the form of yellow maize food aid represents a large proportion of the cereals available for consumers to buy on the market, and populations in urban areas rely heavily upon the market for basic staples. Estimates of marketed surplus from domestic production of white maize are in the range of 13-20%, or about 70,000 - 100,000 metric tons annually (MAP/UAP 1994; MA/DEA/Estatistica 1994; NDAE/DS 1993). This means that the yellow maize commercial food aid about doubled maize supplies on the market in the country, mostly in the urban areas of Maputo and Beira, where price effects can be expected to be greatest.
Table 1.1. Cereal Supplies and Sources in Mozambique: 1989/90 through 1995/96

| Marketing Year (April to March)
| Production | Food Aid |
|------------|----------|----------|----------|-----------|---------|
| | White Maize | Rice | Sorghum/ Millet | Total | Yellow Maize Commercial | Yellow Maize Total | White Maize Emergency | Rice | Wheat | Total | Commerce Cereal Imports | Total Cereals Avail. |
| 1989/90 | 330,000 | 95,000 | 177,000 | 602,000 | 83,000 | 145,000 | 228,000 | 0 | 72,000 | 109,000 | 300,000 | 0 | 1,011,000 |
| 1990/91 | 452,900 | 96,400 | 181,000 | 730,300 | 126,000 | 221,200 | 347,200 | 34,000 | 47,600 | 116,400 | 545,200 | 0 | 1,274,500 |
| 1991/92 | 327,100 | 56,300 | 154,900 | 538,300 | 124,900 | 248,800 | 373,700 | 14,900 | 58,500 | 123,000 | 447,100 | 0 | 1,108,400 |
| 1992/93 | 133,000 | 33,000 | 71,000 | 237,000 | 271,700 | 374,200 | 645,900 | 15,900 | 61,600 | 47,700 | 723,400 | 70,000 | 1,077,200 |
| 1993/94 | 533,100 | 49,000 | 165,000 | 747,100 | 77,000 | 208,100 | 285,100 | 0 | 28,500 | 57,000 | 313,600 | 86,700 | 1,204,400 |
| 1994/95 | 527,000 | 97,000 | 193,000 | 817,000 | 70,200 | 123,900 | 194,100 | 70,900 | 50,000 | 103,100 | 315,000 | 105,000 | 1,269,200 |
| 1995/96 | 733,800 | 76,000 | 278,700 | 1,088,600 | 56,000 | 40,000 | 96,000 | 40,000 | 24,200 | 73,600 | 233,800 | 153,700 | 1,476,100 |

Marketing year: April - March for DSA 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 farm.

1 Includes 10,100 in white maize commercial food aid imports in 1991/92.
This figure is strictly white maize imports for emergency program, and does not include local purchase quantities since those quantities are included in the production estimates.
Prior to 1994/95, commercial imports were rice and wheat. In 1994/95, an estimated 12,000 metric tons of white maize were imported from South Africa. The informal sector may be illegally importing white maize commodities, but these informal imports are unrecorded and so not included here.
1995/96 data is projected for full marketing year.

Sources: Ministry of Commerce, Department of Food Security, Boletim 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).
There is no domestic yellow maize production, so any production disincentives through prices would be felt by the producers of the main domestically-produced substitute good, white maize. On the consumption side, yellow maize is the less-preferred consumption staple compared to white maize. Yellow maize is prepared for the table in much the same way as the local white maize. Available at prices below the local white maize, yellow maize products give the low-income consumers an alternative consumption good at a lower market price.

1.4 Debate on disincentives

While recognizing the benefits of commercial food aid for consumers, current policy debate in Mozambique centers around the effects of food aid arrivals on both producer and trader incentives. Incentives include not just the level of prices, but also the anticipated fluctuations in prices (opportunity for arbitrage), risks, and the availability of the commodity. All of these in turn depend upon the markets’ and traders’ behavior.

As argued in Isenman and Singer (1977), producer disincentives stem from the arrival of cheap (or free) food aid commodities which reduce demand for locally produced goods, thus reducing overall prices in the markets. In such a case, farmers would face lower prices for their commodities and have less incentive to produce the basic consumption staples. In addition, the food aid arrivals might increase price risks through countercyclical price declines. That is, commodity prices might decline during the hungry season when food aid arrives. A lower mean along with a higher risk would make risk-averse net surplus farmers worse off than before, even when the poor urban consumers would benefit
from the reduced costs of obtaining food. This analysis depends upon the price responsiveness of farmers. If a lower price or increased risk reduces their incentives to produce staples, such price effects mean that Mozambique may suffer the long-term consequences of increased food aid or import dependency.

The incentives to trade in locally produced commodities could be decreased by lowered quantities of the local commodity available (thin markets for the domestic good), or from high price risks for the local commodity with an inability to predict food aid arrivals and price declines. Volatility in prices itself need not be a disincentive to traders, if they perceive that the fluctuations present arbitrage opportunities, rather than just an increase in risk. Food aid arrivals may also limit transport availability for local commodity trade. Firms allocate their limited transport resources to the highest profit activity, and this is often food aid. This transport constraint is more apparent with emergency food aid distributions in rural areas with severe transport constraints. The government is withdrawing from direct market activities in buying and selling of grains and flours, thereby increasing the importance of motivating private traders to work with local maize.

All of these potential disincentive effects depend upon various factors, including the price for market sales, the total quantity arriving in relation to quantities available in the market, and consumer preferences. Decisions on the quantity and pricing for commercial food aid are made by both the donors and GOM.
Evaluation of the effects of food aid must rely upon knowledge of market structure and organization. Prices may be determined through government administration, base-point pricing, monopoly or monopsony, collusive action between agents, purely competitive market forces, or some combination of these mechanisms. In the past the government played a key role in the purchase and sales of agricultural commodities, including maize. A minimum producer price is still set, yet there is no effective enforcement mechanism in most parts of the country. It is also necessary to know who is trading with producers, where they purchase and sell maize, and other aspects of the rural marketing system. The price discovery process is dependent upon the market channels available and the competitiveness of these markets. Given all of the changes within the country since the Economic Rehabilitation Program (ERP) and Peace Accord, knowledge about the current structure and performance of maize marketing is critical.

A related problem is the extent of spatial integration of maize markets in Mozambique. If markets are highly spatially integrated, with price shocks from one market quickly and fully transmitted to other markets, the effects of food aid arrivals on Maputo prices will be transmitted to consumers and producers in other regions of the country. On the positive side, if market integration is improving, localized scarcities in Maputo will serve to draw on reserves elsewhere in the country and the producers and traders will respond to the need. Since producer price data is lacking for the relevant historical period, the hypothesis that food aid arrivals affect producer prices cannot be directly tested. However it will be shown that retail prices for markets in the production areas serve as a good proxy for producer prices in order to evaluate those effects.
Spatial market integration is also of interest for policy makers in determining investment priorities and potential for increasing marketed production. Structural transformation of the food system is retarded as long as each region (potentially each household) remains in autarky. Market integration would indicate that price signals are being transmitted from consumption centers to production or import centers, in order to guide investment. The lack of market integration would indicate that either transaction costs are too high to motivate transactions or that other constraints are blocking market development.

1.5 Organization of the dissertation

This dissertation is organized into eight chapters, progressing from a description of market structure and organization into the econometric models, and then the results and policy implications. Chapter 2 will present a brief review of previous research on the effects of food aid in the developing world. Chapter 3 describes the rapid appraisal methodology used to evaluate the structure and performance of the maize markets in Mozambique, as well as the findings of that analysis. Chapter 4 will discuss yellow maize food aid in the context of that market structure, including the administration, delivery, and marketing of food aid.

Chapter 5 presents the data and their characteristics. Chapter 6 details the food aid VAR model and simulations. Chapter 7 presents the market integration model. In conclusion, Chapter 8 brings together the econometric analysis and the rapid appraisal results, exploring the policy implications of these findings.
Chapter 2

Previous Evaluations of Food Aid Effects in Developing Countries

2.1 Reviews of potential effects of food aid

There are two basic objectives of food aid, as noted by von Braun and Huddleston (1988):
1) a transfer to people who are in need and unable to obtain sufficient food supplies, and
2) a source of funds for the government, reducing foreign exchange constraints or other
resource constraints, and providing resources for development projects.¹

The actions to obtain these two objectives may have medium- to long-term effects that
undermine the food security of a recipient country. Research on the effects of food aid is
extensive, varying both in theme and in analytical methods.² Maxwell and Singer (1979)
review early attempts to evaluate food aid, with examples mainly from the Indian
experience of the late 1950s and 1960s. Later, in 1989, Jones surveyed the literature on
food aid disincentive effects in sub-Saharan Africa. Two recent books provide much of

¹ Another basic objective is self-interest, political or economic, on the part of the donor country. The
donors may use food aid deliveries to sustain producer incomes in their own countries through
government purchases and extraction of commodities from the domestic markets of the donor
country, often termed “surplus disposal” in the food aid literature. While it is important in
determining the type of food aid available, the self-interest objective will not be discussed further
here.

² The extensive literature on food aid cannot be covered in this brief chapter. Those interested should
refer to the reviews indicated below, as well as the sources listed in them.
the background information and discussion of issues. Edited by V. Ruttan, Why food aid? (1993) includes excerpts from much of the literature on the effects of food aid. In Food aid reconsidered: Assessing the impact on third world countries, editors Edward Clay and Olav Stokke (1991) concentrate on recent food aid efforts, particularly in sub-Saharan Africa, providing articles that orient the reader on effects, their measurement, and possible policy alternatives.

Maxwell (1991) categorizes food aid disincentive scenarios into macro versus micro scenarios with possible effects through prices, policies, food habits, and labor. In the guidelines developed by Shaw et al. (1991) for the World Bank and the World Food Programme (WFP), price disincentives are related to the absorptive capacity of the economy, i.e., “the level of food aid that can be absorbed without causing prices to fall below the border price” (1991, p.2). This is not the only issue with regard to prices, since increasing the volatility in prices or adding an additional source of price variability, may create price risks unacceptable to traders or farmers.

The policy disincentives of commercial food aid stem from the budget subsidies to the government which may allow the government to ignore agricultural policy needs or food security policy needs. The budget subsidies are often given, however, to provide additional resources necessary to support policy reform, so there may be both positive and negative effects on policy reform. Negative effects of food aid on food aid are attributed to the availability of imported food aid commodities that create new demand for imports, increasing the dependence upon imported staples, rather than the domestically produced
staples. Regarding the labor disincentives, the issue is usually raised concerning either food for work programs and labor market distortions, or free distribution of food reducing the need to sell labor, neither of which is at issue here. Thus, the remainder of this chapter will focus on the potential price disincentives from additional supplies brought onto the market at subsidized prices.

2.2 Analysis of price disincentives

When concerned about the effects of food aid on local markets, the primary focus of researchers has been on producer price disincentives. The argument is the following: food aid commodities arrive at subsidized (or zero) prices, adding quantities to the markets, displacing the consumption of locally produced food commodities, depressing their prices, and thereby reducing production incentives, eventually leading to lowered production of food grains (Isenman and Singer 1977). Researchers have thus attempted to determine trends in food prices and production, and determine how food aid quantities may influence those trends.

Isenman and Singer (1977) present one of the most well-known analyses of the effects of food aid on local prices in their work on India in the 1950s and 1960s. As the authors noted, the lack of data precluded a multi-equation econometric model to evaluate effects and instead they used a "common sense" approach and some basic price analysis. The food aid effects depend on several factors: 1) the extent to which food prices are depressed with the arrivals of food aid; 2) the aggregate supply response of farmers to
price changes; and 3) other nonprice constraints on production and incentives to produce, such as the lack of inputs.

Using annual data from 1955-1971 for India, Isenman and Singer (1977) found evidence of possible short-run negative price effects, but positive long-run effects on prices and consumption. There were declines in producer prices for rice in the short run. However, in the long run, there were income-induced demand increases that were supported by the increased nonagricultural investments. Food aid, by keeping the price of food low, ameliorated difficulties of a food bottleneck, thus bolstering investments and economic growth (Isenman and Singer 1977). In addition, they cite further research (Mann 1969; Rogers, Srivastava, and Heady, cited in Isenman and Singer 1977) that looked directly at production and prices through the 1950s and 1960s, with findings that bolster Isenman and Singer's arguments that the price effects were short-term. An additional concern was that food aid was used to support the government in pursuing policies that did not favor the agricultural sector. The authors stress that food aid can be used to support policies both favorable and unfavorable to agriculture, just as with monetary aid.

Farzin's (1991) work in Somalia sought to evaluate various effects of food aid, including whether or not the food aid displaced commercial imports. This is important for US food policy since the legislation specifically states that food aid must be additional to, rather than displacing, commercial imports. In Somalia’s case, Farzin found that donors did not decrease the amount of food aid arriving after the crisis, resulting in continued dependence of the government upon counterpart funds as well as continued disincentives for the
domestic crop production. The research does show evidence of disincentive effects of food aid through lower prices for consumption goods, but the analysis is based on annual prices and production, thus not lending itself to a more dynamic analysis of the effects.

The role of food aid in price stability has been evaluated by several researchers. Farzin found that food aid programs of the donors in Somalia were uncoordinated, resulting in unpredictability of food aid flows which “added to local price instability and increased the risks and uncertainties facing local producers” (p.269). He did not extend the analysis to evaluate how such variability might have affected traders. With research conducted in Ethiopia, Buchanan-Smith (1988, as cited by Maxwell 1991) argues that trader incentives may be undermined by food aid, with unexpected price volatility increasing the risks and reducing inter-seasonal storage. In general, the effect of food aid on market development and traders’ activities has not been a focus of researchers in the past. A recent study on the informal markets in Maputo addressed the relationship between food aid arrivals and the development of the informal markets (Tscherley et al 1996). The research in this dissertation continues from that knowledge base.

In a 1989 survey of literature on the impacts of food aid specifically in an African context, Jones found that the lack of reliable statistical information hampered efforts to evaluate the direct market disincentive effects of food aid. Jones concluded that existing research

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3 Some food aid commodities enter directly into commodity price stabilization programs as reserves. In the current research, the focus is on commodities which enter into the market directly, not through a commodity reserve program. Discussion of price stabilization programs can be found in documents such as Pinekney 1989 and Mellor and Ahmed (1988).
shows that the more important effects of food aid may stem from the policy disincentives from food aid rather than the direct market disincentives observed in prices. Nevertheless, Jones writes that “given the lack of reliable statistical information the true extent of [direct market disincentives] has been unclear” (p. 16).

