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The Effects of Food Aid on Maize Prices in Mozambique

INTRODUCTION

Peace Accords signed in October 1992 ended a long period of civil war in
Mozambique, but the war had caused severe constraints on food production.
Furthermore, a devastating regional drought during 1991–2 put additional
pressure on the food system, so that by the beginning of 1992 a major famine
was threatening the country. The response was food aid, which during 1992–3
represented 60 per cent of the total cereals available to consumers (Tschirley *et
al.*, 1996). The country and its economy recovered slowly and food aid gradu-
ally declined. By 1994–5, the proportion of food aid in total cereal supply had
dropped to 15 per cent (ibid.).

The objective here is to evaluate the effects of commercial food aid, in the
form of yellow maize imports, on the domestic prices of white and yellow
maize in Maputo, the capital of Mozambique. Maputo is the main port for food
aid arrivals and distribution, as well as the main consumption market for
locally produced cereals. The analysis is undertaken using weekly data in order
to focus on some of the short-term dynamic responses to food aid that cannot
be captured in an annual or quarterly model (for example, Farzin, 1991; Stevens,
1979). Furthermore, the analysis is undertaken for two distinct periods: the
war/drought period of April 1990 to February 1993 and the recovery from
April 1993 to November 1995. The two periods are contrasted to illustrate
different effects that food aid can have in different situations.

In contrast to many previous structural analyses of the effects of food aid,
the approach here is to use a vector autoregression (VAR) model. The advan-
tage of the approach is that the dynamics of the model are left unrestricted and
identification is based only on contemporaneous relationships between vari-
ables in the system (Sims, 1980; Fackler, 1988; Myers *et al.*, 1990). This is a
particular advantage in the case of food aid in Mozambique because there is
considerable uncertainty surrounding what types of traditional identification
restrictions should be imposed during periods of drought and war. In addition,
a traditional structural analysis using a large-scale econometric model would
require data that are either unavailable or questionable in the case of maize
markets in Mozambique. Using minimal identification restrictions, a VAR
approach provides a vehicle for summarizing historical correlations in food aid

arrivals and maize prices, and can be used to estimate the effects of food aid 'shocks' on market prices for white and yellow maize.

THE VAR MODEL

The VAR model is specified as a three-equation system in weekly food aid arrivals and weekly retail prices of white and yellow maize in Maputo. Food

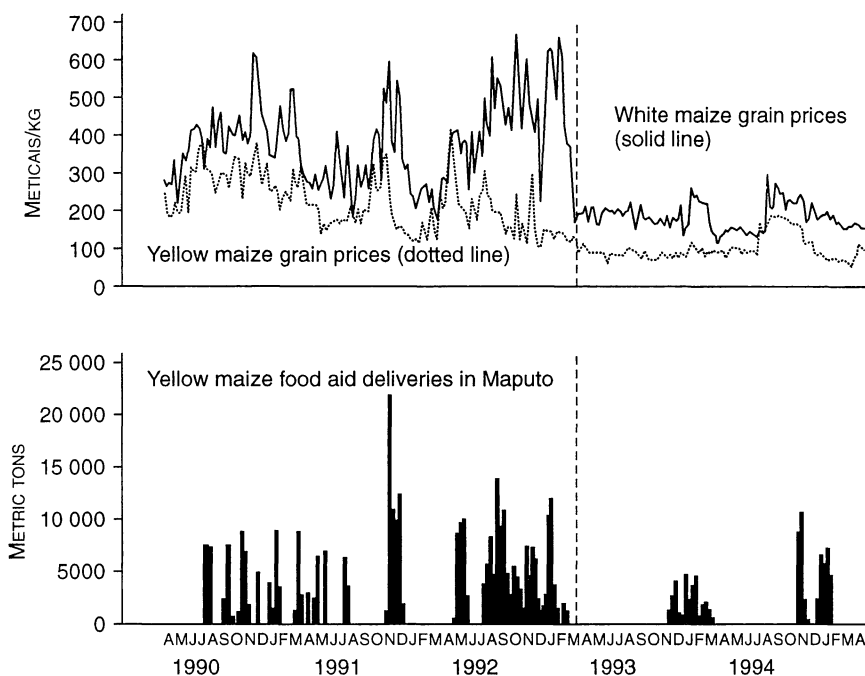**FIGURE 1**   *Weekly real retail prices and food aid deliveries in Maputo, April 1990–April 1995*

Note: Prices are deflated to a 1989 base year with the CPI deflator. Food aid deliveries are the metric tons of yellow maize grain delivered to private agents in Maputo each week, from warehouses or the port of Maputo. Dashed vertical line indicates March 1993.

