FOOD AID AND POVERTY ALLEVIATION IN MOZAMBIQUE: THE POTENTIAL FOR SELF-TARGETING WITH YELLOW MAIZE

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1. INTRODUCTION

Food aid has played an instrumental role in providing for the welfare of the poor in war torn Mozambique, one of the poorest countries in the world. This is especially the case in Maputo, the capital, where civil conflict resulted in the provision, and subsequent sale of food aid being its lifeline for survival.[1] By far, the most important food aid commodity destined for Maputo is yellow maize grain, virtually all of which is supplied by the United States P.L. 480 program. In theory, this yellow maize grain is supposed to be distributed through the government's food rationing system,[2] although in practice, a large share is leaked and finds its way to the parallel market at prices determined by supply and demand (Sahn and Desai 1993). Although yellow maize supply in Maputo derives entirely from imports, the fact is that yellow maize grain behaves essentially as a nontraded commodity. In the short-term, where tastes and preferences are quite stable, the level of imports determines the price of the product.

There are growing pressures to reduce the level of yellow maize food aid imports into Maputo, and to ensure that whatever is marketed, is sold at a price that reflects the world market price of yellow grain plus transport costs to Maputo. This derives from the perception that with peace, the need for food aid is diminishing, supposedly as production increases and marketing costs decline. Likewise, there is a concern that food aid distributed in the urban market is both a disincentive to rural producers, and not well targeted to poor households. Food aid distribution in the cities is thus seen as a blunt instrument for poverty alleviation, a threat to the resurgence of a healthy agriculture, and an impediment to raising incomes of the rural poor.

The arguments against continued high levels of food aid sales in Maputo have intensified given events in 1993, a year of unprecedented levels of emergency drought relief yellow maize food aid inflows into both urban and rural areas of Mozambique. The heightened concern over the possible disincentive effect of the commercial distribution of yellow maize grain has emanated from a failure to distinguish between such a program of sales of food aid, and the emergency distribution of food aid in rural areas in response to the severe drought of 1992, an effort that was unfortunately mismanaged.

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[1] In addition to the commercial food aid program in Maputo, and Beira, there is a free food aid emergency distribution program in rural areas that is operated as a separate effort, and will not be the subject of the discussion in this paper.

[2] For a description of the ration system, see Alderman, Sahn, and Arulpragasam (1991).

More specifically, the problem with the emergency distribution program stemmed from the fact that much of the emergency food aid, particularly that destined for rural areas, arrived late, after the successful white maize harvest in early 1993.[3] Thus, much of the yellow maize food aid ended up for sale in rural markets in mid-1993, while post-harvest market prices for white maize were low. The emergency yellow maize food aid destined for rural areas flowed back to Maputo. Subsequent shipments of yellow maize food aid for Maputo thereafter remained in storage, only to deteriorate in quality.

Although it is clear that emergency food aid distribution in rural areas that continued even after the 1993 harvest was ill-timed and excessive, we argue that such events should not be confused with a nonemergency, commercial sales program of yellow maize food aid in Maputo. In fact we will show that there is every reason for caution in reducing levels of yellow maize food aid supplied to Maputo (as opposed to rural areas and other urban centers), owing to the self-targeting attributes of the commodity.

The analysis in this paper is based on data for the period April, 1991 to March, 1992, a period in which the white maize harvest of 327 thousand tons in 1991/92 was typical of those in Mozambique since the onset of communal violence in the mid-1980s. The period analyzed predates the failure of the 1992/93 harvest in early 1992. Furthermore, dramatic changes in the country were once again to occur by mid-1993, owing to the end of the civil war, the successful harvest that followed the 1992 drought, and ill-timed, post-harvest deliveries of food aid to rural areas. So, while the concept of "typical" circumstances is difficult to define in the unstable and rapidly changing political, economic and climatic environment characteristic of Mozambique, several major themes of the 1991/1992 analysis apply to the current and likely future situations.

To address the issue on the role and effectiveness of food aid in poverty alleviation in Maputo, and whether there are any deleterious effects on the rural poor of using food aid to alleviate urban poverty, we develop a multi-market simulation model. We employ household survey data to estimate demand parameters and a poverty line. Then, applying the model to data on individual households, we simulate the effects of changes in levels of food aid on calorie consumption and various poverty measures.

The structure of the multi-market model is outlined in Section 2. The model includes equations for prices, production, consumption and trade for seven agricultural commodities and "nonfood." Households are disaggregated into three groups: Maputo poor, Maputo nonpoor, and rural households in Mozambique's three southernmost provinces. In addition to presenting the model itself, we also detail in Section 2 the methodology for arriving at, and estimates of demand parameters. Furthermore, the approach used to derive the poverty line, and simulate how exogenous policy changes affect the level of poverty, is presented.

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[3] White maize production in 1993/94 is estimated at 533 thousand tons, 48 percent greater than the average harvest from 1982/83 to 1991/92.

In Section 3, we discuss the Maputo household survey and some descriptive information on food consumption patterns and calorie intake in Maputo. We present the data by expenditure quintile, as well as distinguishing between the poor and nonpoor, following the methodology described in Section 2.

Results of simulations are given in Section 4. First, we present simulation results of the multi-market model showing the effects of changes in yellow maize food aid on prices, production, consumption and incomes. Next, the model is applied to the data on individual households to estimate the impacts of food aid policy changes on calorie consumption of poor households and various poverty measures. A cost benefit analysis of the subsidy through yellow maize imports is also presented.

Finally, in Section 5 we present some concluding comments. These are designed to guide policy-makers and to suggest avenues for future research.

2. THE MULTI-MARKET MODEL

The analysis of the impact of policy and external shocks on agricultural commodities involves consideration of supply, demand, trade and incomes. While this analysis is sometimes done separately for individual commodities, there are often important interactions between commodities on both the supply and demand side that make it important to conduct the analysis in a multi-commodity framework. The multi-market model summarized here (equations are given in Appendix 1) is designed to capture the major interactions across commodity markets and thus provide an appropriate analytical framework for Mozambican agricultural and food policy.[4] The data employed to construct the model and derive the model parameters are discussed in Appendix 2.

MODEL STRUCTURE

Eight commodities are included in the model: yellow maize, white maize, rice, wheat, export crops and vegetables (including fruits, roots and tubers, and pulses), meat (including fish and other food not listed above), and nonagriculture. All are produced domestically except yellow maize and wheat, and all are traded internationally, although trade in vegetables and meat is very small and is fixed exogenously in the model. Households are divided into three groups: Maputo nonpoor, Maputo poor, and "rural" (the rest of the population of the three southern provinces of Maputo, Inhambane, and Gaza).

The model determines the level of domestic production of agricultural commodities given rural prices; nonagricultural production is fixed exogenously. Rural prices are linked to urban consumer prices by a fixed marketing margin.[5]

Consumption of both urban and rural households is a function of household income and consumer prices. (For rural households, the consumer price is equal to the producer price). Nonagricultural output is fixed and nonagricultural income varies with the price of nonagricultural goods in the model.[6] Agricultural incomes are determined by quantities produced and their prices.

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[4] See Braverman and Hammer (1986) for a formal presentation of a multi-market model in another African context. Further details concerning the model construction are also found in Dorosh and Bernier (1993).

[5] The marketing margin is fixed as a constant percentage markup between rural and Maputo prices.

[6] An alternate assumption would be to fix non-agricultural income in real terms, with the overall price level used as the deflator.

The method by which prices are obtained varies according to whether the commodity is traded or nontraded. For traded goods, the domestic price level is determined by world prices and the exchange rate. Net imports adjust so that total supply equals demand.[7] For nontraded goods, (vegetables and meat), net imports are set to the base level of imports, and the model solves for the consumer price that clears the market, equating supply and demand.

For traded goods, consumer prices are linked to border prices by the exchange rate, tariffs, marketing costs and, in cases where the official consumer price is fixed, rents. For commodities where the level of net imports is not fixed, rents are zero and the consumer price is determined by the border price. The level of net imports adjusts to equate supply and demand. For yellow maize, which is imported in fixed amounts under foreign aid agreements, the quantity of net imports is fixed, the consumer price adjusts to equate supply and demand and rents are earned by those able to buy at the official border price and sell at the market clearing price.

The numeraire of the model is the price index of nontraded goods, *PNT*, which is computed from the price of nontraded agriculture (vegetables and meat) and nontraded nonagricultural goods. The exchange rate adjusts so that exogenous foreign capital inflows equal the excess of import demand over export supply. Given the fixed price index of nontraded goods, *PNT*, the nominal exchange rate is equivalent to the real exchange rate.