2.3 Methodologies

Researchers have used a variety of tools to reach their conclusions. In the early literature, basic price and quantity analysis was used, including some correlation coefficients and ordinary least squares regression analysis. Examples are Isenman and Singer's (1977) work in India, Khadka (1989) in Nepal, and Stevens (1979) in four African case studies. Isenman and Singer did cite two other multi-equation studies of food aid in India. However, in their analysis, based on a “common sense view,” an expected yield was estimated and then expected prices given that yield. Those prices were compared to the realized prices and the food aid to see if lower than expected prices could be associated with years in which food aid was high, and it was found to be true. Then, the authors looked to see if years of low prices for food grains were followed by declines in production that could not be explained by rainfall, and the evidence was less clear.

As Stevens did in 1979, Farzin’s (1991) analysis uses aggregate price, import, and production data, showing trends over time, with narrative on economic relationships connecting the pieces together. Farzin’s study focused on the issue of import dependence and changes in consumption habits. He supported his conclusions by comparing consumption data and relative consumer prices over different time periods during which
there were food aid arrivals. This follows Maxwell’s (1991) recommended use of both quantitative and qualitative methods for evaluation, as reflected in Maxwell’s (1986) study in Senegal, where lack of data frustrated detailed evaluation.

As data and computers have increased technical potential, researchers have developed general equilibrium models. An example of this type of analysis is Cathie’s (1991) research on Botswana using a social accounting matrix for the period 1965-1984 and aggregate data on production, income, imports, exports, prices, labor remittances, and net resource inflows. The data demands of this analysis make it inappropriate for the current case. In addition, the annual analysis ignores the intra-annual dynamics of the supply and price relationships.

Micro-level studies have been used to evaluate food aid, as with Bezuneh, Deaton, and Norton (1988), but the focus was on food for work programs and the direct effects upon household resource allocation of the recipients of the food aid.

In the current literature on the effects of liberalization and structural adjustment, time series techniques are commonly used in price analysis, to determine if real prices have increased or decreased, and to estimate the variation and possible structural shifts. The development of market information systems in many countries during the 1980s has enabled researchers to incorporate time series analysis, previously limited by the data constraints.
The literature, while addressing the issue of producer prices and food aid, has not had the detailed price and arrival data necessary to look at the short-run dynamics and the uncertainty that may be added to production and trading within a given year. While the average annual price may remain the same or even be higher, it may be the distribution of those prices through the year that is of interest to traders and producers.

Lavy’s (1991) analysis is the only article specifically on food aid found that uses VARs, the econometric approach that will be used in this research. Farzin used annual data on aggregate cereal production, imports, and food aid for 33 countries in sub-Saharan Africa for the period 1970-1987 to evaluate whether food aid had positive or negative effects on the economies. The results point to food aid having a significant positive effect on food production over time. However, given the heterogeneity in the countries, the difference in relative importance of food aid between the countries, and the different policy and market environments involved, as well as structural changes during the period (independence, economic reforms), there are doubts as to the validity of the results. Lavy does attempt in various ways to deal with the heterogeneity, however data constraints are present.

2.4 Market integration in the food aid literature

The market integration literature contains many examples of time series econometrics from the early use of price correlation coefficients over time and space, to notions of Granger-causality, to more recent work with Error Correction Models (ECM) and cointegration analysis. All of these analyses are based upon the Law of One Price, with variations due to assumptions about competitiveness and efficiency.
As was found with studies attempting to assess direct food aid effects on markets, analysis of the price discovery process involves so many factors that structural models are not possible in a developing country environment. Few countries collect the entire set of data necessary to correctly specify a structural model. In addition to the data problems, structural models are identified on the basis of strong restrictions on the parameters and their interactions.

Time series modeling has added to the recent work with market integration, enabling analysts to use these techniques to model relationships over time. Sims promoted vector autoregressions (VARs) for macroeconomic policy analysis. He stressed that the VARs are able to evaluate the long-term trends between variables, and the responses of different variables from shocks from other sources.

One of the most difficult aspects of this type of econometric analysis is linking the statistical relationships to sound economic theory. In the early work with VARs, found in articles by Sims, for example, researchers identified systems assuming that the simultaneous relationships between the variables followed a strictly recursive structure. This is a strong assumption, often violated in reality. Recent developments in computer technology and econometrics have enabled analysts to develop other nonrecursive systems for identification based on economic reasoning.

It is still important to bear in mind the cautions of Harriss and Faminow and Benson regarding what prices can tell, based upon the economic structure and physical reality.
That two prices move together may indicate competitive markets effectively operating. However, the same comovement can be found where an oligopolist operates or where the government administers prices. Prices in two spatially separate markets may move together not because the markets are directly connected, but because both markets are affected by some common phenomenon.

Sexton, Kling, and Carman (1991) used weekly data to model market integration in the point-space tradition, with each market having its own supply and demand factors. In equilibrium, there are three possible arbitrage regimes: efficient arbitrage, relative storage, and relative glut. The existing regime depends upon the transaction costs, the price in the markets of the supply region, and the autarky price of that region. There was trade when the difference between the market price and the autarky price was greater than the transactions costs.

In an analysis of market integration and the transition from war to peace in Ethiopia, Dercon (1994) provides an example of the econometric analysis using error correction methods, an adaptation of VARs in which long-run relationships between markets are key. This will be discussed further in Chapter 6. The author’s comparison of different time periods is based in part on separate analyses for each period. For some aspects, regressions are estimated using dummy variables for the war to peace transitions. The latter method may be questionable when underlying structural changes are ignored in the dummy variable simplification.
In addition to the classic spatial market integration, with the same commodity in two spatially distinct markets, researchers have applied market integration analyses across commodities. When two commodities are substitutes or complements, as is the case with white and yellow maize products, the prices for each are expected to move in concert. Regarding substitutability, Sexton, Kling, and Carman state that if goods are not perfect substitutes (i.e., there is no stable premium between them), “then their price difference may systematically range above or below \( \sigma \), (the premium) in response to variations in each product’s individual supply-demand factors” (p.574). This relationship between products’ prices over time is part of the analysis needed in cases where the food aid commodity is distinct from the locally produced commodity.

2.5 Analytical concerns in the present study

Back in 1977, Isenman and Singer point out the three major factors in determining whether or not food aid has a price disincentive effect on farm production: 1) the extent to which food prices are depressed with the arrivals of food aid; 2) the aggregate supply response of farmers to price changes; and 3) other nonprice constraints on production and incentives to produce, such as the lack of inputs. The present research first looks at prices and whether they are affected by food aid, using as analytical support recent developments in econometrics in addition to the common sense qualitative analyses suggested by Maxwell(1991). In addition to the direct price effect, this research addresses the potential disincentive effects upon traders that stems from unpredictable variations in prices. Points 2 and 3 of Isenman and Singer’s list cannot be answered with the current research, although qualitative analysis provides orientation on possible answers for Mozambique.
Thus, both the food aid disincentives research and the market integration research offer tools that will be helpful for the present study on food aid in Mozambique. In the next chapter, the structure and conduct of the maize markets will be described in order to set the stage for the econometric work that will evaluate the market outcome in the changing economic environment.
Chapter 3

Maize Markets

3.1 Introduction

Walking into any market in Mozambique, the observer will see many people selling white and yellow maize grain or flour. Prices observed in these markets are the end result of the interaction of many agents, thus information on how supplies arrive in the markets, who is involved in the process, and the information available to the agents enables the information in prices to be analyzed. To interpret changes in prices, a thorough knowledge of the organization of markets is necessary, including the competitiveness, the integration between markets, and the role of the private and public sector.

Mozambique’s fight for independence and the subsequent years of civil war left much of the production and market infrastructure destroyed or useless. The socialist policies in the post-Independence era introduced changes and then market reforms initiated in 1987 began a new process of change. However, it was difficult for researchers to follow the whole process. The landmines and frequent assaults on the roads made research in rural areas difficult and government funds for research were limited. This has meant a paucity of research on the currently evolving markets, with a few exceptions (MAARP 1990, Quezada et al 1990, Billing 1990, MOA/MSU WP#10 1993).
Thus, in 1994, the Ministry of Agriculture and Fisheries project in connection with Michigan State University (referred to as MAP/MSU) assisted the Agricultural Economics Directorate (DEA) in the development and implementation of a rapid appraisal (RA) of the domestic maize markets, focusing on white maize and the constraints on market development. Earlier research in Maputo (conducted by MAP/MSU in 1992 and 1993) provided much of the basis for the yellow maize markets and food aid analysis, which will be detailed in Chapter 4. Figure 3.1 shows the location Maputo (the capital city), Chimoio (a research site), as well as the provincial boundaries.

This chapter will present a brief description of white maize production and total maize consumption in Mozambique, followed by a brief review of the organization and performance of the white maize markets, focusing on the aspects relevant for the current analysis of food aid and the maize markets. The fragility of the nascent markets, the lack of market infrastructure, the prevalence of the informal sector traders in spite of the bias against them, the high risks in production and trade are all factors that contribute to the effects of food aid on these markets.

3.2 Maize production in Mozambique

Maize production in Mozambique is almost entirely white flint, open-pollinated varieties, with no yellow maize production. Based upon rain-fed production systems, total white maize production in Mozambique in any given year depends upon the timing and quantity of the rains. As can be seen in the rainfall data for Chimoio station in the center of the
Figure 3.1 Map of Mozambique with Maputo, Chimoio, and provincial borders
country (Figure 3.2), there is a single rainy season (unimodal distribution), thus there is only one cropping season per year in most parts of Mozambique. In the late 1980s and early 1990s, war limited the production of maize. Roads and even footpaths to distant fields were dangerous for farmers to travel, so only the fields close to villages could be cultivated in the areas most affected by the war.\textsuperscript{1} Transportation problems also limited the delivery of inputs and consumer goods. Finally, many rural stores were destroyed during the war and traders were prevented from purchasing surplus production. After the drought, many farmers relied upon the seeds distributed by relief agencies and are continuing to use the later generations of those seeds, even though some were hybrids.

As Table 1.1 indicates, annual production was below 500,000 metric tons per annum between 1988 and 1992.\textsuperscript{2} The 1993/94 and 1994/95 crop years experienced both better rainfall and an end to war, and production has begun to increase. Family sector farmers (farmers with less than five hectares of cultivated land) produce approximately 95 percent of total domestic maize, with private farmers, state cooperatives, and mixed farms producing the remaining 5 percent (Agricom 1994). During the 1989-92

\textsuperscript{1} Tschirley and Weber (1994) analyzes rural household production as affected by war and other factors in northern Mozambique in the recent period before the Peace Accords.

\textsuperscript{2} All production and consumption figures in Mozambique must be taken as indicators rather than exact numbers, until new censuses of the population and of rural production can be conducted.
Figure 3.2 Total monthly rainfall at Chimoio station, 1991 - 1995

period, the large-scale commercial sector (including mixed companies and state cooperatives) produced an average of 22,000 metric tons annually, with 95 percent sold on the market. According to AGRICOM records, during the 1989 - 1992 marketing years, an average of 76,600 metric tons of maize was commercialized per annum (MA/DEA/Estatistica, 1994). By 1994, production was estimated at 527,000 metric tons, with 158,000 metric tons projected for marketed surplus (ICM 1995).

Per hectare production estimates for the family sector vary. A 1993 farm household survey of twenty districts nationwide by MA/DEA/Estatistica found that district average yield per hectare ranged from a low of 259 kg/ha in Buzi District in Sofala to a high of 1,330 kg/ha in Gondola District in Manica (MA/DEA/Estatistica 1995). From the same 1993 survey, average marketed production by the family sector was 14 percent of total maize production. As indicated in Figure 3.3, production of maize in Mozambique varies by region. The southern districts are generally less productive for maize due to soil type, soil exhaustion, and rainfall patterns, with most districts producing less than 5,000 metric tons annually. In the central and north, production varies by district, with districts in Nampula, Zambezia and Cabo Delgado having more than 10,000 metric tons each.

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3 The marketed tonnage estimated by AGRICOM and by ICM is based mainly upon the formal sector trade, thus reflecting the minimum marketed maize quantities. Actual quantities marketed in the country may be much larger due to the strong participation of the informal sector.
Figure 3.3 District level maize production in Mozambique, 1993/94
3.3 Maize consumption in Mozambique

Maize consumption figures are difficult to estimate due to the lack of recent household consumption surveys, population changes during the war, and no recent census of population. Maize is a major staple, although some regions of the country consume manioc or rice as an alternative staple. Across the 10 regional capitals (excluding Maputo), in a 1992/3 survey of income and expenditures, 30 percent of average monthly total household expenditures went toward bread and cereals, about half of which (49%) were expenditures on maize products (Republic of Mozambique, CNP/DNE 1994). Thus, 15 percent of average monthly household expenditures in these urban zones were on maize. In Maputo, a household expenditure and consumption survey conducted in Maputo in 1991/92 estimated that for the poorest 20 percent of households, household expenditures on maize products were 18 percent of total household expenditures at that time (Sahn and Desai 1993), however the drought was affecting consumption patterns during the survey period and a new survey is needed.

The income and expenditures surveys from the provincial capitals that were cited above did not have consumption components. Rural traditions and the past unreliability of the markets means that many urban households have land plots in the surrounding rural areas and cultivate basic consumption goods. The DNE 1992 urban household survey indicated that an average of 73 percent of the households in the provincial capitals own agricultural land, reaching almost 90% of the households in Tete, and many produced maize for own household consumption (Republic of Mozambique, CNP/DNE 1994). In the 1994 preference survey in poorer neighborhoods of Maputo, 47 percent of the households
indicated obtaining at least some maize from nonmarket sources, including maize from 
own fields and from friends and relatives elsewhere, although 90 percent said that market 
purchases were the main source of maize for the household (MAP/MSU WP # 18, 1994).

The Cornell consumption survey in Maputo in 1991/92 was undertaken when regional 
drought and war limited consumption alternatives and affected relative prices, so it is 
difficult to estimate actual consumption, yet this study provides the best estimate available. 
In terms of total consumption, Dorosh et al. (1993) used the 1991/92 household 
consumption survey to calculate Maputo urban area maize consumption of 110,000 metric 
tons annually, about 9,000 metric tons monthly. When comparing this to a total 
nationwide marketed amount of 76,000 metric tons annually, the need for imports is clear, 
at least until production of maize for the markets can increase, and transport can get the 
supplies down to the Maputo consumers.