Source: MOA/MSU SIMA Database, 1995.

aid arrivals are commercial yellow maize food aid delivered into the hands of private agents each week, either directly at the port or from warehouses. The price data are weekly real retail prices in meticais per kilogram, deflated by the consumer price index with a base year of 1989.

Figure 1 plots the data used to estimate the VAR, with the dotted vertical line indicating March 1993, the transition month between the war/drought and recovery periods. Summary statistics for the data are also provided in Table 1. Mean prices are clearly higher in the war/drought periods and there are larger mean food aid deliveries. There is also much greater variability in all series during that war/drought period. A rapid decline in white maize prices occurred when the first post-drought harvest of white maize came onto the market and domestic traders were able to gain access to the production zones. This represents a structural shift and suggests estimating separate models for the two periods.

Preliminary testing was conducted on each variable in the system to determine its stationarity properties. The Augmented Dickey–Fuller, the Phillips–Perron and the Kwiatkowski–Phillips–Schmidt–Shin tests were applied (Hamilton, 1994; Banerjee *et al.*, 1993). The results generally support the conclusion that each of the series is stationary. Given this evidence, the VAR models for both time periods were each specified in the levels of the food aid and real price variables, with a linear trend included in all equations.

Lag lengths for the VAR were chosen on the basis of Akaike's Information Criterion (AIC), the Schwartz Criterion (SC), and sequential likelihood ratio (LR) tests (Hamilton, 1994). The AIC suggested seven lags, SC one lag and LR four lags. In view of the well-known tendency for AIC to overparameterize as the sample size increases, and for SC to underparameterize in small samples, a lag length of four was chosen for the VAR.

One of the most critical aspects of VAR modelling is the identification and interpretation of the structural error terms ('shocks') which drive the dynamics of the system. In this study we investigated a range of alternative identifications to determine the degree of sensitivity of the results to each one. Except for a few cases, in which the identification restrictions seemed implausible from an economic perspective, the outcomes turned out not to be very sensitive to the identification chosen. Hence results are reported for just one identification scheme per model.

For the war/drought period, a recursive identification was chosen with white maize prices (WP) ordered first, food aid deliveries (FA) ordered second, and yellow maize prices (YP) ordered last. The logic behind this specification is that, during this period, local white maize markets were somewhat isolated, sporadic and dominated by the large quantities of yellow maize appearing as food aid. However, white maize remained the preferred consumption good when it was available. Thus it is hypothesized that WP is not influenced contemporaneously (that is, within a week) by the availability of food aid or shifts in yellow maize prices. On the other hand, releases of food aid and yellow maize prices may be sensitive to contemporaneous changes in supply and demand conditions for white maize (that is, white maize price shocks). Similarly, food aid does not respond contemporaneously to yellow maize prices but food aid shocks can immediately (within a week) influence yellow maize prices through their supply effect.

TABLE 1 *Descriptive statistics*

| Statistic | War/drought period (3 Apr. 1990 – 28 Feb. 1993) | | | Recovery period (4 Apr. 1993 – 28 Apr. 1995) | | |
	White maize price (meticais/kg)	Yellow maize price (meticais/kg)	Food aid (metric tonnes)	White maize price (meticais/kg)	Yellow maize price (meticais/kg)	Food aid (metric tonnes)
Mean	384.30	234.04	2 276.30	201.72	123.52	733.86
Standard deviation	102.08	66.38	3 738.17	32.99	31.21	1 867.42
Variance	10 420	4 406	13 973 915	1 088	974	3 487 257
Median	386.19	222.30	0.00	196.69	113.04	0.00
Maximum	658.71	413.92	21 660.00	306.70	204.46	10 414.35
Minimum	191.19	126.50	0.00	135.32	78.63	0.00
Skewness	0.48**	0.49**	2.02***	0.64***	1.48***	3.16***
Kurtosis	−0.21	−0.51	4.77***	0.18	1.17**	10.50***

Note: * indicates significance level of 10%; ** indicates significance level of 5%; *** indicates significance level of 1%.