MODEL PARAMETERS

Three major sets of parameters influence the behavior of the model: supply elasticities, own- and cross-price elasticities of demand, and income elastici-

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[7] World prices are themselves endogenous, depending on the choice of elasticity of export supply parameter. An export supply function from the rest of world is included, with Mozambique's import price (PW_i) positively related to the level of its imports (M_i), reflecting higher marketing costs associated with smuggling larger quantities of goods across borders:

$$M_i = MO_i * (1 + \epsilon_i^m * [PW_i/PWO_i - 1])$$

For goods which are traded freely on international markets, such as export goods and rice, the elasticity of export supply ϵ_i^m is made very large, so that the world price is essentially fixed. For goods such as white maize which is traded across land borders, this elasticity may be less than infinity, but still greater than zero. In all the simulations presented in Section 3, ϵ_i^m is made very large and world prices are exogenous.

ties of demand (see Appendix 2). Supply parameters derive mainly from estimates from other countries and theoretical restrictions on the matrix of parameters (symmetry of cross-price elasticities of supply and zero homogeneity). The demand parameters derive from econometric estimates using the urban survey data. The methodology employed involved estimating a system of equations in an AIDS framework (Deaton and Muellbauer 1980)

$$W_i = \alpha_i + \sum_k \beta_{ik} \log P_k + \gamma_{ik} \log \frac{X}{P^*} \qquad (1)$$

where W_i is the budget share of the i^{th} good, and X is total expenditures on the group of goods, P^* is Stone's price index computed across all goods in the group, and P_k is the price index of the k^{th} composite good. The composite good price index is calculated for each household as:[8]

$$P_k = \sum_{J=1}^{Y} \left(\frac{P_j}{P_o} * W_{jk}\right) \qquad (2)$$

where W_{jk} is the expenditure share of commodity j in group k for each household; P_j is the price of commodity j paid by household; P_o is the mean price of commodity j across all households; and Y is the number of commodities in group k

Three-stage least squares (3SLS) were employed in the estimation, enabling us to endogenize expenditures, with symmetry and homogeneity restrictions imposed. Furthermore, selectivity bias related to the consumption/nonconsumption decision was addressed through the method suggested by Heien and Wessel (1990) that involves including lambdas derived from a dichotomous choice models of whether or not to consume a product.

While these parameter estimates are incorporated in the simulation model to examine the effect of price changes on consumption patterns, and poverty, as discussed below, we also computed a matrix of price and income elasticities. These provide the reader with insight into the nature of consumer behavior that are not immediately apparent in examining parameter values generated by the

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8 For households that did not purchase a commodity, the average price paid in the month surveyed, in the district in which the household was resident was used. For non-food prices, the following goods were used in constructing the index: soap and cosmetics, wood, charcoal, cooking gas, tobacco, kerosene, and gasoline and diesel fuels.

demand estimation.[9] Perhaps the most important finding is that for the poor, yellow maize is an inferior good, with an income elasticity of -0.571 (Appendix Table 2.5). This is an initial indication that subsidizing yellow maize will be an effective self-targeting mechanism for poverty alleviation. Corresponding to expectations, the meat, fish and dairy group, other foods and beverages, that includes food eaten outside the home, and nonfoods have characteristics of luxury good. Examining the own price elasticities reveals that they are relatively lower for yellow maize that for the other staple grains, white maize and rice. This could reflect, in part, that its price is far below that of substitutes, and that consequently, marginal price increases will not precipitate a large substitution to other goods. Overall, however, the elasticities suggest a high degree of own-price responsiveness of consumers.

Also shown in the table are cross price effects. These are small, although generally corresponding to what we would expect in terms of substitutes and complements in the food basket. In a couple of cases cross-price effects are positive, such as where an increase in yellow maize price results in a small decline in white maize consumption. This is explained by the dominance of the income effect. More specifically, while the positive compensated elasticities (not shown) indicate that the two commodities are indeed net substitutes, the income effect dominates in the Slutsky decomposition to result in the uncompensated effect being negative.

Despite the quality of the demand estimates, the model simulations in Section 4 will nonetheless include sensitivity analysis to changes in several key behavioral parameters of the model. This will ensure that the results of the simulations are not highly sensitive to plausible changes in parameters.

POVERTY LINE

In addition to the behavioral parameters discussed above, another key model parameter is the level of income that distinguishes the urban poor and nonpoor. In the model, the urban poor are defined as those households falling below the poverty line developed for Maputo, and discussed in our earlier work (del Ninno and Sahn 1993). In brief, the poverty line is derived by designating a level of food energy intake based on normative standards. Thereafter the system of demand discussed above is used to identify the income level below which a household can

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9 The formulas for the computation of the elasticities have been derived from Green and Alston (1990) where for a linear approximate AIDS.

$$\epsilon_{ij} = \beta_{ij}/w_i - \gamma_i\, w_j/w_i \qquad \forall\ i \not\equiv j$$

$$\epsilon_{ij} = -1 + \beta_{ij} - \gamma_i \qquad \forall\ i \not\equiv j$$

$$a_i = 1 + \gamma_i/w_i$$

Different budget shares for the poor and non-poor were used to calculate the different elasticities.

be expected not to achieve this level of consumption.[10,11] The method for setting the poverty line has a number of advantages (Ravallion 1993). For example, it is not necessary to determine the basic needs for nonfood goods. Instead, the approach employed automatically includes an allowance for nonfood consumption. Similarly, estimating the empirical relationship between calories and income (proxied by consumption expenditures) provides a unique poverty line that can be framed in larger welfarist terms, where the poverty line represents the point on the consumer's cost function that corresponds to a reference utility level. [12]

To amplify, the indirect utility function of the household is expressed as a function of income and prices (the former income, also being a function of the prices), such that:

$$U = u(P, Y) \tag{3}$$

The fixed utility value that distinguished poor from nonpoor is not only a function of income, but of the prices faced (as well as the characteristics of the households, which are assumed fixed in the simulations). Thus, using the data from the survey, the poverty line was determined to correspond to income of Y, given that the household was facing the vector of prices, P. With the change in the prices as a result of policy intervention, one can define an equivalent level of income Y_p, that provides the same level of utility as prior to the price change, such that:

$$Y_p = c(P_p, u(P,Y) \tag{4}$$

where $c(.)$ represents the cost function of the household, which gives the minimum income requisite to maintain utility $u(P, Y)$, while facing the new price

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10 See Osmani (1982) and Foster, Greer, and Thorbecke (1984) for a more complete discussion of the methodology employed.

11 The level of consumption that we chose for our normative standard is 2,500 calories per adult equivalent. In addition, we also defined an ultra-poverty line, that will be used in the next section, based on an intake of 2,000 calories per adult equivalent.

12 While shortcomings with this method are acknowledged, for the most part they revolve around the difficulty in making comparisons of poverty levels across space and time where there are shifts in activity levels, household characteristics, tastes and wealth. These problems are not germane to this exercise. For a more complete discussion of the merits and limits of the approach used to set the poverty line, see Ravallion (1993).

vector P_p. Thus, we define the equivalent income as that which would enable the household to reach the same level of utility after the price change that the household faced prior to intervention.

In the simulations, we employ the demand model to estimate the equivalent income at different values of P, which are also endogenized in the model. Or in other words, we estimate a new level of income that will enable the household to achieve the same level of money metric utility prior to policy change that generates a new vector of prices. Furthermore, recognizing that $Y = f(P)$, the model also adjusts the vector of nominal household incomes in conjunction with arriving at new levels of equivalent incomes that correspond to the policy changes modeled.

3. THE DATA AND DESCRIPTIVE STATISTICS

The base data for the model consist of estimated levels of consumption expenditures by households, production, trade and prices for the eight commodities included. Household expenditure estimates (e.g., volumes and quantities) in urban areas are derived from the 1991-92 Food Security Department/Cornell Food and Nutrition Policy Program integrated survey of 1816 households in Maputo. Data on expenditures and incomes for rural households are considerably less certain, and are derived from sectoral level data on production and producer prices, as well as the data on expenditure patterns of the urban poor. Details are given in Appendix 2.

Concerning the integrated household survey, it was conducted over a seven month period, October 1991 to April 1992. The multipurpose survey was designed to collect detailed information on household structure, consumption, prices, incomes, labor market activities, morbidity, child nutrition and feeding practices and housing characteristics. The sample was a self-weighted random sample of households in greater Maputo (including Maputo City, Matola, and Inhaca).

Budget shares by expenditure quintile, and for the poor and nonpoor in Maputo are shown in Table 1. The results indicate that among the staple grains, the commodity group of bread and related products has the highest budget share overall, 8.2 percent. Rice is next important, with the budget share of 7.8 percent. Yellow maize grain's budget share is 6.1 percent, roughly twice that of white maize. Within the yellow maize group, flour without bran has the largest budget share, comprising nearly the sum of grain and flour with bran.

Examining these data by per capita expenditure quintiles yields a number of important findings. First, the shares of yellow maize products, both individually and in combination, fall rapidly across the expenditure quintiles. For example, for households in the bottom quintile of the expenditure distribution, yellow maize products comprise 13.7 percent of the household budget. In contrast, yellow maize products comprise only 1.2 percent of total expenditures for those in the highest quintile. The rate of decline in budget shares is roughly proportional for all yellow maize commodities.