In consumption studies, there has been extensive discussion on the substitutability of white 
and yellow maize. Tschirley et al. (1996) present the strong evidence that white and 
yellow maize products are imperfect, but close, substitutes\(^4\), with yellow maize an inferior 
good compared to white maize, but cross-price elasticities would appear to be high\(^5\)

\(^4\) Perfect substitutes require that consumers would be indifferent to the two commodities at some 
fixed margin between their prices; however, in white/yellow maize consumption, approximately one-
quarter of consumers indicated in a 1994 Maputo household survey that they would not consume 
yellow maize regardless of the price differential between white and yellow. Thus the goods are 
imperfect substitutes.

\(^5\) The cross-price elasticity of demand for white and yellow maize products remains unknown. 
Dorosh et al. (1995) estimated a very low value of 0.013 for the elasticity of demand for yellow 
maize with respect to white maize price; however the data were collected at a time of increasing white
Women in Mozambican households use either white or yellow maize to make the local "chima", a maize porridge eaten daily. There are regional differences on preferences and substitution of commodities in consumption. In some regions, manioc becomes a hungry season substitute for maize products, as in the north. Rice is considered the preferred good (to maize products) for many urban households. In terms of complements for the consumption of maize products, there are no clear choices, since the types of sauces used with the "chima" vary greatly, with peanuts and dark green leafy vegetables predominating.

Consumption of maize products depends upon the household income level, composition, and preferences, as well as prices. The preparation methods for white and yellow maize are similar enough, such that preparation costs do not vary greatly. However, for hand-pounding, the flint maize varieties (including the white maize varieties grown in Mozambique) are harder and lose less of the endosperm, resulting in a preferred "chima", while the dent varieties (including all of the yellow maize that arrives in Mozambique) tend to become powder with the pounding, resulting in a pastier "chima". Regardless of how the maize is prepared or the color of the maize, consumers in Maputo and other urban areas depend upon the markets to supply the basic grain, so logically the structure of those markets influences the consumers' options.

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maize scarcity and rising real and nominal prices. The 1994 Maputo preference study (MOA/MSU WP#20) suggests that there should be a much higher value for the cross price elasticity of demand for yellow. The issue will remain unresolved until new consumption analyses can be undertaken in current market conditions or longitudinal studies conducted.

6 For an in-depth discussion on the characteristics of flint and dent maize in consumption in Mozambique, see Weber et al. 1992.
3.4 Rapid Appraisal (RA) Methodology

A rapid appraisal (RA) methodology was selected for the market research, using the basic framework of Structure-Conduct-Performance (S-C-P), focusing on the structure and conduct aspects. As Holtzman (1986) defined it, a RA is "a broad preliminary overview of the organization, operation, and performance of a food system or components thereof, designed to identify system constraints and opportunities". A combination of informal interviews, formal surveys, and secondary data are used. The choice of activities depends upon the objectives and prior knowledge of the system. This methodology is a flexible and rapid way to identify agents and structures (Holtzman 1986), a basic objective of this research in Mozambique.

The RA consisted of the following aspects: 1) informal interviews with key informants, from the public and private sectors; 2) formal interviews, based on survey instruments, with traders in both the formal and informal sectors; 3) direct market observations; and 4) various types of secondary data, including prices, family sector survey data, and infrastructure status.

In each research site, the research team went to at least one retail market site, searching for various types of traders, usually accompanied by enumerators from the market information system, the SIMA. The SIMA enumerators are generally well known in the

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markets, helping the research team to overcome problems that might arise due to lack of confidence of the traders in strangers. Survey instruments were designed specifically for each basic type of trader thought to be operating in the markets, including itinerant wholesale traders, itinerant retail traders, informal retail traders in markets, and formal wholesalers. The interviews obtained information on type of products, costs of transport and of products, sales prices, taxes and fees, units of transactions, suppliers, and clients. With respect to market observations, the research team noted the number of traders, the available transport, the products offered for trade, common units, and other aspects of the basic operations. The language of the interview depended upon the languages of the participants, preferably the local language, but at times in Portuguese.

Various criteria entered into the selection of sites for the RA, including overall agricultural production, production of maize, commercial and parastatal activity in maize markets, access, and population. Variability in the criteria was sought. For example, sites were selected that had good transport access while other sites were chosen for difficult access. Based upon the criteria identified by the research team, seven research sites were selected. Table 3.1 presents basic information on location and characteristics of the sites chosen for the RA, while Figure 3.4 indicates the location of each district on the map. For the 1993/94 production year, Manica Province had the highest estimated maize production in the country, although by 1994/95, it was only fourth in total estimated production. The Beira Corridor highway and railway have been maintained throughout the war and assure accessibility at least near the Corridor itself. The area has been commercially active in
Table 3.1 Characteristics of the research sites for the rapid appraisal

<table>
<thead>
<tr>
<th>Site</th>
<th>Zone</th>
<th>Province</th>
<th>Number of market-places visited</th>
<th>Provincial population in 1993</th>
<th>Provincial maize production in 1993/94 production year (metric tons)</th>
<th>Qualitative assessments</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Level of commercial activity</td>
</tr>
<tr>
<td>Caia/Sena</td>
<td>Center</td>
<td>Sofala</td>
<td>2</td>
<td>1,336,000</td>
<td>52,000</td>
<td>Low</td>
</tr>
<tr>
<td>Chimoio/Sussundenga</td>
<td>Center</td>
<td>Manica</td>
<td>2 in Chimoio, 1 in Sussundenga</td>
<td>659,000</td>
<td>102,000</td>
<td>High</td>
</tr>
<tr>
<td>Homoio/Maxixe</td>
<td>South</td>
<td>Inhambane</td>
<td>1 in each</td>
<td>1,297,000</td>
<td>38,000</td>
<td>Moderate</td>
</tr>
<tr>
<td>Malema/Mutuali</td>
<td>North</td>
<td>Nampula</td>
<td>none</td>
<td>2,957,000</td>
<td>41,000</td>
<td>Low</td>
</tr>
<tr>
<td>Mocuba</td>
<td>Center</td>
<td>Quelimane</td>
<td>1</td>
<td>2,985,000</td>
<td>92,000</td>
<td>High</td>
</tr>
<tr>
<td>Montepuez/Balama</td>
<td>North</td>
<td>Cabo Delgado</td>
<td>1</td>
<td>1,261,000</td>
<td>45,000</td>
<td>Moderate</td>
</tr>
<tr>
<td>Nampula/Ribaue/Namialo</td>
<td>North</td>
<td>Nampula</td>
<td>1 in Nampula, 1 in Namialo</td>
<td>2,957,000</td>
<td>41,000</td>
<td>Moderate</td>
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</tbody>
</table>
Figure 3.4 Map of Mozambique with rapid appraisal sites, July - September 1994
maize markets for years and was the site of market research in 1990. Other sites chosen, such as Caia and Sena in Sofala province, had very poor access to large urban markets and also had poor production in the 1993/94 production year. In the north, Malema and Mutuali had good production but poor access; Mocuba had fairly good production and has limited access to the Quelimane market, while Ribaue was in a similar position for the Nampula market.

3.5. Agents in the markets

3.5.1. Intervenientes

In the marketing of agricultural commodities, the term "interveniente" (loosely translated as "people who act within the markets") is used in Mozambique to designate all economic agents who buy and sell in the market. The following types of intervenientes were identified: 1) farm producers, both family and private sectors; 2) rural traders, both formal rural store traders ("lojistas" in Portuguese) and informal; 3) retailers, formal and informal, all in the marketplaces; 4) itinerant traders, retailers and wholesalers; 5) formal wholesalers; and 6) public sector agents including parastatals and donors. Figure 3.5 presents a stylized view of the major agents involved in the supply of white maize from farm producers to consumers during the RA period. The informal sector was very active between the center and the south, serving as the middlemen and middle women between producers and urban consumers. The formal sector traders supplied the parastatal Mozambican Cereals' Institute (ICM), and the donors. That role definition becomes important in discussing the fragility of the maize markets, as well as the sources of
Figure 3.5 Principal marketing channels for domestic white maize observed during Rapid Appraisal in 1994/95 marketing year.
dynamism in those markets. Figure 3.6 indicates the strong participation of the informal sector in accumulation, short-term storage, and assumption of risks, whereas the formal sector participated only minimally in any of these functions during the 1994/95 marketing season, according to the assessment of the RA team.

“Formal” and “informal” are used here to indicate the relationship that the trader has with legal authorities. Formal sector agents are registered as retailers or wholesalers with the Ministry of Commerce and have legal status. Informal agents do not have legal recognition for their commercial activities. At the retail level in the marketplaces, there is little difference between the formal and informal. At the wholesale level, however, the formal sector wholesalers have more resources and permanent assets than the itinerant wholesale traders.

3.5.2 Marketing channels prior to ERP

In the 1980s, maize was marketed using a combination of private and public sector agents. The first buyer was the “lojista”, the formal sector rural trader who engaged in a variety of activities, including buying and selling of smallholder production, provision of production inputs and consumer products, and provision of credit. Lojistas sold the agricultural commodities to the state sector or to large-scale formal wholesalers, and then through the government shops or private retailers, the maize was bought by consumers. A few lojistas said that they bought limited quantities of white maize to store and then sell back to consumers in the hungry season, but this did not appear to be common.
<table>
<thead>
<tr>
<th>Function</th>
<th>Bulking</th>
<th>S-T Storage</th>
<th>L-T Storage</th>
<th>Transport</th>
<th>Processing</th>
<th>Risk bearing</th>
<th>Information</th>
<th>Capital</th>
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<td><strong>PRODUCERS</strong></td>
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<td><strong>INFORMAL SECTOR</strong></td>
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<td>Rural store trader</td>
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<td>Distrib. wholesaler</td>
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<td><strong>PUBLIC SECTOR AND OTHERS</strong></td>
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<td>Donors/NGOs</td>
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Note: Table shows the assessment of importance of different agents in fulfilling market functions. Transport is the provision of transport and does not include arranging for transport. S-T Storage is short-term storage of less than 1 month; L-T Storage is long-term storage of more than 1 month.

**Figure 3.6** Agents and functions observed in the white maize markets, July - September 1994
During this period, there were official price schedules for maize from the producer level all the way to the consumer level. With the government as an active buyer and seller on the markets through its agricultural products' marketing board AGRICOM, the official prices were relatively effective. The government granted monopoly trading rights to lojistas for their zones of influence. The resulting marketing system had the lojistas purchase maize and other agricultural products from the farm producers; the lojistas then sold directly to the parastatal marketing board or to a wholesaler who traded with the marketing board or sold maize at the retail level. Thus, private sector traders were active in the white maize markets at both wholesale and retail levels.

The lojistas were most often of Portuguese or Asian descent and, at the time of Independence, many of the lojistas left the rural areas, either for the cities or for foreign destinations. During the ensuing war years, many stores were damaged or destroyed, and so in some regions, operating stores are rarities. By 1992, the official statistics registered more than 10,000 stores, of which 33 percent were either destroyed or non-operational, the majority in rural areas (Republic of Mozambique, CNP 1993). According to the Provincial Directorate of Commerce in Manica, a major maize production zone, out of 461 authorized retail outlets in the province, 209 stores were destroyed, 74 were non-operational for other reasons, and 178 retail stores (39 percent) remain in operation, many of those in the urban areas of Chimoio and Manica City (personal communication, Director of Commerce, Manica Province, 1994).
The effects of the war were less severe in the north such that lojistas still buy maize from the producers for sales to private wholesalers or the parastatal ICM. The informal sector development has lagged behind in this zone, as well. Throughout the country discussions on the “commercial network” and market development involve rehabilitating these multipurpose rural stores. In the meantime, other marketing channels are developing to fill the void left at the producer level, particularly in the hard hit central zones of the country.

3.5.3 Marketing channels in the informal sector

The informal sector has grown tremendously in the period since the PRE began and especially since the Peace Accord took effect. This sector has no legal status and is occasionally the target of police crackdowns, although the government for the most part looks the other way. Initially, the informal sector was focused in the urban areas, selling small quantities of goods obtained through illegal imports, through leaked food aid or ration shop supplies, or through other means. The informal urban maize traders traveled wherever transport was available in order to obtain supplies, including the southern production areas of Gaza and Inhambane as well as Swaziland.\(^8\) There was also active trading in food aid yellow maize supplying towns such as Xai Xai and Inhambane. After the Peace Accords, the geographical range expanded to include the central production areas in Manica Province, whose location is shown in Figure 3.1.

\(^8\) MOA/MSU Working Paper #10 (1993) presents a more detailed presentation of the growth and operation of Maputo informal markets for white and yellow maize products.
The informal traders from Maputo and Beira travel to the production areas with cash to purchase grain. They go into the rural areas, following the recommendations of other traders, friends, and family. Traveling with cash for grain purchases, empty sacks, and a tarp to cover the maize, they live for a week or so at a crossroads or truck stop, buying white maize that the farmers carry on their heads from the farm to the crossroads. Sales are based on volumes, so no scales are needed. There may be several different traders at a given spot, either friends from Maputo or competitors from another city. At one crossroads in Manica provinces, there was observable competition between two women traders from Maputo sitting together on their sacks at one side, and three male traders from Beira, with their sacks on the other side. Farmers approached on foot with 30- to 50-kilogram sacks of maize carried on their heads, seeking the best price.

After purchasing up to the limit of their funds, the itinerant traders hire transport to the nearest paved road and then transport to the city from which they came. They sell the maize in bulk on the fringes of the markets to retailers from the market, who in turn sell in small, nonstandard units to the consumers. There is a notable shift in gender of the traders between regions, with women traders from the south and men traders from the center and north. Cultural and ethnic differences may explain the shift.

The informal sector dominates retail sales of domestic white maize in Maputo and elsewhere. After the PRE in 1987, informal marketplaces began to appear and grow in Maputo, often near the official marketplaces. Called "dumbanengues" in the south and "tchungamoios" in the north, the informal marketplaces abound with individuals selling
basic food stuffs, fuel, and other consumption goods, in small units. Edible oil is sold in sizes as small as a bottlecap, while maize grain and flours are sold by the bowl, cup, or can. In Maputo, the most common unit is a used infant formula can which holds about 800 milligrams. Traders group themselves by commodity and competition appears to be strong, with little price variability or price bargaining for the most common foodstuffs. As indicated in surveys done in Maputo markets, many white maize retailers obtain white maize from itinerant traders within the same market or from a nearby larger market. Thus, the informal traders fulfill most of the marketing functions from rural producer to urban consumer.