Source: Banerjee *et al.* (1993) for significance level.

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For the recovery period, a different recursive identification scheme was selected, based on changes taking place in the maize market. At that time white maize supply constraints were released by a combination of increased domestic and regional production, increased movement of traders, continued growth in informal markets and gradually reduced availability of yellow maize. As a result of these changes, food aid declined in importance and apparently became less responsive to contemporaneous changes in white maize prices. Indeed, with the increased importance and integration of white maize markets, it is logical to assume that white maize prices were now influenced contemporaneously by food aid arrivals and yellow maize prices. This leads to an ordering of FA, YP, WP.

Another important event occurred during the recovery period. In July 1994, some donors and non-governmental organizations (the World Food Programme in particular) announced a plan to purchase local white maize for their emergency programmes, rather than import yellow maize. As a result, maize prices experienced a sharp increase which cannot be explained by any other observed market phenomenon, either on the supply or the demand side. The change is incorporated as a one-time mean shift, following the work of Perron (1989). Seasonality also becomes a factor in the period because local white maize becomes available only in June, when the harvest begins. To adjust for this a seasonality indicator variable was added for the hungry season.

VAR ANALYSIS

Analysis of the VAR models was conducted using standard impulse response methods (Hamilton, 1994). Primary interest lies in the dynamic response of white and yellow maize prices to typical shocks to the amount of food aid being delivered. If there is no response, we can conclude that market prices are not influenced by food aid. If yellow maize prices respond, but white maize prices do not, we can conclude that yellow maize food aid influences domestic yellow maize prices, while white maize markets are isolated from food aid effects. On the other hand, if there is a significant response in both prices we would conclude that the markets are connected and yellow maize food aid significantly affects white maize prices.

Historical simulation of prices, obtained in the assumed absence of commercial food aid, can also be conducted using the VAR. In this case, the yellow maize and white maize price shocks are set at their historical values. The food aid shocks are then altered to ensure that the amount of food aid in each period becomes zero (see Myers *et al.*, 1990). The VAR is then simulated with the new shocks in order to estimate historical price paths in the absence of food aid. Price paths with and without the food aid can then be compared to isolate the effects of the food aid.

RESULTS AND DISCUSSION

There has been considerable previous research on the effects of food aid on developing economies (for example, Isenman and Singer, 1977). Previous research has also indicated that informal maize markets in Maputo are relatively competitive and responsive (Tschirley *et al.*, 1996; MOA/MSU, 1993). The results presented in this section support this view of responsive, connected markets leading to important food aid effects. We first examine the war/drought period and then turn to the recovery period.

The war/drought period

The results of the VAR analysis support the argument that informal market prices were responsive to food aid imports, even during the war/drought period. The responses of each variable to a one-standard deviation shock in each of the structural errors during the war/drought period are plotted in Figure 2. A one-standard deviation shock corresponds to 2600 metric tonnes for food aid, 65 meticais/kg. for white maize prices, and 34 meticais/kg. for yellow maize prices (in real 1989 meticais). The middle plot in Figure 2 shows the response of each series to a single food aid shock of 2600 metric tonnes, holding other shocks to zero. Yellow maize prices immediately decline about 0.4 s.d. (14 meticais/kg.) and then gradually return to their previous level by about the eighth week. White maize prices do not drop at all as an immediate response to a food aid increase because of the identification scheme. However, even when no contemporaneous response is allowed, white maize prices decline in later periods, although to a lesser degree than yellow maize prices. Thus food aid appears to have a strong depressing effect on white maize prices.