The pattern of changes in budget shares for white maize products differs from yellow maize. In both cases, the budget share increases between the first and second quintile, suggesting that for the poor, white maize products are luxury goods. Across the other quintiles the budget shares fall, although more precipitously for grain than flour.

Rice and bread budget shares across expenditure quintiles move in an almost identical way. Like white maize products, they both display characteristics of luxury goods in the lower expenditure quintile. However, unlike white maize,

Table 1 — Distribution of Average Budget Shares by Per Capita Expenditure Quintiles and Poverty Classification

	Poverty Classification		Per Capita Expenditure Quintile					
Commodity Group	**Nonpoor**	**Poor**	**1**	**2**	**3**	**4**	**5**	**ALL**
	Percent							
Yellow maize (all)	3.39	11.69	13.67	7.54	5.34	2.88	1.22	6.14
Yellow maize grain	0.99	3.36	4.04	1.98	1.65	0.82	0.35	1.77
Yellow maize flour	1.69	5.37	5.90	4.02	2.71	1.34	0.54	2.90
Yellow maize flour with bran	0.72	2.97	3.73	1.55	0.98	0.72	0.33	1.46
White maize (all)	2.89	3.57	3.38	4.09	3.93	2.83	1.33	3.11
White maize grain	1.37	2.16	2.20	2.25	2.08	1.10	0.53	1.63
White maize flour	1.52	1.41	1.18	1.85	1.86	1.73	0.80	1.48
Rice	7.85	7.75	6.89	9.47	8.48	8.71	5.53	7.82
Oil	2.15	2.08	2.06	2.15	2.25	2.24	1.93	2.13
Sugar	2.75	4.25	4.53	3.73	3.44	2.81	1.70	3.24
Fruits and vegetables	8.84	12.33	12.87	11.01	10.47	9.03	6.59	9.99
Bread, wheat, and baked goods	.34	7.95	7.06	9.43	9.36	8.42	6.79	8.21
Roots, tubers, pulses	6.29	6.74	6.67	6.83	7.06	6.95	4.67	6.44
Meat, fish, dairy	11.50	6.14	5.38	7.61	9.02	11.75	14.90	9.73
Other foods, etc.	7.54	4.00	3.91	4.72	5.68	7.14	10.38	6.37
Other foods	5.20	2.45	1.99	2.98	3.91	5.07	7.49	4.29
Milling	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Meals out	2.23	1.50	1.87	1.70	1.64	2.00	2.72	1.99
School meal	0.11	0.05	0.06	0.04	0.12	0.08	0.17	0.09
Nonfoods	38.46	33.51	33.58	33.42	34.95	37.23	44.94	36.82
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total household expenditure (Meticais/month)	389,699	164,264	142,406	206,581	256,845	317,811	652,883	315,210
Per capita expenditure (Meticais/month)	81,042	22,904	19,195	30,618	42,690	61,922	154,858	61,833
Number of households	1216	600	364	363	363	363	363	1,816

Source: Computed from FSC/CFNPP survey data.

their budget shares are relatively stable until the fifth quintile, when they eventually fall.

The budget shares tell a number of other interesting stories. For example, the data suggest a large number of luxury goods, including the meat fish, and dairy group with its rapidly increasing budget share across the quintiles. But without doubt, the most interesting story in the budget share data is that while there is little decline in the food share across the expenditure quintiles, there is a dramatic change in the composition of food and nonfood expenditure. The high value that household's place on diversity, quality and convenience in the diet is manifest.

Of course, budget share information includes the zero shares of nonconsumers. It is therefore useful to examine the percentage of households that are consuming food commodities. This is shown in Table 2 where we see that for the yellow maize products there is a steady decline in the share of consumers across expenditure quintiles. This decline in the share of consumers is particularly precipitous for yellow maize grain and yellow maize flour with bran. In contrast, for rice and white maize, there is a jump in the share of consumers between the first and second quintile. Thereafter, one observes a leveling out in percentage of households consuming, in the case of the former at around 95 percent, and in the case of white maize, with just over half of the households being consumers in the upper four quintiles.

Of major interest to the issue of household welfare is not simply the food consumption patterns, but also how these relate to the household's consumption of calories, and the importance of the commodity groups in providing for the household's nutrient intake. The contribution of individual commodities to calorie intake will thus be determined by a combination of the level of the budget share, and the price per calorie. Table 3 shows the cost in local currency (Meticais) to obtain 100 calories. The least expensive source of calories is yellow maize grain. Yellow maize flour and white maize grain, most of the latter of which is domestically produced, are the next cheapest sources of calories. There is substantial premium paid for consuming white maize flour, most of which is imported. Rice is the most expensive source of calories among the staples, with consumers paying nearly two times more per calorie than for yellow maize flour. Interestingly, the price per calorie for oil and sugar are nearly the same as for rice. It is also noteworthy that there is little variation in the calorie-price across expenditure quintiles for the staple products. Exceptions are white maize flour, which varies in quality depending on its source and level of extraction in the milling and commodity groups for fruits and vegetables and meat, fish and dairy products. This would suggest it is only in the case of these groups that quality differences are large, and that other commodities are relatively homogenous in terms of their characteristics.

Combining the information on budget shares and calorie price, we arrive at the level of calories, and calorie shares by expenditure groups. The results show that average per capita daily calorie consumption increases from 1,441 for the lowest quintile to 3,559 for the highest (Table 4). The information on shares highlight the importance of yellow maize products as a source of calories

Table 2 – Percentage of Households Consuming Commodity Groups by Per Capita Expenditure Quintile and Poverty Classification

Commodity Group	Poverty Classification		Per Capita Expenditure Quintile					ALL
	Nonpoor	Poor	1	2	3	4	5	
	Percent							
Yellow maize (all)	59.46	87.17	89.56	79.06	75.48	59.50	39.39	68.61
Yellow maize grain	27.88	47.33	48.63	41.32	39.12	26.17	16.25	34.31
Yellow maize flour	39.14	54.00	54.12	52.62	47.66	39.67	26.17	44.05
Yellow maize flour with bran	14.31	26.83	26.65	22.31	18.46	15.43	9.37	18.45
White maize (all)	54.28	43.00	38.46	52.62	53.99	56.75	50.96	50.55
White maize grain	29.77	28.67	26.65	35.54	35.54	27.00	22.31	29.41
White maize flour	37.09	22.67	18.96	31.40	31.96	38.84	40.50	32.32
Rice	94.82	81.67	77.47	90.08	93.39	95.87	95.59	90.47
Oil	95.81	88.33	84.89	93.66	95.87	95.59	96.69	93.34
Sugar	96.05	93.00	91.48	95.59	96.42	97.52	94.21	95.04
Fruits and vegetables	98.93	98.00	97.25	98.90	99.17	99.17	98.62	98.62
Bread, wheat, etc.	96.30	88.00	85.16	93.39	96.97	94.77	97.52	93.56
Roots, tubers, pulses	98.60	96.17	95.05	97.80	98.90	99.17	98.07	97.80
Meat, fish, dairy	96.30	90.00	86.26	93.66	95.87	97.52	97.80	94.22
Other foods, etc.	97.53	90.83	87.64	96.14	96.69	98.62	97.52	95.32
Other foods	96.55	89.50	85.71	95.04	96.14	97.80	96.42	94.22
Meals out	20.39	13.17	13.74	19.01	19.01	19.28	19.01	18.01
Number of households	1,216	600	364	363	363	363	363	1,816

Source: Computed from FSC/CFNPP survey data.

Table 3 — Calories Prices (Average Cost in Meticais of 100 Calories) for Commodity Groups by Per Capita Expenditure Quintile and Poverty Classification

	Poverty Classification		Per Capita Expenditure Quintile					
Commodity Group	Nonpoor	Poor	1	2	3	4	5	ALL
	Meticais							
Yellow maize (all)	13.60	13.32	13.34	13.42	13.51	13.45	13.92	13.48
Yellow maize grain	10.09	9.65	9.71	9.60	10.29	9.79	10.38	9.89
Yellow maize flour	15.11	15.50	15.43	15.67	15.58	14.36	14.95	15.27
Yellow maize flour with bran	16.89	16.01	16.18	15.89	16.95	16.65	17.37	16.46
White maize (all)	23.90	20.02	19.87	20.55	21.69	24.26	26.95	22.81
White maize grain	15.12	15.49	15.70	15.12	15.72	14.98	14.44	15.24
White maize flour	31.57	27.12	27.80	28.33	30.08	31.22	33.25	30.54
Rice	31.66	29.58	29.27	30.12	31.37	31.44	32.60	31.04
Oil	32.86	33.30	33.62	33.38	33.47	31.66	32.94	33.00
Sugar	30.47	30.33	30.38	30.14	30.41	29.87	31.37	30.43
Fruits and vegetables	120.36	94.37	90.16	98.51	105.49	114.06	150.72	111.83
Bread, wheat, etc.	46.80	50.10	51.12	48.23	47.98	47.18	45.04	47.83
Roots, tubers, pulses	54.12	50.28	51.48	50.06	50.54	52.59	59.68	52.87
Meat, fish, dairy	227.38	175.21	166.78	195.08	197.40	218.63	270.68	210.91
Other foods	1,068.63	1,690.84	1,967.22	1,247.04	1,353.05	985.90	846.67	1,263.91

Note: Only reported purchases are used for the calculations of the statistic.