3.5.4 Marketing channels in the formal commercial sector

As will be seen, the formal sector and the informal sector in the white maize markets do not have joint transactions. The formal wholesalers obtain white maize in two basic ways. As noted earlier, the formal rural retailers, “lojistas”, provided maize purchased from producers and sold to the wholesalers, a system still in place in the north. Alternatively, in areas in which the rural lojas were largely eliminated, the formal sector wholesalers send out their representatives to purchase white maize from private and family sector producers. The final purchaser in both cases is either a donor or ICM.

The weak participation of formal wholesale agents in white maize marketing, as shown in Figure 3.6, stems less from supply difficulties than from the perceived lack of a stable

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9 Formal and informal sector trading of yellow maize commercial food aid will be discussed in Chapter 4. Formal and informal do have continued direct trading relations, with yellow maize.
market for the white maize. During the RA, wholesalers complained in every part of the country about the “lack of a market” for white maize. Accustomed to dealing with parastatals that were authorized to buy maize at the official price, wholesalers had not developed private markets for white maize and were not interested in storing what is perceived to be a risky commodity. In 1994, wholesalers became active in the white maize markets only when the donors and ICM began buying white maize, providing the traders with a guaranteed market for immediate sales of maize. Wholesalers bought white maize with prior knowledge of the buyer and the price, thus minimizing the price risks.

3.5.5 Marketing channels and the public sector

Over time the public sector role in the maize markets has shifted. As noted earlier, before the PRE, the government maintained a minimum price system by being an active buyer and seller on the market. Since 1987, that role has greatly diminished. Urban ration shops have been eliminated, and the new marketing parastatal ICM was established in 1994 without the substantial subsidies of previous agencies. AGRICOM, ICM’s predecessor, was declared bankrupt and dissolved in 1994, with its assets turned over to ICM, after years of government and donor subsidies.10

ICM uses commercial bank loans in order to operate in the marketing of maize and the general manager speaks of the need to be a financially sound, independent profit-making

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10 During the RA, most traders still referred to the parastatal agency as “AGRICOM” rather than “ICM”, suggesting that there was no perceived difference between the two agencies other than the name.
business in order to survive. In the future, it is believed that ICM will have to respond to market forces, paying no more than what they can profitably pay.

Occupying the same buildings, sometimes without even a new nameplate, ICM has lost markets due to the problems that traders and farmers had with the previous parastatal, AGRICOM. In a liquidity crisis during the 1993/94 marketing season, AGRICOM issued checks in 1993 that could not be cashed for at least several weeks after maize was received, discouraging future trades. In a glaring example in Manica Province in August 1994, one family sector producer with 10 50-kg sacks of white maize to sell preferred to deal in cash with a rural trader at 450 meticais/kg rather than travel 2 kilometers further to the ICM warehouse and possibly receive 550 meticais/kg but in a check. The rural trader said that AGRICOM’s August 1993 check to that farmer was not honored until January 1994.

Nevertheless, in 1994, ICM purchased 34,000 metric tons from traders and producers throughout the center and north of the country. Of that, about 16,000 metric tons of white maize were sold by ICM to private traders. Otherwise, the maize that enters this marketing channel of formal wholesalers to donors or to ICM is not destined for the retail markets. ICM purchased 22,000 metric tons for the WFP, while donors and non-governmental organizations directly purchased up to another 20,000 to 30,000 metric tons. Thus, around 50,000 (somewhere between 42,000 and 52,000) metric tons was distributed by non-governmental organizations to people without effective demand,
including returned refugees, internally displaced persons, and ex-soldiers. As a result, the local purchasing channel removed 50,000 metric tons of marketed surplus from the retail trade available to consumers. Considering that total marketed surplus was estimated to be about 123,000 metric tons, this represents 40 percent of white maize marketed. This was the maize marketing channel of the formal sector. The donors have made no long term commitment to continued local purchases, and so this channel may no longer be significant in a few years time, leaving the formal wholesale sector without a guaranteed market, likely reducing formal sector participation in white maize markets, unless private market channels develop.

The government still maintains a minimum producer price policy, with the panterritorial, panseasonal prices set at the beginning of the marketing season each year (March or April). Figure 3.7 shows the nominal official producer prices, along with the actual retail level prices in three markets: Maputo, Chimoio, and Nampula. When the actual retail price and the announced producer price are close, there is no potential retail margin left. Farmers can get the retail price by traveling to the markets to sell. Alternatively, if the parastatal ICM were purchasing from farmers, farmers could get the official price. If farmers can only sell to local traders due to transport or other constraints and there is no profit margin for the traders, there will be no maize traded at the official price. Thus

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11 It is possible that some of the maize supplies distributed in the emergency programs were then resold by the participants into the market. The extreme scarcity of alternative consumption staples and the high market prices for them makes it likely that leakages would be small and would not enter Maputo markets since distributions are conducted elsewhere. During the RA, leakages from the distributions to demobilized soldiers were found, but this was highly localized.
Figure 3.7 White maize grain retail prices in Maputo, Chimoio, and Nampula, and official producer prices, Jan.2, 1993 - Nov.25, 1995 (nominal meticais/kg)

Source: MAP/MSU SIMA database.
farmers are likely to face lower than official prices when the retail and official producer prices are close.

In 1994, there were continued difficulties with the producer price policy. The government declared a minimum of 700 meticais/kg and then reduced that to 550 meticais/kg, in part because the donors indicated reluctance to initiate local purchases of white maize at the 700 meticais/kg price. Without the donors participation, ICM has limited access to bank credit and would likely have not participated in the marketing season in any significant way. This would leave the government with no real way to enforce a minimum price policy. Another problem in 1994 stemmed from the official announcement of the minimum price when the marketing season had already begun. This late date prevented producers from adjusting their planting or cultivation investments in accordance with the price. By changing the price after an official declaration, the government further weakened the incentives that an official minimum price might give, leaving uncertainty about the policy's efficacy in future years.

If the government is no longer a buyer, the minimum prices become irrelevant or a hindrance to many producers and traders. The Ministry of Industry, Commerce, and Tourism (MITC) is responsible for enforcement of the minimum price policy, with very limited success. One district administrator lamented that the policy may take markets

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12 A similar scenario is being played out in January 1996, as the World Food Programme indicated that it would not purchase local maize at the official white maize producer price of 1450 meticais/kg for 1996, about US $132 per metric ton at January exchange rates.
away from the farmers, for if he were to enforce the official prices, no traders would buy maize from the farmers at all, and the farmers would be left with maize rotting in storage. For example, a rural store in Nampula Province was closed by an official of the MITC in August of 1994 for purchasing at prices below the official producer price. Yet retail prices in Nampula City at that time, about two hours away by unpaved road, were at or slightly below the official 550 meticais/kg (Figure 3.7), leaving traders no potential margin for covering transport costs if the maize were sold in the market. Traders also cited such closings as harassment, adding another risk factor for private traders due to discretionary enforcement.

3.5.6 Role of processing industries

In industrialized countries, one of the main intermediate sources of demand for raw materials is the processing industry, which needs a reliable supply. The industrial maize milling sector is now beginning to recuperate in Mozambique. In 1995, after several years of reliance upon yellow maize food aid imports, the industrial mills began purchasing more domestic white maize for processing and sales. The Companhia Industrial Matola (CIM) is a recently privatized industrial mill. It purchased 2,000 metric tons of white maize in the north for maritime shipment to the south for milling and distribution near Maputo. This sector could provide a source of demand for the formal wholesalers, but as yet little white maize is involved in these trades.

In Maputo, small-scale maize processing mills can be found near every market, as retailers and consumers buy grain in bulk to take to the mills for custom processing. A recent
nationwide survey of small-scale mills found that almost 100 percent of mills work solely on commission basis, processing maize owned by third parties (MAP/MSU Working Paper #21, 1995). Thus, this sector does not provide a direct source of demand for the white maize.

3.5.7 Imports and exports

A variety of factors influence imports of white maize. In the past, the country has imported white maize food aid from Mexico or from countries in the region, particularly Zimbabwe. These latter are known as triangular transactions, in which a donor purchases maize from a surplus country in the same region as Mozambique. Generally, the world markets for white maize are thin, and regional supplies of white maize are covariant with production variability in Mozambique, making these markets unreliable, particularly in the times of drought, when the need is greatest. However, the southern region of Mozambique suffers from a structural maize deficit and will need supplies even in the best of production years. Whether traders purchase maize from South Africa or from central and northern Mozambique depends upon the relative prices and costs of delivery. One formal trader did import maize from South Africa in 1995. Since September 1995 and in previous periods, small scale informal traders have continuously brought in the finely processed white maize flour from South Africa. The South African price for white maize products thus puts a ceiling on the prices for domestic maize in Mozambique.

White maize exports are illegal according to the food aid agreements, as long as Mozambique is receiving maize food aid from USAID, and thus such trade is unregistered.
Trade between Malawi and Mozambique has developed in the postwar period, but the direction of white and yellow maize trade depends upon the relative prices in each. At times, maize may flow from Malawi to Mozambique; at other times, the flow is reversed.

3.6 Additional considerations

3.6.1 Nonmarketed production

The above details on market channels must be taken in the context of a semi-subistence agricultural sector. By all estimates, less than 25 percent of the maize produced in Mozambique enter these market channels. Home consumption is still the most important destination of white maize, and many households obtain grain through nonmarket exchanges, though the volume of these transactions is not known. Development of the maize markets is needed to provide higher cash income potential for rural households, as well as reduce the vulnerability of land-poor households (Tschirley and Weber 1994). Overall market development ensures the availability of consumer goods and services, providing additional incentives for households to invest in crop production for the market. As various authors (e.g., Kyle 1991, Barker 1985, Billing 1990) have noted, the serious lack of consumer goods in rural Mozambique, especially in the past 10-15 years, has lessened the incentive for farmers to produce for the market.
3.6.2 Marketing margins and price risks

Table 3.2 presents indicative marketing margins from the RA in 1994 for various types of traders in the white maize markets.\textsuperscript{13} While these margins are based on a small, purposive sample, they can help to evaluate the potential effects of price variability on different traders in the system. Consider the case of the formal wholesale traders in Nampula. If they pay the legal minimum producer price, pay all of the taxes, and then sell to ICM in Nampula, they obtain negative returns. This is not to say that the formal traders are participating in a losing activity; rather, if they do buy white maize, they cannot pay the legal price and cover costs, let alone make a normal profit.

In connection with this, comments from the formal traders throughout the country during the RA can be expressed in the often heard phrase “No ha mercado” (“there is no market”). By this, traders meant that there was no satisfactory market, for they would not buy maize unless they knew the prices and the buyer beforehand. The example represented by results of the Nampula formal wholesalers assumes that traders do not store the commodity for any length of time because there was little observed storage by formal traders in the production regions. “Having a market” means quick turnover, guaranteed profit, no price risk. During the RA, only two formal traders were interviewed who stored maize for later sales in the hungry season, and both would sell at the retail level, in small units at rural lojas, not wholesale.

\textsuperscript{13} The table only looks at white maize trade, not at the formal traders in the yellow maize markets. As will be seen in Chapter 4, the low official consignee price leaves a wide margin for rents when market prices are high, rents which are captured by the formal traders.
| Costs, prices, and estimated margins for one 50-kg sack of maize (in meticais) | Type of trader and location |
|---|---|---|---|---|---|---|
| | Itinerant wholesaler in Chimoio | Itinerant wholesaler in Ilé/Mocuba | Itinerant wholesaler in Mulema | Formal wholesaler in Nampula | Informal retailer in Maxixe market | Informal retailer in Chimoio market |
| Destination | Maputo market | Quelimane market | Nampula market | ICM in Nampula | Maxixe market | Chimoio market |
| Purchase price | 28571 | 18000 | 20000 | 27500$ | 47222 | 22222 |
| Taxes and fees | 0 | 0 | 0 | 3250$ | 500 | 500 |
| Transport costs | 10714 | 7000 | 8000$ | 825$ | 0 | 3400 |
| Packaging cost (sacks) | 2500 | 2500 | 2500 | 2500 | 500 | 500 |
| Other costs (milling, credit) | 0 | 0 | 0 | 250$ | 3000 | 0 |
| Own labor: time | 0.1 days | 0.1 days | 1.5 days$ | <0.01 days | 1 day | 0.5 days |
| Hired labor: cost | 0 | 0 | 0 | 500 | 0 | 0 |
| Sales price$ | 55000 | 38250 | 43333 | 32500 | 62500 | 33333 |
| Transport costs as a % of sales price | 19.5% | 18.3% | 18.5% | 2.5% | 0% | 10.2% |
| Gross margin | 48% | 53% | 54% | 15% | 24% | 33% |
| Net margin | 24% | 28% | 30% | -7% | 18% | 20% |
1 Transactions were converted to a standard 50-kg sack unit for comparison purposes.
2 Sales prices for wholesalers are observed wholesale prices at the destination market during interview week (Maputo, 27/8/94; Quelimane 10/9/94; Nampula 3/9/94).
3 The purchase price is the 550 meticais/kg stipulated by the government as the minimum producer price. ICM paid formal traders 600 meticais/kg when ICM sacks were used and 650 meticais/kg otherwise. The negative net returns suggest that they did not pay 550 meticais/kg to purchase.
4 Itinerant wholesale traders were found to pay personal transport only when travelling to production zones.
5 The "Circulation Tax" is 10 percent of the sales price received from ICM. Income taxes not included.
6 Transport costs based on 30 km trip for 200 50-kg sacks at 550 meticais for each ton-kilometer.
7 The cost of capital was based on the 46 percent annual interest rate (including commissions) on commercial loans and one week for each transaction.
8 In Malema, waiting for transport may take up to 10 days.
Looking at the Maputo prices as 1994 progressed can give an idea of what would have happened if a trader had stored white maize for later sales. The purchase price in early August 1994 in the production zones was close to the government minimum price of 550 meticais/kg, with a Maputo retail price of 1050 meticais/kg, leaving a gross margin of 500 meticais/kg. The average monthly price in the Maputo retail market of Xipamanine reached its highest level for 1994 in September with 1750 meticais/kg (nominal price), gross margin of 1200 meticais/kg. The average white maize retail price did not reach or surpass that level again until May of 1995, so a trader with white maize supplies would have done best selling the maize long before the hungry season. Note that in real terms, the retail price of white maize was declining gradually through the September 1994 - March 1995 period, such that real net returns on any maize stored would have been declining over time as well, in comparison with the returns to be achieved in early September, without even including storage costs.