The historical simulation of maize prices, with and without food aid, in the war/drought period is shown in Figure 3. It is interesting that elimination of the food aid would have increased the level of both white and yellow maize prices substantially above their actual values, although other supply and demand shocks in these markets cause the direction and variability of price movements to be similar in the two cases. White maize prices would have been 33 per cent higher in January and February 1993, on average, without the food aid, and yellow maize prices an average of 150 per cent higher. Clearly, in this period, the food aid deliveries played a key role in ensuring the availability of maize at an accessible price for Maputo consumers. Furthermore, the scarcity of white maize, and its role as a preferred consumption good, meant that its price remained relatively high and volatile in spite of the yellow maize arrivals and price movements. Nevertheless, the food aid clearly kept white maize prices down as well, though not to the same extent as yellow maize prices.

The recovery period

The impulse responses for the recovery period are plotted in Figure 4. In this case a one-standard deviation shock corresponds to an innovation of 1250
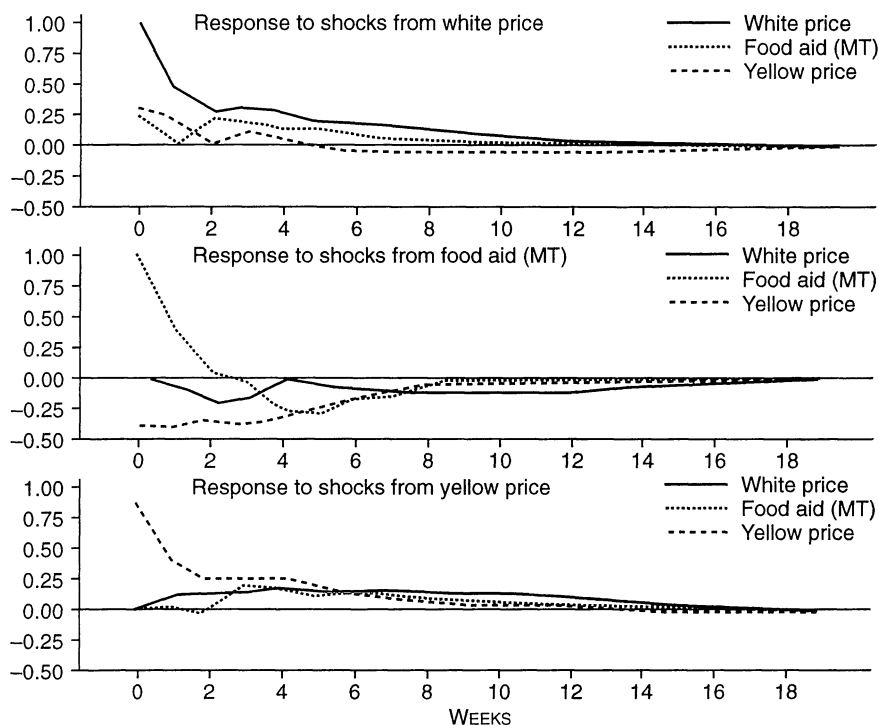
FIGURE 2   *Impulse responses for the war/drought period*

metric tonnes of food aid, 20 meticais/kg. for the price of white maize and 12 meticais/kg. for the price of yellow maize. Comparing these standard errors to those in the war/drought period (2600 metric tons, 65 meticais/kg. and 34 meticais/kg., respectively), it is clear that there was much less uncertainty during the recovery period.