Source: Computed from FSC/CFNPP survey data.

Table 4 — Distribution of Average Calorie Shares of Commodity Groups by Per Capita Expenditure Quintile and Poverty Classification

	Poverty Classification		Per Capita Expenditure Quintile					
Commodity Group	**Nonpoor**	**Poor**	**1**	**2**	**3**	**4**	**5**	**ALL**
	Percent							
Yellow maize (all)	15.99	39.01	43.52	28.43	22.70	14.75	8.55	23.54
Yellow maize grain	6.13	14.55	16.67	10.06	9.18	5.47	3.17	8.89
Yellow maize flour	7.12	16.17	17.29	13.03	10.15	6.36	3.70	10.08
Yellow maize flour with bran	2.75	8.28	9.56	5.35	3.37	2.92	1.68	4.56
White maize (all)	9.91	9.97	9.04	12.25	11.93	9.78	6.65	9.93
White maize grain	6.20	7.07	6.83	8.31	7.99	5.44	3.84	6.48
White maize flour	3.71	2.90	2.20	3.94	3.93	4.33	2.81	3.45
Rice	20.36	13.58	11.52	17.85	18.00	22.50	20.72	18.14
Oil	5.69	3.33	3.17	3.74	4.46	5.55	7.63	4.92
Sugar	7.05	6.74	6.86	6.71	7.09	7.40	6.68	6.95
Fruits and vegetables	6.95	7.31	7.56	6.75	7.31	7.13	6.61	7.07
Bread, wheat, etc.	15.73	8.36	6.86	11.29	13.48	14.89	19.96	13.32
Roots, tubers, pulses	9.89	7.52	7.08	8.24	9.56	10.50	10.15	9.11
Meat, fish, dairy	4.68	1.94	1.70	2.29	2.99	4.36	7.53	3.78
Other foods, etc.	3.75	2.24	2.68	2.44	2.48	3.14	5.52	3.25
Other foods	1.35	0.67	0.60	0.74	0.97	1.15	2.16	1.13
Meals out	2.23	1.49	1.98	1.65	1.35	1.86	3.09	1.99
School meals	0.17	0.08	0.09	0.06	0.17	0.12	0.26	0.14
Total sum	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Average per capita calories/day	2,771	1,605	1,441	1,906	2,309	2,712	3,559	2,388
Number of households	1,216	593	358	362	363	363	363	1,809

Source: Computed from FSC/CFNPP survey data.

for the lowest expenditure quintile. Specifically, these products comprise 43.5 percent of the total calorie consumption of these households. The combination of white and yellow maize comprise over half the bottom quintile's calorie intake. As incomes rise, the share of calories from yellow maize products falls dramatically, to less than 10 percent for the highest quintile. In contrast, the importance of rice and bread rises markedly, making them the primary calorie sources of the rich. Also gaining in importance is the share of calories from meat, fish and dairy, rising from just 1.7 percent in the lowest quintile, to 7.5 percent in the upper quintile.

4. POLICY SIMULATIONS

In this section, we examine the effects of changes in food aid imports of yellow maize to Maputo. The analysis begins at the sectoral level, using the multi-market model presented above to estimate changes in prices, production, aggregate consumption, and trade of major food commodities given changes in yellow maize imports. Changes in aggregate incomes of the three households groups, the urban poor, urban nonpoor, and rural households are derived from the model. We include a sensitivity analysis of the robustness of the results under a variety of assumptions regarding model specification and parameter estimates.

While modeling the effect of policy change on production and consumption at the sectoral level, as well as the aggregate incomes of the three classes of households in the model is of interest, we next extend the analysis to the individual household level. In particular, we take the new price vector derived from the multi-market model, as well as the new aggregate income of the poor, and determine for each household below the poverty line what their new level of calorie consumption and pattern of expenditures would be. That is, we ask the question: how would the calorie consumption and budget shares of each household below the poverty line change if the prices and incomes changed according to the model simulations? We further determine how the head count and depth of poverty measures change in the population as a result of the price shifts and aggregate income changes derived from the model.

CHANGES IN FOOD AID IMPORTS: SECTORAL LEVEL OUTCOMES

In Simulation 1A, yellow maize imports destined for the Maputo market are increased by 15 percent over the base 1991 level. It is assumed that these imports are funded through additional foreign aid inflows. Spending of the countervalue funds generated through sales of the yellow maize imports is not taken into account here.

The price of yellow maize falls sharply as the 15 percent increase in yellow maize supply is sold on the Maputo market (Table 5). The demand parameters indicate that in contrast to the urban poor, the urban nonpoor households are not very responsive to price changes, (i.e., their demand is price inelastic), so the increased supply of yellow maize must be consumed almost entirely by the urban poor. The yellow maize market clears with a 37.1 percent decrease in the yellow maize price and a 28.7 percent increase in yellow maize consumption by the urban poor.

Changes in the yellow maize price affect markets for other commodities as well, by increasing the demand for wheat, meat and nonagricultural goods and lowering demand for substitutes for yellow maize: white maize, rice, and vegetables, roots and pulses. Prices of nontradable vegetables, roots and pulses tend to fall because of reduced demand, thus shifting production incentives away

Table 5 - Increased Yellow Maize Imports[a]; Simulation Results

Simulation	1a	1b	2	3	4	5	6
	Percentage Change						
Production							
White maize	0.10	0.07	0.07	0.04	0.08	0.07	-0.82
Rice	0.12	0.08	0.09	0.16	0.10	0.09	0.60
Export crops	0.23	0.16	0.17	0.26	0.18	0.17	0.62
Vegetables	-0.45	-0.31	-0.36	-0.45	-0.37	-0.36	-0.36
Meat	0.37	0.06	0.29	0.38	0.29	0.29	0.31
Consumption							
Yellow maize total	8.98	5.99	8.98	8.98	8.98	8.98	8.98
Urban nonpoor	0.82	0.56	8.07	0.80	0.56	8.13	3.85
Urban poor	28.71	19.13	21.70	28.73	12.50	21.64	11.17
Rural	0.00	0.00	0.00	0.00	12.49	0.00	11.08
White maize total	-0.21	-0.15	-0.13	0.03	-0.36	-2.37	-0.55
Urban nonpoor	1.46	1.01	1.17	1.72	0.51	-5.65	0.29
Urban poor	-0.92	-0.64	-0.68	-0.66	-0.62	-7.38	-0.63
Rural	-0.73	-0.51	-0.54	-0.49	-0.64	-0.56	-0.84
Rice	-1.77	-1.23	-1.36	-1.77	-1.11	-1.36	-1.01
Wheat	2.51	1.73	1.99	2.51	1.26	1.99	1.14
Nominal incomes							
Urban nonpoor	-0.43	-0.29	-0.36	-0.42	-0.34	-0.36	-0.28
Urban poor	-0.43	-0.29	-0.36	-0.42	-0.34	-0.36	-0.37
Rural	-0.40	-0.28	-0.36	-0.44	-0.38	-0.36	-0.95
Prices							
Yellow maize	-37.07	-27.47	-30.28	-37.10	-19.63	-30.22	-18.46
White maize	-0.36	-0.24	-0.36	-0.67	-0.36	-0.36	-4.89
Rice	-0.36	-0.24	-0.36	-0.36	-0.36	-0.36	-0.36
Wheat	-0.36	-0.24	-0.36	-0.36	-0.36	-0.36	-0.36
Vegetables	-1.55	-1.07	-1.23	-1.58	-1.30	-1.23	-1.62
Meat	3.80	2.61	2.94	3.84	2.93	2.93	3.12
Nonagriculture	-0.43	-0.29	-0.36	-0.42	-0.34	-0.36	-0.36
Real incomes							
Urban nonpoor	0.20	0.18	0.19	0.21	0.01	0.19	0.18
Urban poor	3.63	2.67	2.96	3.65	1.89	2.95	2.11
Rural	-0.07	-0.06	-0.06	-0.08	2.53	-0.06	2.30
Rent	-0.32	-0.22	-0.24	-0.32	-0.13	-0.24	-0.12
White maize imports	-0.86	-0.62	-0.56	0.00	-1.27	-7.40	0.00

Source: Model simulations.

Notes:

1a. Base Simulation: 15 percent increase in imports sold on the Maputo market. (Econometric estimates for
urban household demand parameters.)
1b. 10 percent increase in yellow maize imports sold on the Maputo market.
2. Own-price elasticity of demand for yellow maize by urban non-poor households changed from 0.0 to -0.2.
3. Fixed white maize imports.
4. Increased rural consumption of yellow maize.
5. Greater cross-price elasticities of demand between yellow and white maize.
6. Simulations (3), (4) and (5) combined.

from these goods, and towards tradable agricultural commodities and nonagricultural production. Production of white maize, rice and export crops rises slightly (0.1 to 0.2 percent), while production of vegetables, roots and pulses falls by 0.5 percent.