In 1995, a different story emerges, with prices for white maize continuing to rise from August through mid-January 1996. Traders with maize stored are seeing much higher returns. The combination of average local production, reduced yellow maize food aid, and high levels of local purchases of food aid supplies makes the difference between the two years. The expectation of temporal arbitrage opportunities may encourage investments in storage facilities for white maize or other marketing infrastructure. Such investments are unlikely in an environment in which the price risks are high, few risk bearing mechanisms exist (as will be discussed below), counter cyclical price declines are not uncommon, and temporal arbitrage has negative expected returns.
3.6.3 Risk-bearing mechanisms

Price and other risks are common in agricultural product markets. In order to manage price risks, various mechanisms have been developed in markets throughout the world. One major way to manage risk in the US and other countries is the use of futures markets, in which traders and producers buy and sell futures contracts that offset their production or trade positions. There are no futures markets in Mozambique.

Instead, producers tend to minimize their risks through diversification of production. Rather than specialize in the production of a single cash crop, producers have a combination of cash and subsistence crops. In Mozambique, there is not just the threat of a low price for the crop, but there is also the possibility that traders will not be present to purchase maize at all.

The history of a strong public sector presence has conditioned traders to rely upon administrative pricing to remove price risks, setting pan-territorial, pan-seasonal prices, and then serving some of the intermediary functions, as well as some retailing functions in urban areas. In the new market environment, traders reduce their risks through involvement in other activities. In Mozambique, formal traders may buy other agricultural commodities, such as beans, cashews or manioc, for sales to processors or retailers. During the RA, the formal traders had warehouses stocked with processed consumer goods, including imported rice, wines, beer, sugar, paper products, and batteries, rather than agricultural goods.
These mostly imported goods provide higher expected returns on investment than the agricultural products. In particular, for maize, the formal traders indicated a reluctance to become active in maize markets unless there was some kind of guaranteed transaction, such as a commitment from a donor or from the government parastatal to purchase. Lack of capital to invest and problems with the public sector were cited as well during the RA as limiting factors for business expansion in white maize markets.

In the months since the Peace Accords were signed, the variability in maize prices has declined considerably. The remaining variability has three identifiable sources, both on the supply side: 1) weather variability; 2) seasonality, and 3) food aid arrivals. There may be additional volatility added to prices by changing transport costs. Weather variability and seasonality are common sources of risk and have not stopped trading activities and investments in other countries. Food aid arrivals are different. Administrators can remove some of the uncertainty by developing a highly transparent process for decision-making and delivery. Arrivals can be gradually released in order to smooth out the flows to the markets, as will be discussed in Chapter 4.

3.7 Brief summary of the observed marketing functions

Figure 3.5 presents a stylized view of white maize trading as observed during the 1994/95 marketing season. The main marketing outlets for producers were the itinerant informal traders, particularly in the south and center. Urban consumers relied upon informal and

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14 Chapter 6 will describe the characteristics of prices in the war/drought period and in the post-war period.
formal marketplaces for their purchases, with nonmarket sources still important. The figure does not capture the routes traveled by the nonmarketed output.

The formal sector, when it operated in white maize markets, dealt with other formal sector commercial agents or the public sector. The lack of rural stores in many areas of the center and south limits the effectiveness of traditional trading systems. Itinerant traders do not generally sell to the formal wholesalers because higher prices can be obtained by itinerants in the urban markets. As will be discussed in Chapter 4, the wholesalers and informal sector have traded major quantities of yellow maize, and in that case, the wholesalers are the supply source.

The government role with ICM and the direct donor purchases were important in providing the guaranteed price environment for white maize in which formal wholesalers were willing to operate. How long the formal sector can depend upon such an environment remains to be seen.

3.8 Characteristics of the markets relevant for food aid analysis

The following characteristics of the Mozambican white maize markets are critical for the food aid analysis:

- fragility of nascent markets;
- need for investments in marketing infrastructure;
- bias against informal sector;
- high risks due to price volatility; and
- consumption versus market incentives

3.8.1 Fragility of nascent markets
In the past, the public sector has served as risk bearer and disciplinarian of the private sector, such that the formal private traders have not yet developed as independent, risk-bearing agents in the market. With the public sector withdrawing, there has not been a strong movement for the formal commercial sector to step into the gap. There are cases in which private wholesalers have taken advantage of arbitrage opportunities, as occurred when a southern wholesaler traveled in August 1994 to Beira and Chimoio to purchase white maize for later retail sales in the south. Price volatility makes this risky, especially when hungry season food aid shipments arrive, as will be seen later.

3.8.2 Need for investments
The participation of the formal sector in white maize markets has been limited in recent years to supplying guaranteed markets with fast turnover of stocks. Investment in storage and transport infrastructure for the maize markets and related agricultural goods markets is very slow in taking place, in spite of the deterioration and destruction that occurred during the war. Formal traders state that the maize markets are too unreliable, too volatile for other than very short-term activities, and the interest rates on bank credit are too high to justify investments. The informal traders, using their limited available funds for operating capital, lack the capital for investments in anything more than tarps and sacks, and have no access to bank credit.
3.8.3 Bias against the informal sector

As is true in many parts of the world, the informal sector is disparaged by many people in Mozambique, including government officials. In Manica Province, one official wanted to control their activities, accusing informal traders of extracting too much maize from the province, threatening food security. This is a concern that is reiterated by local authorities throughout the country. The formal traders want a level playing field, in which the informal sector becomes formalized, paying taxes and observing rules just as the formal sector must do. Meanwhile, the informal sector is constantly under the threat of sanctions or extortion, yet they are active in the markets. To eliminate the informal sector would take the dynamism and competitiveness out of the white maize markets.

3.8.4 High risks due to price volatility

As will be discussed in later chapters, maize price volatility and unpredictable price fluctuations may be limiting investment and participation in the domestic maize markets. Sources of the volatility and fluctuations include weather shocks, transport constraints, food aid arrivals, and changing government policy.

One aspect that contributes to the price instability is the lack of interseasonal storage. With predictable interseasonal price changes, traders who buy maize at harvest, can store maize and sell it later in the hungry season, realizing profits above their storage costs. In Mozambique, food aid arrivals in the hungry season can depress prices such that there are losses with interseasonal storage. The unpredictable nature and quality of these arrivals contribute to the perception of risk in storage.
Looking at the food aid arrival information, yellow maize arrived in September, October, and November of 1994, placing a damper on the expected seasonal increase in white maize prices. The same phenomenon of a counter cyclical decline or stabilization in white maize prices can be seen in September - November 1992, December 1993 - March 1994, and again in late 1995, and all can be associated with food aid arrivals of yellow maize.

This is exactly why the formal traders in Maputo, when attending meetings with government and donor officials, ask quite pointedly, “How much food aid is coming, when is it coming, and what quality will it be?” This ties in directly with the difficulties of food aid planning and objectives, in which traders want incentives to operate and consumers need food at an accessible price.

3.8.5 Consumption versus market incentives

Food security is defined as “a situation where each person has economical and physical access at all times to an adequate food supply allowing each person to live a productive life, in good health, and without malnutrition or undernourishment” (Laval University 1995). One of the objectives of the commercial food aid is food security, to assist low income consumers, providing a consumption staple at an accessible price. With the war and drought, extreme scarcity meant that the white maize prices soared out of reach as in June 1992, when food aid yellow maize became available as a cheaper alternative. Mozambique did not produce enough food nor generate enough foreign exchange to import food, so food aid was used to fill the gap in the most difficult period, the hungry season.
Now, as local production of the white maize comes back into the markets, finding the appropriate price and the relevant food aid quantities is the challenge. The food aid arrivals are deliberately timed to diminish the rising hungry season prices, yet traders need prices to rise over time in order to cover their storage costs. Policy makers and donors need to strike a balance between accessibility for poor urban consumers and price incentives for rural producers and traders to invest in maize production and marketing.

3.9 Review of key issues with white maize traders

Since domestic maize production began to recuperate after the drought and war, essentially two white maize market channels have developed in Mozambique. Figure 3.5 indicates the flows of these two channels. The formal sector, including commercial traders, the parastatal marketing board (AGRICOM and then ICM), and donors, combine to purchase maize from producers, transport to warehouses in deficit regions, and then distribute to ex-soldiers, returned refugees, internally displaced persons, and others identified as vulnerable groups with no effective purchasing power. Economies of scale in accumulation and transport may be obtained. Only the donors pay for long term storage, with little risk-sharing by the formal traders.

Urban consumers use the second market channel, whereby the informal itinerant traders travel to the production areas, purchase maize directly from the producers, use backhauling transport to return to the city. At that point, the informal urban retailers buy the maize, arrange for milling if necessary, and sell in nonstandard units in the local marketplaces. These informal white maize markets are characterized by small individual
scale of operations, small investments of capital, and rapid turnover. Currently, the informal trading provides the information and physical trading links between surplus and deficit markets such that market integration may be obtained.

There are signs of continued change in the maize markets in Mozambique. In response to very high prices in regions hit by a cyclone in 1994 in Nampula Province, private traders in the north began traveling to Cabo Delgado to purchase maize and then traveling to Nampula to sell it. In August and September 1994, a formal trader from Gaza Province was up in Sofala and Manica, buying two truckloads of white maize to then take to Gaza and sell during the hungry season at retail level. The industrial mill CIM purchased 2,000 metric tons in Cabo Delgado in 1995 to ship to Maputo and mill, selling the flour on the Maputo market. In 1995, one formal trader brought in commercial white maize imports from South Africa. These are all indications that the formal sector is beginning to take advantage of arbitrage opportunities in the maize markets.

Local purchases provide a major impetus to the development of the formal sector trading. That is one of the objectives of such transactions. Local purchases, however, do not represent an addition to domestic supplies. If Mozambique is deficit in producing maize and no substitutes are available, imports will be needed to assure food security, whether those are private sector commercial imports or food aid imports.

Actions taken on the yellow maize markets will condition the opportunities available to both the formal and informal sectors. In the next chapter, the yellow maize food aid
management and distribution system will be described, as well as the markets for yellow maize and their relationship with white maize markets.
Chapter 4

Food Aid in Mozambique

4.1 Structure of food aid

The United States and other donors have imported large quantities of yellow maize as a food aid commodity since the late 1980s, when Mozambique was having production deficits due to weather, civil war, and the consequences of agricultural policies focused on the state sector (Kyle 1991). Averaging 58 percent of total marketed maize supplies between 1989 and 1995, as shown in Table 4.1, commercial yellow maize food aid has been critical in the food security of low income urban consumers in particular. This chapter details the decision making and delivery system for food aid and then presents an overview on how yellow maize markets are organized and how they are linked with white maize markets.

4.1.1 Making the decision on commercial food aid

USAID and the European Union (EU) have been the major donors involved in commercial yellow maize food aid, with the Ministry of Industry, Commerce, and Tourism (MICT) as

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1 This chapter is based upon Tscharley, Donovan, and Weber 1996, and MOA/MSU Working Paper #10, 1993. Those works present more analyses and historical detail on food aid in Mozambique.
Table 4.1 Yellow maize food aid in total availability and market supplies

<table>
<thead>
<tr>
<th>Marketing year</th>
<th>Total yellow maize food aid as a percentage of</th>
<th>Commercial yellow maize food aid as a percentage of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total cereals food aid</td>
<td>Total cereals availability</td>
</tr>
<tr>
<td>1989/90</td>
<td>48.5</td>
<td>21.3</td>
</tr>
<tr>
<td>1990/91</td>
<td>63.8</td>
<td>27.2</td>
</tr>
<tr>
<td>1991/92</td>
<td>70.4</td>
<td>35.0</td>
</tr>
<tr>
<td>1992/93</td>
<td>83.3</td>
<td>59.7</td>
</tr>
<tr>
<td>1993/94</td>
<td>90.9</td>
<td>24.8</td>
</tr>
<tr>
<td>1994/95</td>
<td>61.6</td>
<td>15.7</td>
</tr>
<tr>
<td>1995/96</td>
<td>41.1</td>
<td>6.5</td>
</tr>
</tbody>
</table>

¹ The Early Warning Unit of the Ministry of Agriculture (1994) estimated that 23% of white maize produced for human consumption is marketed.

Source: See Table 1.1 for data, sources, and notes.
the GOM counterpart.\textsuperscript{2} USAID has imported yellow maize for two reasons: 1) domestic US stock availability, and 2) desire to choose a commodity that is self-targeting for low income consumers. In view of domestic maize production shortfalls and the importance of maize as a staple, the MICT requests yellow maize. The EU and other donors have brought additional commercial food aid imports of wheat and rice, but in lower quantities.

When requesting commercial food aid, MICT indicates the quantities and the markets for which maize is needed. Maputo, the capital and the largest urban market with over one million inhabitants is high on the list of priorities, but Beira and Nacala are also port cities that receive commercial yellow maize food aid directly. This research focuses on Maputo since it is the largest consumption market in the country, receives the largest shipments, and thus if food aid does have an effect, it will be strongest in these markets.

The GOM requests specific amounts of yellow maize commercial food aid, corresponding to the anticipated excess demand over domestic production and imports, as well as the need for funds. There is no formula used in the calculation, just rough assessments on supplies and needs. The commercial trade sector has not been involved in the decisions on quantities to import and prices, although during the planning period in 1995, MICT held meetings with donors and consignees in order to get information, ideas, and concerns regarding commercial food aid for the October 1995 - March 1996 period.

\textsuperscript{2} The EU also imports white maize from international markets or from regional markets, however they brought in yellow maize during the drought.
In order to reduce the per unit transport and handling costs, USAID and other donors request shipments in large lots, 10,000 to 25,000 metric tons. Because of the proceeds from monetization, MICT has strong incentives to immediately sell all supplies upon arrival. Likewise, MICT stores the unsold quantities of maize in government warehouses or commercial warehouses at government expense, with high risk of losses through theft, mishandling, and deterioration.

The release of large quantities in a short period of time has obvious effects upon the prices in the markets. Figure 4.1 gives the monthly average retail price of yellow maize and the monthly total commercial food aid yellow maize deliveries in Maputo for April 1990 through November 1995. There are several periods of interest indicated on the figure. In November-December of 1991, a large shipments arrived in Maputo and prices for yellow maize grain decreased, even as white maize supplies were diminishing with the approaching hungry season, and the same happened in November 1994. In late 1992 and early 1993, a series of large shipments resulted in retail yellow maize prices decreasing once again during the hungry season and remaining low over almost a year. In each case, white maize was a scarce commodity, so only yellow maize own supply can explain the downward pressure on supply. Demand factors could also be responsible, but there are no know major demand shifters during the periods being discussed. Tschirley, Donovan, and Weber (1996) conducted initial analysis of the effects of food aid arrivals on the retail
Figure 4.1. Maputo monthly yellow maize food deliveries and nominal yellow and white maize grain retail price, December 1992 - November 1995

Source: MAP/MSU SIMA dataset.
yellow maize prices in Maputo, analysis that will be extended in the empirical chapters of this dissertation.