The top plot in Figure 4 shows the responses to a typical food aid shock, holding all other shocks constant. The response of yellow maize prices follows a similar pattern to that in the war/drought period; food aid has a depressing effect on price that dies out after about eight weeks. However, the white maize prices responds differently. The initial (contemporaneous) response of white maize price remains zero but in the following week there is a WP *increase*. This may be a result of the unexpected increase in food aid being interpreted as a signal that white maize supplies are tighter than had been thought, resulting
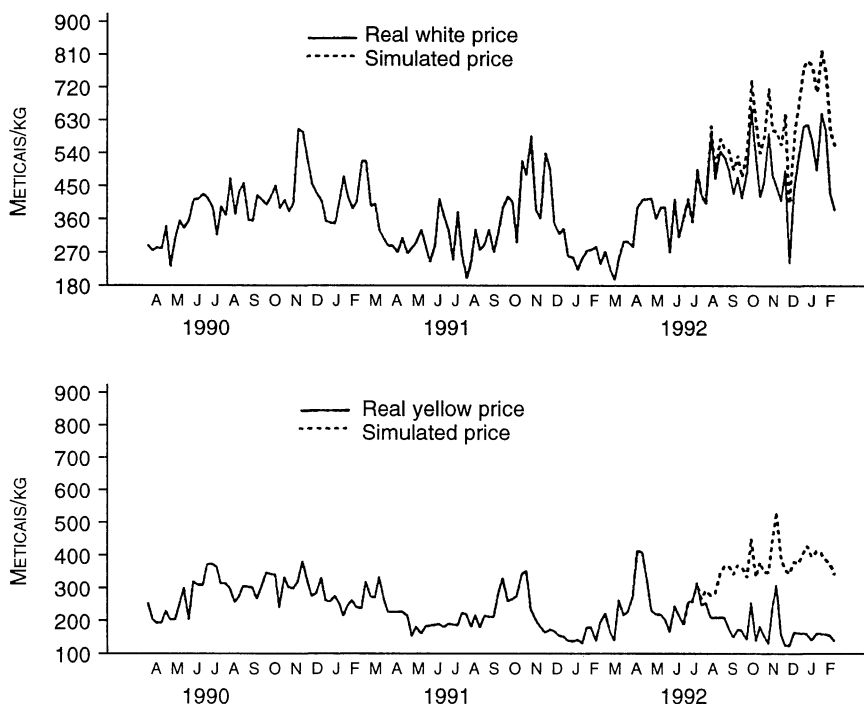
FIGURE 3   *Simulation for the war/drought period assuming no food aid after 31 July 1992*

in an increase in demand (and price) for the preferred white maize product. In subsequent weeks, however, the effect of the food aid shock on white maize prices becomes negative, since it would seem increasingly clear that supply and demand conditions for white maize have not changed (remember that other shocks besides food aid are set to zero) and the additional supply of yellow maize food aid begins to depress prices for both types of maize. Eventually (after about eight weeks), the food aid shock no longer has any significant price effects.

The simulations which show how prices would have evolved through the recovery period in the absence of food aid are shown in Figure 5. The removal of two large food aid shipments in the November 1994–January 1995 period (a total of 47 600 metric tons) would have led to generally higher yellow and white maize prices through the period. The simulated white maize price for February 1995 was 208 meticais/kg., 14 per cent higher than the actual real
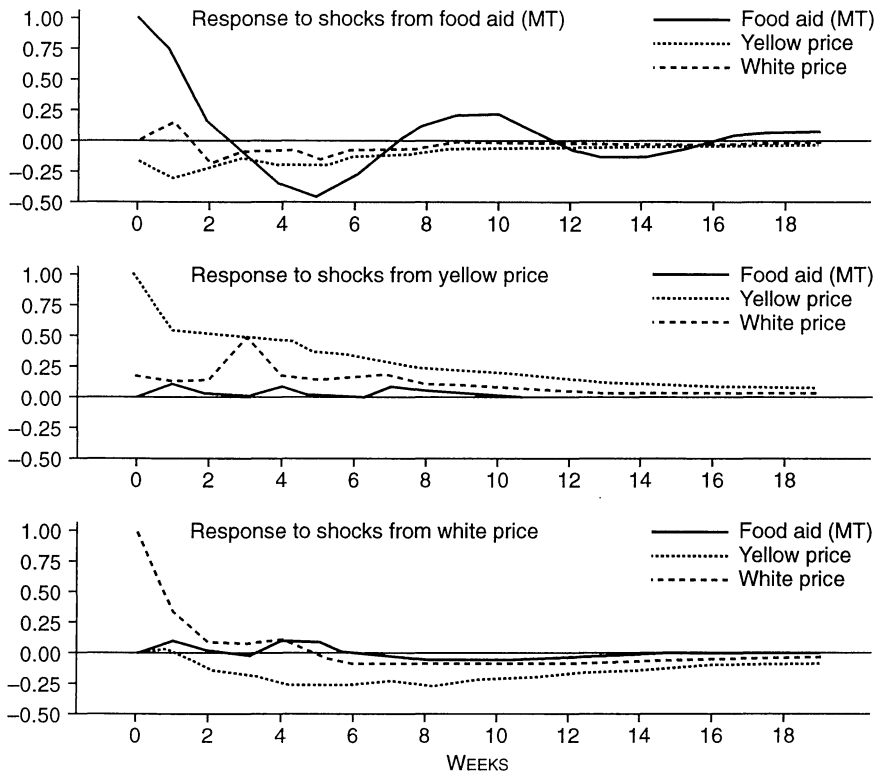
FIGURE 4   *Impulse responses for the recovery period*