This gain in production takes place in spite of a small appreciation of the real exchange rate (a reduction in the price of tradables relative to nontradables). Because the cost of the incremental yellow maize imports is small on a macroeconomic scale, 2.1 million dollars,[13] the real exchange rate appreciates by only 0.4 percent. (Although the price of vegetables, roots and pulses falls, this is outweighed by an increase in the prices of other nontradable goods such as nonagricultural goods and meat.)

The increase in yellow maize imports thus has little effect on the white maize market. The 37.1 percent decrease in the yellow maize price, in itself, leads to only a 0.9 percent decrease in demand for white maize by the urban poor (and a 1.5 percent increase in demand by the urban nonpoor).[14] The small real exchange rate appreciation only slightly lowers white maize prices relative to prices of nontradable goods in general. But the decline in the price of vegetables, roots and pulses as demand shifts towards yellow maize outweighs the effects of the real exchange rate appreciation and actually leads to a slight increase in incentives for production of white maize. White maize imports fall by 0.9 percent.

The net effect of the changes in prices and agricultural production is to increase aggregate real incomes of the urban poor by 3.6 percent, mainly because of lower food prices. Aggregate real incomes of the urban nonpoor increase only slightly since these households consume relatively little yellow maize. Because the terms of trade shifts against rural households as the prices of vegetables, roots and pulses, and grains fall, real incomes of rural households fall very slightly (-0.1 percent).

Reducing the change in yellow maize imports to only 10 percent, (Simulation 1b), shows that the model is nearly linear for small changes in imports. Real incomes of the urban poor rise only 2.67 percent, 74 percent of the rise in Simulation 1a.

Sensitivity Analysis

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[13] The 15 percent increase in yellow maize imports is equal to 11,500 tons of yellow maize, valued at $182.6 per ton c.i.f.

[14] Unlike the poor, for the urban non-poor, yellow maize is not a net substitute for white maize. The low magnitude of the positive compensated elasticity is offset by the income effect, so the uncompensated cross-price elasticity of white maize demand with respect to the price of yellow maize is slightly negative.

A key parameter determining the extent of a fall in yellow maize prices with additional imports is the own-price elasticity of demand for yellow maize by urban households. Although this parameter is empirically estimated, we nonetheless perform sensitivity analysis in Simulation 2 where we change the own-price elasticity of demand for yellow maize — by the urban nonpoor from 0.0 in Simulation 1 to -0.2, with the elasticity for the poor remaining at -0.55 as in Simulation 1.[15] As demand for yellow maize by the nonpoor becomes price-responsive, their consumption of yellow maize rises by 8.1 percent with the increase in yellow maize supply. Consumption of yellow maize by the poor thus rises less (by 21.7 percent instead of 28.7 percent as in Simulation 1) and the price of yellow maize falls less steeply (-30.3 percent versus -37.1 percent in Simulation 1a). Since the yellow maize is less effectively targeted, real incomes of the urban poor rise by 3.0 percent (compared with 3.6 percent in Simulation 1a). Effects on supply and rural incomes are dampened since the fall in yellow maize prices and the resulting shift in demand away from nontraded food crops are smaller.

In Simulation 3 we assume that white maize imports are fixed in the short run (due to problems in information flows or other market imperfections). Under such a scenario, any decline in white maize demand would affect domestic demand, and thus prices, not the level of imports. Although a fixed level of white maize imports is a highly unlikely scenario, nonetheless, once again we simulate an extreme, worst case scenario for farmers. The white maize price is 0.3 percent lower than in Simulation 1a as imports are not permitted to fall with the decrease in demand. Production of white maize increases by 0.04 percent compared with a 0.10 percent increase in Simulation 1a, although the net effect on rural income is negligible.

All of the above simulations have assumed that yellow maize sold in Maputo is consumed only by urban households and does not find its way into rural markets. In Simulation 4, we show the effects of yellow maize being supplied throughout the region so that the same price holds for all consumers. This extreme assumption provides an upper bound for the magnitude of the effects of leakages outside the Maputo market, not only because it assumes outflows of aid from Maputo to the countryside, but that the yellow maize marketed is sold in rural areas at the same price as in Maputo. In reality, even if there were market flows to the countryside, prices in rural markets would be higher than in Maputo due to the large transport and other marketing costs.

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[15] The income elasticity of demand for yellow maize is also adjusted upward to -1.345 so as to maintain homogeneity of degree 0 in prices and incomes. Engel's Law (the sum of the income elasticities weighted by the budget shares must equal unity) is satisfied by reducing the income elasticity of non-food from 1.338 to 1.321. Finally, zero homogeneity in prices and incomes for non-foods is satisfied by reducing the own-price elasticity from -0.975 to -0.950. With these adjustment, symmetry of the cross-price effects is no longer maintained, however.

The results of such a scenario would be that consumption of yellow maize rises by 12.5 percent for both urban and rural households. Real incomes increase by 2.5 percent for rural households, but the 1.9 percent gain for urban poor households is substantially less than in Simulation 1 (3.6 percent).

Another key parameter influencing the impact of a subsidy on yellow maize on the demand and price of white maize is the cross-price elasticities between yellow and white maize. For Simulation 5, the adjusted own-price elasticities of demand for yellow maize from Simulation 2 are used, and the cross-price elasticity of demand for white maize with respect to a change in the yellow maize price is increased from -0.046 to 0.150 for the urban nonpoor and from 0.004 to 0.200 for the urban poor.[16]

White maize demand now falls by 2.4 percent and white maize imports fall by 7.4 percent as urban consumers substitute towards yellow maize. The spillover effects of increased yellow maize imports on the white maize market are still small however, mainly because Maputo accounts for only a small share (11 percent) of national consumption and 33 percent of regional consumption of white maize. A 10 percent decrease in Maputo's demand for white maize would only represent a 3.3 percent decline in the region's demand for white maize.[17] Moreover, because the white maize price remains tied to world prices, domestic production of white maize is almost unchanged. The change in consumption of yellow maize and real incomes of the urban poor are essentially identical to those in Simulation 2.

Finally, Simulation 6 shows the combined effects of fixing white maize imports (Simulation 3), allowing the additional yellow maize imports to be sold in rural areas (Simulation 4), and using the new parameters from Simulation 5, in order to set an upper bound on potential disincentive effects on white maize. White maize prices fall 4.9 percent and white maize production falls by 0.82 percent. Consumption of yellow maize by the urban poor and rural households increases by 11.2 and 11.1 percent, respectively, and the 21.0 percent drop in

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[16] Adjustments to other parameters are also made to maintain symmetry of the cross-price effects and to satisfy Engel's Law. The new elasticities are as follows:

	Urban Poor	Urban Non-Poor	Rural
ϵ^D (*wmz,ymz*)	0.200	0.150	0.200
ϵ^D (*ymz,wmz*)	0.138	0.073	0.138
η^Y (*ymz*)	0.112	-0.166	0.112
η^Y (*wmz*)	0.314	0.198	0.314
η^Y (*non-agric*)	1.463	1.361	1.463

[17] The model here assumes that Maputo is fully integrated only with the Southern region of Mozambique. If white maize from other regions of Mozambique also fed into the Maputo market, the effects of changes in Maputo demand on white maize production would be even smaller.

yellow maize price contributes to a 2.1 percent increase in real incomes for the urban poor and a 2.3 percent increase for the rural households.

Thus, under a wide range of assumptions on model parameters and structure, a policy of open market sales of increased yellow maize imports is an effective self-targeting mechanism for increasing real incomes and of the Maputo poor, without having any significant deleterious effects on rural producers. Several key parameters drive this result. First, are the own-price elasticities of demand for yellow maize, which are larger in magnitude for the poor than for the nonpoor. Second, Maputo comprises a relatively small share of regional consumption of white maize. Third, cross-price effects on the white maize market are small, even with a change from the econometrically estimated parameters and fixed white maize imports. Fourth, white maize is a traded commodity, whose price is set internationally. And fifth, a large share of Maputo's white maize consumption is from commercial imports, which will bear the brunt of any decrease in demand for white maize.

IMPACT ON CONSUMPTION PATTERNS AND CALORIE INTAKE OF POOR HOUSEHOLDS, AND LEVEL OF POVERTY

Given the price and aggregate nominal income changes derived above, we now turn to the issue of the implication for calorie intake and poverty. We extend our inquiry only to the 10 and 15 percent changes in imports shown in Simulations 1A and 1B, since sensitivity analysis in the other simulations did not alter appreciably the observed outcomes.

As a result of an increase in the supply of yellow maize imports of 10 and 15 percent, calorie intake of the poor will increase by 8.65 and 12.38 percent, respectively (Table 6). As with the earlier simulations, this increase is due primarily to a rise in the consumption of yellow maize, the least expensive source of calories. The substitution effects increase the calorie shares for yellow maize, from 44.10 percent in the base case, to 48.66 and 50.43 percent, respectively, under the two import scenarios found in Simulations 1A and 1B.