4.1.2 Consignees and food aid allocations

"Consignees" is the word used to designate the private traders and parastatals who receive allocations of commercial food aid stocks for market sales. Originally, parastatal marketing agencies and industrial mills (including CIM) received the yellow maize grain either for direct sales in government ration shops or for milling and later distribution through the ration shops. After a 1991 assessment report (Louis Berger, International 1991) presenting evidence of the poor payment performance of the parastatals, USAID pressured for private traders to be authorized to receive and market the commercial food aid stocks. This also accorded with USAID policy reform efforts to reduce the role of government in the markets.

The wholesale traders who are consignees are often engaged in various activities: import of foodstuffs such as rice and wheat flour; purchase and resale of domestic agricultural products including white maize, rice, and cashews; milling of maize and wheat grain; and export of agricultural goods, particularly cashews, tobacco, and seafood.

The GOM has a set of criteria to determine which traders are eligible to purchase yellow maize stocks. Among the qualifications are ownership of warehouse facilities, access to means of transport, adequate liquidity, and good standing on payments for previous shipments (Austral 1992). USAID has pressured for the number of consignees to be
expanded such that collusion is avoided in the markets. The EU experience based on only two consignees for a yellow maize shipment of 15,000 in 1992 demonstrates the potential for the exercise of market power in the Mozambican markets. In that case, detailed in MOA/MSU Working Paper #10 (1993), one of the consignees controlled sales to the market in order to maintain higher prices. Only when the next USAID shipment was about to arrive did the warehouse doors open for further sales. Since 1993, MICT has designated at least 18 consignees for each USAID shipment, avoiding that problem.

Increasing the number of consignees to receive maize at the port and diminishing the amount received by individual traders resulted in new problems at the port, with possible delays in unloading shipments. Every day that the ship is docked is costly, and so GOM and the donors want the ships unloaded rapidly and the delivery to consignees completed as quickly as possible. Procedures were modified, such that large scale traders were allowed at the port directly and the smaller scale consignees with less than 1,000 metric tons, went to warehouses to obtain their allotments, thereby reducing pressure at the port. However, thefts from port warehouses in December 1995 and January 1996 are putting this system (and the entire Title III program) in jeopardy.

One of the other benefits of selling yellow maize directly to private traders has been the development of a small-scale milling sector (MOA/MSU Working Paper #10, 1993; MOA/MSU Working Paper #20, 1995). With the industrial mills in crisis and no longer receiving special concessions for the yellow maize, the informal traders and urban households took maize directly to local small hammer mills for grinding into a low cost,
straight-run meal. Generating income and employment, the local hammer mills are now beginning to appear in towns and villages throughout the country.

4.2 Pricing of commercial food aid

The Title III Food for Peace Program of USAID is specifically designed to provide commodities for commercial sale by the receiving government, which then uses the funds generated for development purposes. The price paid by the consignees to the government is determined by the GOM, through its National Salaries and Prices Commission on the basis of recommendations from MICT; the donors make recommendations only.

Regardless of the consignee price set by the government, USAID regulations state that the value (in FAS prices) be deposited by the government of Mozambique for development funds. Figure 4.2 shows the nominal consignee price, along with retail market prices in Maputo. Donors have recommended prices close to the free-alongside-ship (FAS) price.\(^3\) The USAID regulations state that the equivalent value for the FAS price be covered in counterpart funds, regardless of the revenues generated by the government sales.

Consignees are charged a fixed metical/kg rate, and generally prices have not changed during the distribution of a given shipment, except when quality changes necessitate lowering the price. Prior to 1993, the government set a fixed resale price at which

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\(^3\) The FAS price is the price for the commodity placed at the ship in the Gulf Ports, in the case of US maize. It does not include the transcontinental shipping costs, the port handling costs, or any of the other additional costs that are in the import parity price, and so FAS is below the import parity price.
Figure 4.2. Maputo white and yellow maize grain retail prices and official consignee prices (nominal meticais/kg), April 1990 - December 1995

Source: MOA/MSU SIIMA database, Ministry of Agriculture and Fisheries, Maputo.

Retail and official prices are nominal meticais/kg.
consignees could sell the food aid maize. However, since early 1993, traders have been permitted to sell the yellow maize on the market at the market prices.

The low consignee prices do not necessarily result in lower consumer prices. Tschieley, Donovan and Weber (1996) provide the analysis to show how low consignee prices may result in high rents that are captured by consignees rather than by lower prices for consumers. In a quantity constrained system, demand determines the prices in the market, so that as long as the price to consignees is below the market price by a "reasonable" margin, lowering the consignee price even lower makes no change in consumer price.

As Figure 4.2 indicates, the consignee prices are changed infrequently, usually just once each year with the first arrival for that marketing year's hungry season, between September and December. During 1991 and 1992, MICT offered the mills offered a price discount and longer payment periods than traders for food aid maize. The prices on Figure 4.2 do not reflect this price discount; the private trader price is shown. Since 1993, all receivers have been given the same conditions.

Prices have been lowered on a few shipments due to quality problems, some of which was sold at low prices to animal feed agents.\(^4\) The arrival of damaged maize has caused difficulties with planning the allocations to consignees. In 1991 and 1992, MICT sold the shipments immediately to parastatals and wholesale traders, according to the allocations

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\(^4\) The prices in Figure 4.2 do not reflect either the millers’ discount as mentioned above, or the discounted price for animal feed agents of the deteriorated maize sold in 1993.
that had been pre-determined. In late 1992 and early 1993, with famine threatening, large quantities of both emergency and commercial food aid arrived, as can be seen in Figure 4.2. Some of the maize was in poor condition, and the consignees would not accept their allotments. The larger consignees, such as Ignacio de Sousa, Capela, and EURAGEL, evaluated the quality before accepting full consignments, because they intended to store the maize and sell gradually over the hungry season. Because the consignees did not accept delivery of their allotments, GOM had to store the deteriorating stocks of those 1993 shipments in grain warehouses. As shown in Figure 4.2, yellow maize grain retail prices in mid-1993 were close to the consignee price. For example, in June 1993, the consignee prices were 329 meticais/kg (and had been since October 1992) while the average monthly 1993 retail price was 374 meticais/kg, only 14 percent higher.

For the consignees, the relationship between quantities and prices determines the quantities that they will accept from food aid shipments. In a 1995 meeting between MICT, USAID, and consignees, the consignees would not address the issue of a consignee price level until information was released on quantities and dates for both commercial and emergency food aid arrivals and distribution.

4.3 Food aid in the markets

4.3.1 Agents and channels in the Maputo markets

In contrast with the white maize markets, there is active trade between the formal and informal sectors in the yellow maize markets. The formal sector consignees receive allotments of yellow maize which they pick up at the port or warehouses and then store or
immediately sell. Both formal and informal sector redistribution wholesalers arrive at the traders’ warehouses to purchase sacks of the grain (MOA/MSU WP#10, 1993) at the market prices, as indicated above.

There is little delay between the arrival of ship in port and the arrival of the yellow maize in the informal markets. In fact, trucks often leave directly from the port to go to Bazuka and other markets in Maputo. In 1993, “paper trading” developed.5 This trading enabled consignees to sell part of their allotment before it arrived in the port to a trader who was authorized via a paper receipt to pick the maize up from the port directly, as a “representative” of the consignee. While not legally condoned, officials did not take action against it. It results in very fast delivery of yellow maize to the markets. In July of 1993, a USAID shipment began unloading at the Maputo port at 6:00 a.m. MOA/MSU researchers observed the first bags of that shipment arriving in Bazuka market by 10:00 a.m. on the same day.

Informal traders work in the markets in Maputo and other towns in the southern zone. They sell the maize in 50 kilogram bags, usually still in grain form, but a few traders take the maize to local hammer mills for grinding and then sell bags of the flour. The retail traders in the marketplaces then buy the bags of grain or flour to break down into smaller nonstandard units for sale. The informal retail and wholesale traders for yellow maize

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5 Paper trading is described in greater detail in MOA/MSU WP#10, 1993.
work side by side with the white maize traders in the marketplaces (MOA/MSU Working Paper #10, 1993).

4.3.2 Agents and channels in other markets

Traders of yellow maize work in many markets throughout Mozambique, either with commercial food aid or with leaked emergency food aid, as will be discussed further below. Wholesalers from urban areas in the south, including Xai Xai, Maxixe, and Inhambane, are on the list of consignees and take supplies from the port directly to the other cities, although if Maputo prices are high, the bags may never leave Maputo. In other cases, buses and trucks will leave the area around Bazuka market loaded with sacks of sugar and yellow maize for sales in those areas. In Maxixe, SIMA enumerators reported that yellow maize grain was present in the local market in 92 out of the 147 weeks of observations (63 percent) from December 1992 through November 1995.

In the production areas of the center region, SIMA enumerators reported no yellow maize grain present in the market in Chimoio 72 percent of the time (106 out of 147 weeks) in the January 1992 to November 1995 period. Further north in Nampula City, SIMA enumerators reported yellow maize absent in 92 percent of the weeks with recorded data (136 out of 148 weeks). There were scarcities in Maputo, particularly during 1995, when there was no yellow maize grain observed in the Maputo markets between July 22 and October 7. Over the entire 1992 - 1995 period, however, SIMA enumerators reported no
yellow maize grain on the Maputo market in only 17 percent (26 out of 153 weeks) of the weeks recorded.\(^6\)

The absence of yellow maize in the regional markets is a consequence of high transport and other transaction costs relative to the prices in Maputo and the prices of the substitute white maize. The price margins between wholesale in Maputo and retail in Chimoio may have been too narrow, resulting in an efficient no-trade equilibrium. In addition, as noted in Chapter 3, demand in the regional markets is weak while supplies of white maize are relatively abundant. The result is little yellow maize actually moving from urban port regions to more distant towns. The issue of market integration will be discussed in Chapter 9.

4.3.3 Competitiveness in the markets

Tschirley et al. (1996) present evidence supporting the hypothesis of competitive markets for yellow maize, at least in Maputo. USAID requested that MICT expand the number of possible consignees in 1992 in order to avoid market concentration issues, and since then shipments have been at least 18 consignees per shipment. Tschirley et al. (1996) determined that the four firm concentration ratio for the seven shipments between August 1992 and January 1993 was 28 percent, an indication of lack of concentration. Recently, MICT personnel have been more concerned about excessive numbers of consignees,

\(^6\) For comparison, from January 1992 to November 1995, SIMA enumerators reported white maize grain absent from the Chimoio, Nampula, and Maputo markets for 2 percent, 1 percent, and 1 percent of the weeks, respectively.
resulting in problems with certification and unqualified traders causing delays in the delivery of 1995 shipments.

4.3.3 Potential diversion to animal feed

In other countries, people have diverted food aid supplies from human consumption into animal rations, particularly when poultry, swine, and beef industries are willing and able to pay more than poor consumers. In Mozambique, the war decimated small animal husbandry, such that this problem has not arisen in any large scale. There were sales in 1993 and 1994 of deteriorated maize grain to those industries. Examiners for MICT declared the yellow maize grain “unfit for human consumption” and so it was sold at a reduced price to traders and small animal producers, particularly in the poultry industry. It is possible that some of these supplies made their way to the human food chain. However, the deterioration of the grain was perceptible both to the eyes and the nose, lessening the likelihood that large quantities were bought and sold for human consumption.

4.4 Emergency yellow maize food aid in the markets

As Figure 4.3 indicates, large volumes of emergency yellow maize food aid also arrived in Mozambique during the 1989 to 1996 period, particularly during late 1992 and early 1993. There are two basic ways in which emergency food aid enters the market. First it may be stolen from ports, warehouses, or railcars before it ever reaches the targeted receivers or distribution point. Prior to 1993, knowledgable sources indicate that up to one-third of emergency supplies were leaked this way. MOA/MSU researchers identified some emergency supplies in the Maputo markets in 1992. Changes in administration and
Figure 4.3. Monthly food aid deliveries in Maputo, March 1990 - April 1995

Source: MAP/MSU Food Aid dataset

Excludes arrivals to government warehouses and animal feed agents.
transport lowered these percentages. Nevertheless, these leaked quantities exert downward pressure on prices in Maputo. Alternatively, recipients of emergency food aid may sell the food they receive in order to purchase other articles or services. The GOM and non-governmental organizations targetted internally displaced persons, returning refugees, and demobilized soldiers for emergency relief. Most of these populations were in rural areas or in the smaller urban zones of the center and north such that supplies sold by them are unlikely to have affected Maputo markets.

4.5 Summary of yellow maize in the markets

Formal and informal traders have developed business relationships based upon the yellow maize commercial food aid deliveries, with the formal sector as wholesalers and the informal sector the middlemen and women, as well as the retailers. This is in contrast to the dual marketing channels in domestic white maize marketing, with the formal sector serving the public sector needs and the informal sector serving the urban consumers.

GOM sets the consignee prices at levels below the FAS and much below the retail market prices. By involving at least 18 consignees with each shipment, MICT helps to ensure that prices to be charged are established through competition, rather than collusion.

Nevertheless, there are substantial rents to be obtained by the consignees due to the limited quantities. At the retail level, traders of white and yellow maize work in close proximity in the markets, providing a competitive environment
When MICT delivers the maize to consignees at the port of Maputo, traders immediately begin taking supplies to the local markets for sale. The effects of the deliveries in the Maputo and Beira markets can be almost immediate. This research uses the weekly SIMA data in an effort to capture some of the rapid prices movements.

USAID and other donors bring in yellow maize in order to provide government budget subsidies and to help temper consumer price spikes for the basic staple of low income urban consumers. That the yellow maize arrivals dampen yellow maize prices can be seen in the price graphs. Since the government has strong incentives delivery all the maize as quickly as possible to avoid losses in storage, large quantities are released onto the market. These shocks of yellow maize food aid deliveries will be further analyzed in the empirical chapters to follow.