price of 183 meticais/kg. For yellow maize, the simulated price was 76 per cent higher than the observed price (160 meticais/kg., compared with 91 meticais/kg.). In a period in which overall price fluctuations were relatively small and prices were low compared to earlier times, these represent important effects for traders.

CONCLUSIONS

In the war/drought period, consumers benefited from increased yellow maize supply and lower yellow maize prices that can be traced back to the arrivals of yellow maize food aid on the Maputo market in the 1990–93 period. However, the local white maize market was also influenced in very important ways as a
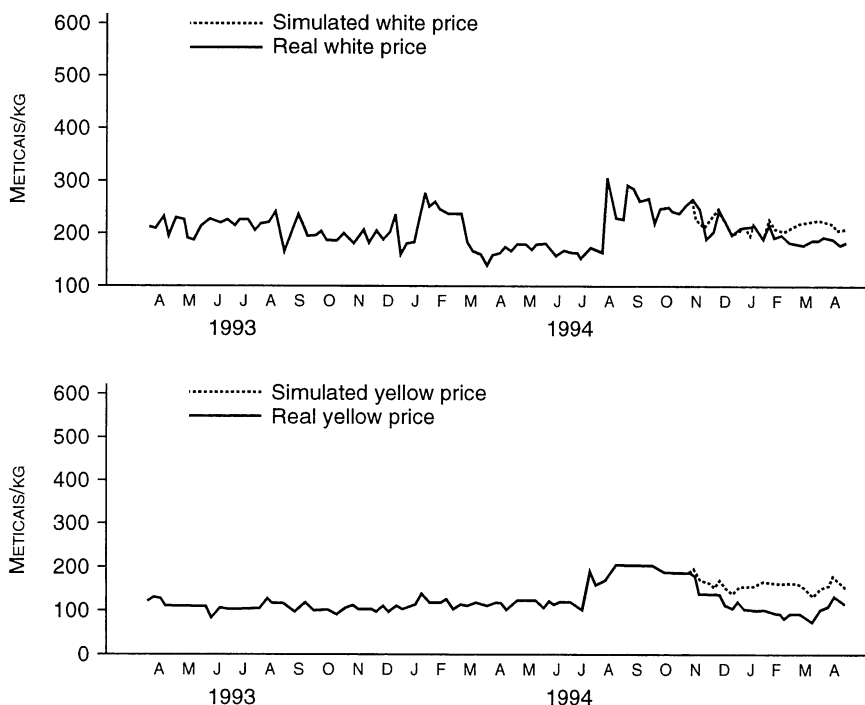
FIGURE 5   *Simulation for the recovery period assuming no food aid during November 1994–January 1995*

result of food aid. Indeed, the results in this paper show that the general level of white maize prices was considerably lower with the food aid than it would have been without it, but that the food aid did little to reduce the tremendous white maize price fluctuations and market uncertainty that characterized the war/drought period.

In the recovery, with agricultural production increasing and the economy beginning to benefit from the Peace Accords, yellow maize food aid arrivals continued to influence white maize prices, as well as their expected strong effect on yellow maize prices. The simulation results show that food aid arrivals just prior to and during the hungry season can lower white maize prices in a countercyclical fashion, long before the next harvest is due. This affects traders' margins and the ability to recover storage costs, and thus may be affecting storage and marketing investment in the domestic markets. Domestic consumers benefit in the short run, with lower prices for both yellow

and white maize prices; however, a disincentive effect on domestic production and marketing cannot be ruled out in the longer run.

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