How do the above exogenous price and supply changes of yellow maize affect the actual head count of poor and the depth of poverty? To address this question, we examine the impact of price changes on three poverty measures. First is the headcount measure H, defined simply as:

$$H = \frac{q}{n} \tag{5}$$

where q is the number of households below the poverty line Z, and n is the

Table 6 – Impact of Changes in Imports on Budget and Calorie Shares, and Calorie Consumption of the Poor

			Percent Change in the Yellow Maize Imports			
	Base Line		+10		+15	
Commodity	Budget Shares	Calorie Shares	Budget Shares	Calorie Shares	Budget Shares	Calorie Shares
			Percent			
Yellow maize	12.86	44.10	11.17	48.66	10.45	50.43
White maize	4.46	10.18	4.43	9.32	4.43	8.99
Rice	6.97	10.84	6.87	9.83	6.83	9.45
Oil	2.24	3.11	2.26	2.92	2.27	2.84
Sugar	4.52	6.88	4.57	6.46	4.60	6.29
Fruits and vegetables	13.95	6.72	13.63	6.10	13.51	5.85
Bread, wheat, etc.	8.40	7.70	8.55	7.21	8.61	7.02
Roots, tubers, pulses	7.70	7.08	7.38	6.31	7.25	6.00
Meat, fish, dairy	5.34	1.40	5.99	1.40	6.25	1.40
Other foods and beverages	4.54	2.00	4.59	1.80	4.61	1.73
Nonfoods	29.02	0.00	30.55	0.00	31.20	0.00
Total shares	100.00	100.00	100.00	100.00	100.00	100.00
Total per capita expenditures (Meticais/Month)	22,904		22,831		22,806	
Total per capita calories/day		1,664		1,808		1,870

Source: Computed from FSC/CFNPP survey data.

number of households in the population. In addition, we estimate the poverty gap index, *PG*, defined as follows:

$$P = \frac{1}{n} * \sum_{i=1}^{q} \left(\frac{Z - Y_i}{Z}\right) \qquad (6)$$

where Y_i is the income of persons or household i, Z is the poverty line, n is the total number of individuals or households, and q is the number of individuals below the poverty line. Furthermore, we employ the Foster-Greer-Thorbecke P_2 measure which is as follows:

$$P_2 = \frac{1}{n} * \sum_{i=1}^{q} \left(\frac{Z-Y_i}{Z}\right)^2 \qquad (7)$$

In order to examine how these three indexes are affected by a change in supply and prices, we go back to our money metric measure of utility that we used to construct our original poverty line for the survey population. Given the sets of prices that prevailed at the time of the survey, and used in the baseline simulation, the poverty line and ultra-poverty line, based on the level of income needed to consume the normative calorie intakes of 2,500 and 2,000 per capita, are Meticais 32,400 and 21,380 per capita per month, respectively (del Ninno and Sahn 1993).

Prior to intervention (the base case), 33.96 percent of the households are below the poverty line, and 12.99 percent are classified as ultra-poor (Table 7). The average depth of poverty is 9.7 percent. A 20 percent decline in the price of yellow maize reduces the head count of the poor to 29.0 percent, and the poverty gap index to 8.81 percent. The share of the ultra poor declines by an even greater percentage, from 12.99 to 8.82 percent of the population. This drop in the share and depth of poverty, once again, is attributable to a decline in the prices, which reduces the corresponding level of income required to achieve the normative calorie consumption levels.

Similarly, we find that a 15 percent increase in yellow maize imports will reduce the number of poor from 33.96 to 22.82 percent of the population, reflecting a 16.84 percent decline in the level of income required to be classified as poor. But even more dramatic is the decline in the share of ultra-poor, falling from 12.99 percent to 5.46 percent of the population while the ultra-poverty gap fall to just 1.22 from 5.87 percent. This reflects a 22.31 percent fall in the ultra-poverty line.

COUNTERVALUE FUNDS AND THE COST OF THE SUBSIDY

Until recently yellow maize has been sold to consignees at below market clearing levels in a misguided attempt to subsidize consumers. The government has sacrificed potential revenues from countervalue funds by selling at a low

Table 7 – Poverty Level and Depth for Alternative Policy Simulations

	Poverty Line	Poverty Indexes		
	Meticais per Capita/Month	Head Count	Depth	FGT_{P2}
At current prices				
Poverty line	32,400	33.96	9.70	3.99
Ultra poverty line	21,380	12.99	2.90	1.08
10% increase in yellow maize imports				
Poverty line	28,671	26.57	7.01	2.78
Ultra poverty line	18,047	7.72	1.64	0.60
15% increase in yellow maize imports				
Poverty line	26,944	22.82	5.87	2.29
Ultra poverty line	16,610	5.46	1.22	0.45

Source: Sahn et al., FSC/CFNPP survey.

price yet the subsidy has not reached the intended consumers. Results from the 1991/92 DSA/Cornell household survey of Maputo show, however, that most yellow maize was purchased in the open market (dumbanenge) at an average price of 414.2 Mt/kg, 50.6 percent above the official NSA price of 275 Mt/kg.

Selling yellow maize at a market clearing price would thus increase government revenues from countervalue funds. Paradoxically, there is a tradeoff between potential countervalue funds and the level of maize imports. As yellow maize imports increase, the open market price (the price paid by consignees) falls, reducing potential countervalue funds.

Table 8 shows the effects of changes in the level of yellow maize imports on the implicit subsidy to yellow maize consumers, potential countervalue funds and the marginal costs and benefits. Costs are measured in two ways. The first measure is simply the c.i.f. value of the yellow maize imports. The second measure of costs is the net financial cost to the government of using yellow maize food aid to reduce urban poverty, equal to the difference between the c.i.f value of yellow maize imports (plus any government costs associated with the sale of the yellow maize to consignees) and the countervalue funds generated. Two measures of benefits are used, as well: the change in real incomes of the target group (the urban poor) and the change in the number of people below the poverty line.

Assuming a 30 percent marketing markup between c.i.f. and retail and a parallel market exchange rate of 2200 meticais/dollar, the observed market price of yellow maize (414.2 Mt/kg) is 16.9 percent below the border price of yellow maize at the retail level (498 Mt/kg). With a 15 percent increase in yellow maize sold in Maputo (Simulation 1a), the market price falls by 18.5 percent to level 47.7 percent below the border price. Potential countervalue funds are now 34.1 billion Meticais, a decrease of 6.8 billion Meticais from the base level potential countervalue funds. The decrease in potential countervalue funds occurs despite an increase in maize sold because with a price-inelastic demand, the percentage fall in market price (-18.5 percent) is greater than the percentage increase in total sales in Maputo (15.0 percent). The 15 percent increase in imports (11,500 tons) has a CIF value of 4.4 billion meticais (2.1 million dollars). With the marginal increase in real incomes of urban poor households equal to 5.9 billion meticais, the marginal benefit/cost ratio is 1.34. In terms of the number of people below the poverty line, the marginal benefit cost ratio is 79.6 thousand people lifted out of poverty per million dollars (c.i.f.) of yellow maize food aid.

In terms of the financial cost to the government, the marginal cost of the 15 percent increase in yellow maize sold in Maputo is 6.75 billion meticais, as the potential countervalue funds fall from 40.81 billion meticais historically to only 34.06 billion meticais with higher yellow maize sales. The drop in total countervalue funds occurs because the government receives less money on all its sales of yellow maize, not just on the additional 15 percent. In terms of real incomes, the marginal benefits to urban poor households of 5.90 billion meticais are equal to 87 percent of the financial cost to the government. In terms of the

Table 8 – Benefits and Costs of Increased Food Aid to Maputo

	Change in Yellow Maize Imports	
	10 percent	15 percent
CIF value of imports (billion meticais)	52.06	53.53
Countervalue funds (billion meticais)	35.9	34.1
(change)	-4.9	-6.8
Price subsidy to consumers with respect to border price	39.7	47.7
Calorie consumption per capita (level)	1808	1870
(change)	144	206
Change in real incomes of the urban poor		
(billion meticais)	4.34	5.90
(percent change)	2.7	3.6
Population below poverty line		
(thousands)	398.6	342.3
(percent of urban population)	26.6	22.8
Marginal cost		
(import cost, CIF, million dollars)	1.40	2.10
(import cost, CIF, billion meticais)	2.94	4.41
(financial cost, billion meticais)	4.94	6.75
Benefit/cost ratios		
Real incomes/import cost	1.47	1.34
Real incomes/financial cost	0.88	0.87
Reduction in poverty/import cost ('000 people/million dollars)	79.1	79.6
Reduction in poverty/financial cost ('000 people/billion meticais)	22.4	24.7

Source: Model simulations.

number of the poor, the marginal benefit cost ratio is 24.7 thousand fewer people below the poverty line per billion meticais of foregone countervalue funds.