The lack of yellow maize products on the market has important implications for any white maize price declines on these markets. Emergency yellow maize supplies are not leaking onto these markets in large amounts and traders do not bring large quantities of yellow maize commercial food aid supplies to the production regions. Thus, if there is an effect of yellow maize food aid on white maize prices, it does not come from yellow maize supplies introduced directly in those rural markets. This points to the need to assess how food aid affects the white maize prices in the main consumer markets and how those consumer prices then affect the prices in producing regions.
Chapter 5
Data and Preliminary Analysis

5.1 Introduction

This chapter explores the data characteristics and identifies a structural break in the data which separates the sample into a war/drought period and a post-war/drought period. Unit root and stationarity tests confirm that the data do not have stochastic trends, once potential mean and trend shifts are incorporated into the analysis.

5.2 Data sources

Data series were constructed from several different sources. Both white and yellow maize prices were collected at the retail level in urban marketplaces in Maputo. From April 1990 through December 1992, retail prices in Maputo were collected by USAID in Mucoriama market on Saturday mornings, with a single purchase of each product.¹ The commodity is then weighed and the price converted to a standard per kilogram price. The price data from January 1993 through April 1995 were collected by SIMA in the Xipamanine market in Maputo. Each week on Saturdays, enumerators visited Xipamanine and other Maputo

¹ As in many markets in developing countries, commodities are sold to consumers in nonstandard units. In Maputo, the most common unit for retail maize sales is the used 850 milliliter infant formula can, which is filled for the customer and then the contents emptied into plastic sacks or paper. There are very few scales in the markets, so sales are not based upon volume, not weight.
markets to collect three observations on each product for retail and wholesale market levels. To calculate the per kilogram price for retail sales, the quantity of the nonstandard unit was measured by volume in a plastic beaker, and then the per kilogram price was calculated using calculated conversion ratios for each product.

Both Mucoríama and Xipamanine are markets are active in retail maize trade and serve low-income clientele. The USAID/Mucoríama data begin in 1990, whereas the SIMA/Xipamanine data collection for basic staples began collection in 1991, adding grain price collection in late 1992. Figure 5.1 shows the close relationship between the SIMA and USAID data. The SIMA sampling and measuring methodology is more accurate than the single sample of the USAID data, and the SIMA enumerators have extensive training on quality differentiation, thus the SIMA data may be of higher quality. Rather than lose the information for the early period, the two sets were merged with January 1993 chosen as the switching date.

During the 265 week period from April 7, 1990 through April 31, 1995, there were 14 missing values in the white price series and 17 missing values for the yellow price series. Those values were replaced by the mean of the values for the week before and the week after the missing week.

Weekly commercial food aid data set were constructed from data sets and information provided by donors, the Ministry of Finance, Ministry of Industry, Commerce, and Tourism (MICT), World Food Programme, and non-governmental organizations active in
Mozambique. Although a database is being maintained by the MICT in Mozambique for all food aid arrivals, there are gaps due to lack of funding for data collection and revisions. During 1992/93, it was particularly difficult to update the information because of large arrivals, swapping between commercial and emergency programs, variations in record keeping methods by the donors, and delays in shipping. For this analysis, daily off-loading data for commercial food aid were obtained from USAID and SOCOTEC, the firm responsible for overseeing the unloading and delivery of shipments. Detailed arrivals information was also obtained on EU arrivals. The USA and EU account for all of commercial food aid maize arrivals in Mozambique during the study period.

Weekly data are based on the actual delivery of maize into the hands of commercial agents. The numbers may not agree with official USAID or GOM statistics because only commercial sector deliveries are included in the data. If the maize arrived and entered a government warehouse, it would not be included until it is delivered out of the warehouse. Parastatals such as the Empresa de Abastecimento da Cidade de Maputo (Maputo Wholesale Supply Firm, known as EACM) are considered commercial sector agents and are included. During late 1993 and early 1994, some of the yellow maize in stocks deteriorated so badly it was deemed unfit for human consumption and subsequently sold to animal feed operations. Those deliveries were also excluded from the data set on the belief that the inferior maize did not enter the market for human consumption due to its obvious deteriorated state. Losses from the warehouses due to theft are also not included in the food aid deliveries data.
Figure 5.1 SIMA and USAID maize grain retail prices, April 1990 - April 1995
The Consumer Price Index (CPI) data were obtained from GOM. The CPI is estimated on a monthly basis, so conversion to a weekly series was needed. Linear interpolation of the monthly CPI was used to fill in the missing weeks. Data were not available for March and April 1995 for the CPI and so linear trend values were estimated for those two months.

5.3 A structural shift in the data

Plots of the data and of their first differences $(y_t - y_{t+1})$ are presented in Figures 5.2 - 5.7. Inspection of the real maize price charts, there is an obvious shift in the price series. For yellow maize, a sustained downward shift began on November 28, 1992 with a high in real prices of 309 meticais/kg, rapidly reaching a low of 128 meticais/kg by December 12, 1992. This period coincides with the arrival of two large shipments of yellow maize commercial food aid: 1) the Lash Atlantic/Vitoria on Nov. 2 with 33,000 metric tons; and 2) the OMI Missouri/Argo Explorer on Nov. 12 with 21,250 metric tons. In addition, over 50,000 metric tons of yellow maize arrived through emergency programs before the end of December. These arrivals were scheduled to ensure supplies during the hungry season when domestic food supplies would be critically low due to crop failure in the 1991/92 cropping season.

For white maize prices, there was a structural break between February 6 and March 20, 1993. The average real white maize price on February 6 was 644 meticais/kg, but by March 20, 1993, the real price was down to 186 meticais/kg. This period marks the beginning of the first harvest and marketing after the drought, when forecasts of domestic
Figure 5.2 Weekly commercial food aid deliveries and real white and yellow maize prices in Maputo, April 1990-April 1995

Source: MAP/MSU SIMA dataset. Deflated using CPI; Dec. 1989=100. Dashed vertical line indicates April 3, 1993; Bars indicate quantity delivered. Thick line indicates white grain; thin line indicates yellow grain.
production were high and regional production prospects were also good. Not only had production prospects improved, but the Peace Accords had been signed in late 1992 and travel within the country began to resume. Thus, domestic maize could more easily be transported from surplus to deficit areas. With all of the yellow maize available and good prospects for the domestic white maize crop, markets were no longer operating under severe supply constraints.

Maize prices are less volatile after the structural break. This is indicated by a reduction in the variance of real maize prices. The simple sample variance of real yellow prices is 4.4 times greater in the war/drought period than in the post-war/drought period. For real white maize prices over the same periods, the sample variance in the earlier period is 9.4 times greater than in the later period.

Given the structural shifts in supplies and the shifts in the prices, the analysis was divided into two distinct periods, using February 1993 as the separation point. From April 1990 through February 1993, a combination of war and drought limited the domestic and regional supplies of white maize, as well as the internal transport of maize. From March 1993, weather conditions returned to more normal patterns and the Peace Accords were firmly in place. The month of March 1993 is left out of the analyses because it was a transition month in which maize market conditions shifted as both domestic and regional supplies began to reappear in the markets.

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2 Tables 5.1 and 5.5 in the following sections report the sample variances along with other basic descriptive statistics.
5.4 Unit root and stationarity tests

The statistical properties of the variables are important in determining how multivariate time-series models should be specified and estimated. Various tests were implemented to evaluate whether or not each data series was stationary. Hamilton defines stationarity as follows:

"If neither the mean $\mu_t$ nor the autocovariances $\gamma_j$ depend on the date $t$, then the process for $Y_t$ is said to be covariance-stationary or weakly stationary.... Notice that if a process is covariance-stationary, the covariance between $Y_t$ and $Y_{t+j}$ depends only on $j$, the length of time separating the observations, and not on $t$, the date of the observation." (1994, p.45-46).

The term stationarity here will mean covariance stationarity, using Hamilton's definition. If a variable is stationary, we will say that it is integrated of order zero (I(0)), whereas if the variable is not stationary but its first differences are stationary, we will say that the variable is integrated of order one (I(1)).

5.4.1 Stationarity and unit roots

Stationarity of the data is necessary for the usual distribution theory to be used in hypothesis testing and estimation. In some cases, transformation of a variable into log form may be used to achieve stationarity or seasonal cycles may need to be removed. First differencing will also induce stationarity in I(1) series. Recent literature abounds in theoretical and empirical work on cointegration between I(1) series in which common stochastic trends can be determined to identify stationary linear combination of I(1) variables. Several tests are available to test for these properties, each with its advantages and disadvantages.
Dickey-Fuller tests were designed to test the null hypothesis that a series is I(1) against the alternative that it is I(0). (Hamilton 1994). The Augmented Dickey Fuller test (ADF) includes lagged first differences in the estimation to account for autocorrelation in the series. Rejection of the null hypothesis provides evidence that the series is stationary, i.e. distributed I(0). Hamilton (1994) provides a summary of the Dickey Fuller and Augmented Dickey Fuller tests, as well as Fuller’s tables of critical values for the test statistics. However, these tests are not reliable if the data generating process includes moving average terms, if the residuals are heteroskedastic, or if there is remaining serial correlation in the residuals (Myers 1992).

Phillips and Perron (1988) developed additional tests that are more general than the ADF tests, appropriate when serial correlation and heteroskedasticity is present and allowing for drifts and trends in the series. The Phillips-Perron (PP) tests for unit roots are based upon three regressions, with test statistics for different null hypotheses on the coefficients for level and trend stationarity. A summary of the tests and tables of critical values for the test statistics can be found in Banerjee et al. (1993).

With the PP and ADF tests, there must be strong evidence against the null hypothesis, so these tests may have low power. For this reason, Kwiatkowski, Phillips, Schmidt, and Shin (1992) have developed tests that have stationarity as the null hypothesis. The number of lags chosen is important because increasing the number of lags results in decreasing the power of the tests, while helping to correct for autocorrelation. Therefore,
the choice of how many lags to include must be balanced with the number of observations and the resulting power of the tests.

5.5 Unit root and stationarity tests in the initial war/drought period

Table 5.1 gives the descriptive statistics for real white maize prices, real yellow maize prices, and quantity of food aid deliveries over the initial war/drought period. Figures 5.3 - 5.8 show the data and first differences, with a vertical dotted line to indicate the end of the war/drought period. Results of the ADF tests, PP tests, and KPSS tests are reported in Tables 5.2, 5.3, and 5.4, respectively.

Table 5.1 Descriptive statistics of war/drought period

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Real White Price (metrical/kg)</th>
<th>Real Yellow Price (metrical/kg)</th>
<th>Food aid quantity (metric tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>384.30</td>
<td>234.04</td>
<td>2,276.30</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>102.08</td>
<td>66.38</td>
<td>3,738.17</td>
</tr>
<tr>
<td>Variance</td>
<td>10,420</td>
<td>4,406</td>
<td>13,973,915</td>
</tr>
<tr>
<td>Median</td>
<td>386.19</td>
<td>222.30</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>658.71</td>
<td>413.92</td>
<td>21,660.00</td>
</tr>
<tr>
<td>Minimum</td>
<td>191.19</td>
<td>126.50</td>
<td>0.00</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.48**</td>
<td>0.49**</td>
<td>2.02***</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>-0.21</td>
<td>-0.51</td>
<td>4.77***</td>
</tr>
</tbody>
</table>

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%
Figure 5.3 Real white maize prices, April 1990 - April 1995

Figure 5.4 First differences: Real white maize prices, April 1990 - April 1995
Figure 5.5 Real yellow maize prices, April 1990 - April 1995

Figure 5.6 First differences: Real yellow maize prices, April 1990 - April 1995
Figure 5.7 Yellow maize commercial food aid deliveries to Maputo, April 1990-April 1995

Figure 5.8 First differences: Yellow maize commercial food aid, April 1990-April 1995
Table 5.2 Augmented Dickey Fuller (ADF) t-tests for war/drought period

<table>
<thead>
<tr>
<th>Test</th>
<th>White price</th>
<th>Yellow price</th>
<th>Food aid quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF: no trend</td>
<td>-3.28**</td>
<td>-2.81*</td>
<td>-5.61***</td>
</tr>
<tr>
<td>ADF: trend</td>
<td>-3.37*</td>
<td>-3.91**</td>
<td>-5.92***</td>
</tr>
<tr>
<td>Lags</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

Note: Significance levels using critical values found in Hamilton 1994.
Table 5.3 Phillips Perron test results for the level series for war/drought period

<table>
<thead>
<tr>
<th>Test statistic</th>
<th>White price</th>
<th>Yellow price</th>
<th>Food aid quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z((\phi_2))</td>
<td>7.38***</td>
<td>7.24***</td>
<td>15.26***</td>
</tr>
<tr>
<td>Z((\phi_3))</td>
<td>11.06***</td>
<td>10.80***</td>
<td>22.89***</td>
</tr>
<tr>
<td>Z(t alpha~)</td>
<td>-4.09***</td>
<td>-4.19***</td>
<td>-6.24***</td>
</tr>
<tr>
<td>Z((\phi_1))</td>
<td>10.13***</td>
<td>6.12***</td>
<td>20.67***</td>
</tr>
<tr>
<td>Z(t alpha*)</td>
<td>-3.76***</td>
<td>-3.13**</td>
<td>-5.31***</td>
</tr>
<tr>
<td>Z(t alpha*)</td>
<td>-0.66</td>
<td>-1.05</td>
<td>-4.15***</td>
</tr>
</tbody>
</table>

NW lags | 4 | 4 | 4

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

Note: Significance level determined according to Banerjee et al. 1993.
### Table 5.4 KPSS tests for war/drought period

<table>
<thead>
<tr>
<th>Trend/ no trend</th>
<th>Lags</th>
<th>White price</th>
<th>Yellow price</th>
<th>Food aid quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>No trend</td>
<td>0</td>
<td>1.81***</td>
<td>4.38***</td>
<td>1.01***</td>
</tr>
<tr>
<td>No trend</td>
<td>2</td>
<td>0.79***</td>
<td>1.81***</td>
<td>0.54**</td>
</tr>
<tr>
<td>No trend</td>
<td>4</td>
<td>0.53***</td>
<td>1.21***</td>
<td>0.46*</td>
</tr>
<tr>
<td>No trend</td>
<td>8</td>
<td>0.36*</td>
<td>0.81***</td>
<td>0.43*</td>
</tr>
<tr>
<td>With trend</td>
<td>0</td>
<td>1.03***</td>
<td>0.27***</td>
<td>0.10</td>
</tr>
<tr>
<td>With trend</td>
<td>2</td>
<td>0.46***</td>
<td>0.12**</td>
<td>0.06</td>
</tr>
<tr>
<td>With trend</td>
<td>4</td>
<td>0.31***</td>
<td>0.10</td>
<td>0.05</td>
</tr>
<tr>
<td>With trend</td>
<td>8</td>
<td>0.21**</td>
<td>0.07</td>
<td>0.05</td>
</tr>
</tbody>
</table>

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

For white maize prices over the initial war/drought period, the ADF tests rejected the null hypothesis of a unit root at the 0.10 significance level when two lags are included with a trend. Without a trend, ADF tests were rejected at the 0.05 significance level with two lags included. The PP tests were rejected at the 0.01 significance level with two Newey-West lags included. These tests provided evidence of weak trend stationarity. The KPSS tests rejected stationarity around a mean or a trend at the 0.10 significance level or better when up to 8 lags were included.\(^3\) We conclude that these data are weakly stationary around a trend in the initial war/drought period.