Thus, reducing the amount of yellow maize sold actually increases the countervalue funds generated. If the government's objective were to maximize countervalue revenues, it would act as a monopolist and lower imports of yellow maize until the marginal revenue from countervalue funds was equal to the marginal cost (the c.i.f. price).[18] Of course, the actual objectives of food aid policy of the Mozambican government are a mix of poverty alleviation and generation of revenues. Nonetheless, the loss of these potential countervalue revenues represents a real opportunity cost of the policy.

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[18] As long as the price elasticity of demand is less than 1 in absolute magnitude, there is no maximum solution. In practice, as supply decreases and the price rises, demand becomes more price elastic (the absolute magnitude of the price elasticity increases). The econometric analysis provides estimates only for a small portion of the demand curve and do not give an indication of the overall elasticity for a large change in quantity or price.

5. CONCLUSIONS

In this paper we have shown the possibilities of using food aid as an effective means of poverty alleviation in Maputo. Specifically, the simulations, based on a multi-market model constructed using data on supply and demand levels in 1991/1992 and parameter estimates of a system of consumer demand from a survey during the same period, show that yellow maize is self-targeting and that poor consumers are responsive to changes in the price of yellow maize. The simulations based on these parameters indicate the importance and efficacy of continuing, and even increasing the quantity of food aid imports sold in the Maputo market above the levels of 1991/92 as a means of raising calorie intake, reducing the number of poor, and narrowing the poverty gap.

Fortunately, the economic and political situation in Mozambique improved greatly in 1993 as a result of an end to the long civil war and good rains that contributed to the largest white maize harvest in over a decade. How does the analysis using 1991/92 data apply to the situation in 1993 and beyond? Have the momentous changes in Mozambique eliminated the need for food aid sales in Maputo?

In fact, the major results of this analysis still apply to the current situation and are relevant for future policy. In particular, three major lessons emerge from the analysis that have relevance in spite of fluctuations in levels of harvest, world prices or food aid deliveries to rural areas.

First, open market sales of yellow maize in Maputo are likely to remain an effective self-targeting mechanism for reducing urban poverty. The preference for staples other than yellow maize shown by urban consumers in Maputo is a strong one. For higher income consumers a change in yellow maize prices brought about by a change in yellow maize supply has little effect on quantity of yellow maize demanded. But for the Maputo poor, changes in yellow maize prices lead to greater changes in quantity demanded and, because yellow maize comprises a large share of their consumption basket, a significant effect on their real incomes. Of course, over time, there is the prospect that there will be changes in tastes and preferences that will diminish these self-targeting attributes of yellow maize products. This is indeed possible, although, determinable, and should not be a deterrent to bolstering or at least maintaining the food aid program in Maputo in the short-term, especially until economic stability and growth is restored to a war-tattered economy.

Second, marginal changes in the level of yellow maize sales in Maputo vis à vis the levels of 1991/92 are unlikely to have major effects on rural price incentives. This is because in normal years a large share of white maize consumed in Maputo is likely to be imported from Swaziland and the Republic of South Africa, especially in the form of flour. Even if the cross-price effects of lowering yellow maize imports depressed demand, given the magnitude of the elasticities, it is nearly inconceivable that the decline in demand would be so large as to reduce imports to zero and lead to a large drop in the price of white maize.

But even if increased domestic production replaced imported white maize, the simulations show that the decline in white maize price is likely to be small. The urban poor's budget shares to white maize products is trivial relative to aggregate domestic supply, so there is little sector-wide impact of a decline in their demand for white maize. Conversely, the urban nonpoor who consume white maize are not only small consumers of yellow maize, but not nearly as price responsive. Thus, their demand for white maize also changes little. Finally, it is also the case that the areas proximate to Maputo are not major maize producing regions. As long as the yellow maize food aid is initially sold in Maputo, the potential for substantial amounts of yellow maize to be transported and marketed in producing areas is not in the realm of financial feasibility.

Third, because the urban poor are likely to be disproportionately affected by changes in yellow maize imports, strict adherence to import parity pricing for yellow maize food aid sales to Maputo are not necessarily justified. The gains to the government from higher sales prices of yellow maize and the positive, but arguably small gains to producers of white maize in southern regions supplying Maputo must be weighed against the effects of higher consumer prices of yellow maize in Maputo and substantial declines in real incomes of the Maputo poor.

The above benefits of supplying yellow maize food aid to Maputo do not necessarily apply to other urban centers in Mozambique and almost certainly do not apply to rural areas in post-war Mozambique in years of normal harvest. Demand characteristics of non-Maputo households are not necessarily the same as those in Maputo. In isolated markets, impacts of substitution effects on prices may be larger as flows of white maize and other commodities from outside the region are limited. Addressing these issues fully would require data on rural household incomes and expenditure patterns, as well as information on market flows of commodities, a high priority for further data collection efforts.

In sum, we have a clear case in Mozambique of food aid being an appropriate instrument for poverty alleviation in the capital city, Maputo. The conventional wisdom of reducing yellow maize imports and maintaining commercial food aid sales at import parity should be re-examined in light of the results of this paper.

APPENDIX 1: EQUATIONS OF THE MOZAMBIQUE MULTI-MARKET MODEL

SUPPLY, DEMAND, AND INCOMES

Domestic production of commodity i, X_i, is modeled as a function of the base level of production XO_i and domestic producer prices PP_j:

$$X_i = XO_i * (1 + \sum \epsilon^{s}_{i,j} * [PP_j/PPO_j - 1]) \tag{1}$$

The elasticities of supply, $\epsilon^{s}_{i,j}$, determine the price-responsiveness of production to changes in the prices of the output and competing activities.

Household consumption of commodity i is a function of prices faced by the household and household income (Y_h). For urban households, consumption is determined by consumer prices (equation 2). Rural household consumption is determined by producer prices for agricultural commodities produced in rural areas (equation 3).[19]

$$UC_i = UCO_i * (1 + \sum \epsilon^{D}_{i,j,h} * [PC_j/PCO_j - 1] + \eta_{i,h} * [Y_h/YO_h] - 1) \tag{2}$$

$$RC_i = RCO_i * (1 + \sum \epsilon^{D}_{i,j,h} * [PP_j/PPO_j - 1] + \eta_{i,h} * [Y_h/YO_h - 1]) \tag{3}$$

Total consumption of each commodity, CD_i is simply the sum of the demands by all households:

$$CD_i = \sum UC_i + RC_i \tag{4}$$

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[19] In most of the simulations, a logarithmic formulation is used instead of the percentage change equations above (equations 1,2 and 3). The equations are as follows:

$$X_i = XO_i * \prod (PP_j/PPO_j)^{\epsilon^{s}_{i,j}} \tag{1a}$$

$$UC_i = UCO_i * \prod (PC_j/PCO_j)^{\epsilon^{D}_{i,j,h}} * (Y_h/Y_h0)^{\eta_{i,h}} \tag{2a}$$

$$RC_i = RCO_i * \prod (PP_j/PPO_j)^{\epsilon^{D}_{i,j,h}} * (Y_h/Y_h0)^{\eta_{i,h}} \tag{3a}$$

Production of nonagricultural goods is fixed (exogenous) in the model. Nonagricultural incomes for each household, $YNAG_h$, are assumed to change only according to a change in the consumer price of nonagricultural goods.

$$YNAG_h = YNAGO_h * PC_{NA} / PCO_{NA}, \tag{5}$$

Agricultural income for household h is simply the sum of the gross value of production of each crop times the share of production by household h, w_{ih}. In the model, w_{ih} for urban households is non-zero only for vegetables and meat.

PRICES

For tradable goods, the border price is determined as the world price in dollars converted to meticais by the exchange rate and adjusted for tariffs and taxes.

$$PM_i = PW_i * ER * (1 + tm_i) \tag{6}$$

The variability of the world price of tradable goods is determined by the level of Mozambique's import demand or export supply and the world price elasticity $\epsilon^m_{i,t}$. For the model simulations in this paper, $\epsilon^m_{i,t}$ is set to a large number (99999), so that world prices are exogenous.

$$M_{it} = MO_{it} * (1 + \epsilon^M_{i,t} * [PW_{it}/PWO_{it} - 1]) \tag{7}$$

The consumer price for tradable goods is then determined by the border price and marketing costs, $trmarg_i$. For goods for which import quotas are binding, $trmarg_i$ is endogenous, and includes the markup due to rents:

$$PC_{it} = PM_{it} * (1 + trmarg_i) \tag{8}$$

Producer prices are related to consumer prices by a marketing margin, $marg_i$, which is fixed for all commodities except yellow maize (as is discussed below).

$$PC_i = PP_i * (1 + marg_i) \tag{9}$$

MARKET CLEARING

Given the base levels of consumption, production, incomes and prices, the model solves for new values of all endogenous variables so that total supply equals total demand for each commodity.

$$X_i = C_i - M_i \tag{10}$$

For tradable goods, except yellow maize, domestic prices are determined by world prices and the exchange rate (equations 7 and 9), and net imports M_i are endogenous. For "nontradable goods," net imports are very small relative to total supply and are fixed exogenously. Domestic prices of nontradables adjust to clear the markets.