With the yellow maize prices, the unit root tests all indicated that this is a trend stationary series. The ADF tests rejected the null with from 0 to 4 lags included, both with and without the trend component. The PP tests provided strong evidence against the null hypothesis of a unit root with the lag truncation at 4 lags. With the KPSS tests, the test statistic failed to reject at the 0.10 significance level or lower with 4 or more lags and a trend included. Thus, we find that real yellow maize prices are trend stationary as well.

Figure 5.7 shows the bar graphs of the deliveries. A week of very high deliveries in November 1992 resulted when two ships were simultaneously off-loading bulk maize. In general, the port capacity limited the weekly deliveries to less than 10,000 metric tons. In testing the food aid deliveries, the ADF and PP unit root tests reject the null hypothesis of

\(^3\) As Kwiatkowski et al. (1992) state regarding rejection of both hypotheses (stationarity and nonstationarity), "it is not clear what to conclude" (p. 175).
a unit root. The KPSS tests failed to reject the null hypothesis of trend stationarity, at the
0.10 significance level, with one or more lags included.

5.6 Unit root and stationarity tests for the post-war/drought period

5.6.1 Introduction

The data for the post-war/drought period are presented in Figures 5.3, 5.5, and 5.7, shown
with the earlier period as well. An examination of the figures of real prices and food aid
deliveries and their first differences clearly shows that changes have been dramatic. Table
5.5 details descriptive statistics for each series in this later recovery period. Comparing
Tables 5.5 and 5.1, the sample means of all three series have declined along with their
variances. Nevertheless, the mean white price is 63 percent higher than the mean yellow
price in this period, quite close to the 64 percent margin in the war/drought period.

5.6.2 White maize prices and food aid deliveries

For both the white maize prices and the food aid deliveries, unit root tests provide
evidence of stationarity around a trend, although the test results are weak for the white
maize price series (Tables 5.6- 5.8). ADF tests results, reported in Table 5.6, were
stronger for stationarity around a mean rather than around a trend. However, the PP tests
of white maize prices rejected the null hypothesis of a unit root at the 0.01 significance
level, with four Newey-West lags included, both with and without trend terms included.
The KPSS tests failed to reject null hypothesis of stationarity when four or more lags
were included with a trend.
Table 5.6 Descriptive statistics for post-war/drought period

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Real White Price ( meticais/kg )</th>
<th>Real Yellow Price ( meticais/kg )</th>
<th>Food aid quantity ( metric tons )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>201.72</td>
<td>123.52</td>
<td>733.86</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>32.99</td>
<td>31.21</td>
<td>1,867.42</td>
</tr>
<tr>
<td>Variance</td>
<td>1088.00</td>
<td>974.00</td>
<td>3487257.00</td>
</tr>
<tr>
<td>Median</td>
<td>196.69</td>
<td>113.04</td>
<td>0.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>306.70</td>
<td>204.46</td>
<td>10,414.35</td>
</tr>
<tr>
<td>Minimum</td>
<td>135.32</td>
<td>78.63</td>
<td>0.00</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.64***</td>
<td>1.48***</td>
<td>3.16***</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.18</td>
<td>1.17**</td>
<td>10.50***</td>
</tr>
</tbody>
</table>

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

Note: Significance level determined by Doan 1994.
Table 5.7 Augmented Dickey Fuller (ADF) t-tests for post-war/drought period

<table>
<thead>
<tr>
<th>Test</th>
<th>Real White Price</th>
<th>Real Yellow Price</th>
<th>Food Aid Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADF: no trend</td>
<td>-2.75*</td>
<td>-2.03</td>
<td>-4.40***</td>
</tr>
<tr>
<td>ADF: trend</td>
<td>-2.74</td>
<td>-2.06</td>
<td>-4.30***</td>
</tr>
<tr>
<td>Lags</td>
<td>2</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

Note: Significance levels using critical values found in Hamilton 1994
Table 5.8 Phillips Perron test results for the level series for post-war/drought period

<table>
<thead>
<tr>
<th>Test statistic</th>
<th>Real White Price</th>
<th>Real Yellow Price</th>
<th>Food Aid Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z((\phi_2))</td>
<td>(5.64^{***})</td>
<td>1.36</td>
<td>5.78***</td>
</tr>
<tr>
<td>Z((\phi_3))</td>
<td>(8.45^{***})</td>
<td>2.04</td>
<td>8.68***</td>
</tr>
<tr>
<td>Z(t(_{alpha^-}))</td>
<td>-3.57**</td>
<td>-1.98</td>
<td>-3.92**</td>
</tr>
<tr>
<td>Z((\phi_1))</td>
<td>(8.37^{***})</td>
<td>1.90</td>
<td>8.35**</td>
</tr>
<tr>
<td>Z(t(\alpha^*))</td>
<td>-3.37**</td>
<td>-1.91</td>
<td>-3.81***</td>
</tr>
<tr>
<td>Z(t(\alpha^\wedge))</td>
<td>-0.61</td>
<td>-0.50</td>
<td>-3.47**</td>
</tr>
</tbody>
</table>

NW lags \(4\) \(4\) \(4\)

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

Note: Significance level determined according to Banerjee, et al. 1993
Table 5.9 KPSS tests for post-war/drought period

<table>
<thead>
<tr>
<th>Trend/no trend</th>
<th>Lags</th>
<th>Real White Price</th>
<th>Real Yellow Price</th>
<th>Food Aid Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>No trend</td>
<td>0</td>
<td>0.32</td>
<td>3.95***</td>
<td>0.61**</td>
</tr>
<tr>
<td>No trend</td>
<td>2</td>
<td>0.15</td>
<td>1.44***</td>
<td>0.29</td>
</tr>
<tr>
<td>No trend</td>
<td>4</td>
<td>0.1</td>
<td>0.90***</td>
<td>0.24</td>
</tr>
<tr>
<td>No trend</td>
<td>8</td>
<td>0.07</td>
<td>0.54*</td>
<td>0.2</td>
</tr>
<tr>
<td>With trend</td>
<td>0</td>
<td>0.33**</td>
<td>1.48***</td>
<td>0.16**</td>
</tr>
<tr>
<td>With trend</td>
<td>2</td>
<td>0.15**</td>
<td>0.56***</td>
<td>0.08</td>
</tr>
<tr>
<td>With trend</td>
<td>4</td>
<td>0.1</td>
<td>0.35***</td>
<td>0.07</td>
</tr>
<tr>
<td>With trend</td>
<td>8</td>
<td>0.07</td>
<td>0.22**</td>
<td>0.06</td>
</tr>
</tbody>
</table>

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

The ADF and PP tests (Table 5.7) rejected the null hypotheses for food aid deliveries, with or without the trend included. In Table 5.8, the KPSS results support that result, with a failure to reject the null hypothesis of stationarity around a mean or a trend. There were two main periods of food aid deliveries from April 1993 through April 1995, designed to meet the hungry season needs of the urban areas. Most shipments arrived in late October, early November and were distributed through February (in 1994) and through January (in 1995). Due to months without deliveries, the mean was only 734 metric tons per week, with a median of 0. A linear time trend becomes insignificant as soon as any lagged own values are included in simple univariate regressions. Nevertheless, the unit root tests indicate that trend stationarity can be accepted for this series.

5.6.2 Yellow maize prices

The yellow maize series demonstrates no significant trend and very strong first order autocorrelation. In the initial testing with ADF, the null hypothesis of a unit root cannot be rejected (testing conducted with up to 4 lags) except in the case of the ADF with 4 lags at the 0.10 significance level. Further testing with the PP tests results in failure to reject the null hypothesis of a unit root. In the KPSS tests, the null hypothesis of mean stationarity fails to be rejected at the 0.10 significance level with 5 or more lags included, although trend stationarity is rejected through 8 lags at least.

In evaluating the series and thinking about the maize markets, there was a significant upward shift in prices during the week of July 23, 1994. In terms of the harvest, this is
early for scarcities to occur, yet the traders' qualitative assessment of the markets in Maputo, as recorded by the SIMA for that week, showed a decline from "large quantities" to "moderate" quantities, with some traders indicating "very little". A rapid appraisal team was in the center region of the country, the major production zone for the southern consumption areas at this time. They found that the quantities available for purchase were diminishing, as evaluated by local officials and itinerant traders. The government parastatal received funds the last week of July to purchase white maize to be sold to the donors for their local purchase efforts. The World Food Programme (WFP) signed a contract with ICM, such that WFP would buy local white maize from the parastatal rather than from private traders.

The entrance of ICM as a major buyer introduced a new factor into the domestic markets, a new source of demand for white maize. In the past, regional purchases had been made to meet Mozambican needs for white maize, with donors buying in Zimbabwe and importing; however, large quantities of white maize had not previously been purchased locally. In order to further investigate the effects of the maize price shifts in July, August, and September, special unit root tests will be used that incorporate knowledge of exogenous breaks in evaluating stationarity.⁴

⁴ In the earlier decision to divide the analysis into two different time periods due to a break, the differences between the time periods were in mean and in variance. In this case, the difference is thought to be a mean shift only.
Perron (1989) has developed tests that are appropriate to use when a single break in trend or mean is thought to occur in a series. As Perron noted, researchers would find nonstationarity when the data generating process may actually be stationary fluctuations around a mean or trend with a single break. Because of the limited number of observations (before and after the break), testing the period before a break and after a break separately may have very low power against the null of unit roots. Hence, Perron developed the appropriate test statistics to test for a unit root using the full length time series, including the possible mean or trend shifts. There are two cases developed by Perron that we will use here: 1) a single exogenous mean shift at a specified point in time; and 2) that allows for both a shift in the mean as well as a shift in the slope of the trend.

Both models are based on the premise that the shift is “not a realization of the underlying data-generating mechanism of the various series” (Perron 1989, p. 1362), but rather from a rare event that can be considered exogenous. Perron used Monte Carlo techniques to evaluate the distribution of the coefficient on the lagged dependent variable in each case in order to determine the appropriate test statistics when the shift variables are included in the unit root tests. The critical values vary in accordance with when the shift is thought to occur. The July 23, 1994 date is around the 60 percentile of the observations, that is, about 60 percent of the cases occurred prior to July 23, 1994. Once the shift is incorporated into the test statistics, Perron found rejection of the unit root hypothesis in series that were previously thought to be nonstationary.
Table 5.9 Perron’s unit root test for the post-war/drought period with a single exogenous mean shift or mean and trend shifts on July 23, 1994

<table>
<thead>
<tr>
<th>Test</th>
<th>White price</th>
<th>Yellow price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model A: mean shift</td>
<td>-8.63***</td>
<td>-3.79**</td>
</tr>
<tr>
<td>Model C: mean and trend shift</td>
<td>-8.63***</td>
<td>-4.31**</td>
</tr>
</tbody>
</table>

Note: Test is the *t*-test on the coefficient for the lagged price variable in the regression including trend, mean shift indicator, and 5 lags of own prices. Trend shift indicator was also included in Model C. Break occurred at the 60 percent point of the data.

* indicates significance level of 10%
** indicates significance level of 5%
*** indicates significance level of 1%

Note: Significance levels using critical values found in Hamilton 1994
In the Mozambican case, it was hypothesized that there was a shift in the mean of the price series when the local purchases began. As indicated earlier, the test statistics must be modified in the presence of a mean shift. Using the Perron test statistics for a unit root with a single shift in mean at July 23, 1994, the tests reject the null hypothesis of a unit root at the 0.05 significance level for yellow maize prices (Table 5.9). The t-statistic for the coefficient on lagged yellow maize price in the mean shift model was -3.79 compared to a 0.05 critical value of -3.76 for a shift that is within the first 60 percent of the time series. Included in the regression were 5 lags of yellow maize price, as well as the indicator variable for the periods before and after the shift, a time trend, an indicator variable for the day of the shift, and a constant. Testing the white maize series for non-stationarity around the shift resulted in a t statistic of -8.63, significant at the 0.01 significance level.

Testing based on a break in mean as well as a break in trend also resulted in rejection of the null hypothesis of a unit root, with the t statistics on the lagged price coefficient of -4.31 and -8.63 for yellow and white maize prices respectively. As a result of this testing, the inclusion of a mean shift variable or of both mean and trend shift variables in the VAR modeling would be appropriate.

5.7 Seasonality
Seasonality does not appear to be present in data during the war/drought period. Seasonal elements would not be expected to be important, given limited domestic production and storage, the lack of regional white maize production, and the arrival of food aid yellow
maize during most months of the period at fixed prices to the consignees. In the post-
war/drought period, seasonality may be a concern since there is both regional and
domestic production during a single annual crop cycle. Also, food aid tends to be
delivered during the hungry season, when there is scarcity of domestic supplies. This
means that the food aid tends to exert a counter-cyclical downward pressure on white
maize prices. During the marketing season, the price of white maize drops, as is expected
for storable agricultural commodities. There are too few observations to be able to
thoroughly model seasonality in the present context. By not modeling the seasonality, the
estimated impact of food aid shocks on maize prices will be lessened, since maize prices in
general would tend to be increasing during the hungry period. In the post-war/drought
period estimations, dummy variables were included to at least begin to capture the broad
seasonal movements that might be present.

5.8 Implications for time-series modeling

The data were split into the war/drought period (April 1990 - February 1993) and the
post-war/drought period (April 1993 - April 1995) in accordance with the changes in the
economic structure, apparent in the time series plots. The series were all tested for
stationarity by period. Only the late period yellow maize prices indicated potential
nonstationarity. Further testing incorporated a mean shift for the period when local
purchasing began, and rejected the null hypothesis of nonstationarity around this structural
break in the series. These results are used in the next chapter to help specify an
appropriate VAR model for white maize prices, yellow maize prices, and quantity of food
aid deliveries.