For yellow maize, imports are fixed exogenously and the marketing costs on tradables, $trmarg_i$, is made endogenous to reflect rents in addition to normal marketing costs.[20]

MODEL CLOSURE AND THE REAL EXCHANGE RATE

The above equations determine a complete partial equilibrium system of equations. In this system, the exogenous exchange rate determines the price level of the economy. An increase in the exchange rate will result only in an increase in all domestic prices of equal magnitude.

In order to simulate changes in the real exchange rate, some other price or nominal value must be held fixed. Two equations are added to define price index for nontradables, PNT. First, an index of the price of nonagricultural nontradables, PNT_{NA} is defined as part of a weighted average making up the domestic price of nonagricultural goods, PC_{NA}.

$$PC_{NA} = PNT_{NA}\,\alpha^{NA} * (ER*[1+TM_{NA}] * PWM_{NA})^{(1-\alpha^{NA})} \tag{11}$$

where TM_{NA} is the tariff on nonagricultural tradables, PWM_{NA} is the world price of nonagricultural tradables and α_{NA} is the share of nontradables in total nonagricultural expenditures. The price index of nontradables PNT is then defined as a weighted average of the price index of nonagricultural nontradables (PNT_{NA}) and the prices of vegetables and meat.

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20 Rents arise when an import quota is fixed below the level of imports that would be demanded in the absence of the quota. In the case of yellow maize food aid, these rents are captured either by the Mozambican government (if the yellow maize is auctioned) or by consignees (if they are able to purchase the yellow maize at a price below market value).

$$PNT = PNT_{NA}^{\beta_1^{NT}} * PC_{(vegs)}^{\beta_2 NT} * PC_{(meat)}^{(1 - \beta_1^{NT} - \beta_2^{NT})} \tag{12}$$

By fixing the domestic price of nontradables, *PNT*, a change in the nominal exchange rate results in a change in the real exchange rate of the same proportion.

Finally, an equation is added that determines the level of the real exchange rate given a change in foreign savings and a fixed price of nontradables.

$$ER = ERO * CHFSAV * (1 - \beta) / (X * [1+\epsilon_x] - P_m M * [1 + \eta^m]) \tag{13}$$

where the change in foreign savings (*CHFSAV*) is equal to the change in the trade balance ($P_m M - X$). β is the income elasticity of demand for imports, ϵ_x is the export supply elasticity and η^m is the import price elasticity of demand (Dorosh and Bernier, 1993).

APPENDIX 2: BASE DATA AND MODEL PARAMETERS

HOUSEHOLD EXPENDITURES AND INCOMES

Base data for expenditures of urban households derive directly from the 1991-92 FSC/CFNPP household survey of Maputo as the product of per capita values and quantities[21] and an assumed population of 1.5 million. A poverty line of 31,904 Meticais per capita, (del Ninno and Sahn, 1993), is used to distinguish between rich and poor households. In constructing the base data for the multi-market model, we used average prices for all Maputo rather than household specific prices for rich and poor households.

Quantities consumed by rural households are considerably less certain. Consumption of white maize and rice are based on estimates for rural production less marketings (assumed to be zero for white maize). Per capita rural consumption of wheat products and yellow maize is assumed to equal that for the urban poor. Nonfood expenditures are estimated as 25 percent of total expenditures. Other food, both vegetables (including pulses and roots) and meat, are the residual item, with the share of meat in other food equal to its share for the urban poor (25 percent). In general, rural consumption is valued at the producer price.[22] Rural incomes are estimated as the value of own-production of food, production of export crops (mainly cashew, but small amounts of cotton and copra), and nonagricultural incomes (assumed to equal 30 percent of total incomes). Rural savings are assumed to be zero.

The resulting household expenditure shares are given in Appendix Table 2.1. Incomes of rural households are estimated at 51,400 meticais per person, less than 20 percent of per capita incomes of the urban poor in the Maputo survey. The very low figure for the rural poor is in part explained by the lower food prices in rural areas (which determine the value of food consumed from own-production, a major source of imputed incomes). As shown in Appendix Table 2.2, the estimated per capita consumption of major grain staples and cassava in rural areas is over half that of the urban poor. Consumption of groundnuts and beans, major crops (along with white maize) in the farming systems of the region, likely accounts for a significant share of calories for rural households to compensate for the low grain consumption. Nonetheless, even though the estimates of the value of expenditures may overstate the gap in incomes between rural and urban households, there is near universal agreement that in fact rural households are

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[21] Quantities consumed of flour, bread and pasta are converted to grain equivalents.

[22] Rural consumption of imported goods is valued at the urban (c.i.f.) price plus a 100 percent marketing margin.

Appendix Table 2.1 - Mozambique: Household Expenditure Shares

	Maputo Nonpoor	Maputo Poor	Maputo Total	South Rural	Rural	Total
Yellow maize	2.1	10.2	3.5	6.3	6.4	4.8
White maize	2.3	3.9	2.6	9.7	8.1	5.0
Rice	6.7	8.6	7.0	1.9	3.4	5.4
Wheat	7.4	8.7	7.7	9.2	9.4	8.4
Subtotal grains	18.5	31.4	20.8	27.1	27.4	23.7
Vegetables, roots[a]	28.2	26.5	36.2	35.8	53.6	49.6
of which cassava	0.0	0.0	0.4	14.5	48.0	21.3
Meat, other food	18.1	19.4	12.2	12.1	n.a.[b]	n.a.[b]
Nonfood	35.5	20.1	32.9	25.0	18.9	26.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Total (thousand meticais per person)	865.4	272.0	629.1	51.4	50.4	104.0

[a] Vegetables and roots includes fruits, pulses, sugar and oil as well.
[b] Meat and other food included under vegetables and roots for rural and all Mozambique figures.

Source: FSC/CFNPP household survey, Mozambique unpublished national accounts tables, and authors' calculations.

Appendix Table 2.2 — Mozambique: Per Capita Consumption of Staples (kilograms grain equivalent per year)

	Maputo Nonpoor	Maputo Poor	Maputo Total	South Rural	Rural	Total
Yellow maize	41.7	65.3	51.1	17.1	17.1	20.2
White maize	31.5	16.6	25.6	26.3	21.6	22.0
Rice	52.2	20.9	39.7	2.6	4.7	7.9
Wheat	59.0	21.8	44.2	3.6	3.6	7.4
Total grains	184.4	124.6	160.6	49.7	47.0	57.5
Cassava			0.37	18.6	60.5	55.2
Total	184.4	124.6	161.0	68.3	107.5	112.7
Population (millions)	1.5	0.9	0.6	3.0	14.7	16.2

Note: Cassava in grain equivalents, estimated as fresh root weight divided by 3.51. (Conversion factor from FAO Food Balance Sheets, computer printouts.)

Source: FSC/CFNPP household survey, Mozambique unpublished national accounts tables, IMF (1992) and authors' calculations.

considerably poorer than their urban countervalues, a fact reflected in the expenditure estimates.

COMMODITY FLOWS

Production, trade, and total consumption of each commodity are given in Appendix Table 2.3. Production data are Ministry of Agriculture estimates; producer prices are from unpublished national accounts worksheets from the Ministry of Plan.[23] Import data for grains are taken from unpublished Ministry of Commerce data on import arrivals by port. The value of imports of other food is estimated to be 0.3 times the value of grain imports.

MODEL PARAMETERS

Three major sets of parameters influence the behavior of the model: own- and cross- price elasticities of demand, income elasticities of demand and supply elasticities. The urban demand parameters derive from econometric estimates described in Section 4. Rural demand parameters are equal to those for the urban poor, except for the expenditure elasticity of nonfood which is calculated using the expenditure elasticities for the other food commodities and the estimated budget shares for the rural poor, in accordance with Engel's Law (Appendix Tables 2.4 and 2.5).[24]

Due to a paucity of data on supply response in Mozambique agriculture, the matrix of supply elasticities is mainly based on data from other countries and restrictions from economic theory. For white maize, the own-price elasticity of supply is estimated to be 0.2. Own-price elasticities of supply of other commodities are chosen to be low in accordance with estimates for other countries (Rao 1989). Own-price elasticities of supply for rice, export crops, and other agriculture are assumed to be 0.25, 0.40, and 0.20, respectively. Cross-price elasticities were chosen so as to respect symmetry of cross-price effects and zero-homogeneity in all prices. The matrix of supply elasticities is shown in Appendix Table 2.6.

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[23] The exception is cassava, for which the average Nampula price (115 Mt/kg) rather than the official price (225 Mt/kg) as in the national accounts was used to value production of the family sector.

[24] The expenditure elasticity of demand for non-foods by rural households is thus 1.602, compared to 1.423 for the urban poor.

Appendix 2.3 – Mozambique: Base Data Table on Supply and Demand, 1991

	Domestic Production	Imports	Marketing	Total Supply	Maputo Nonpoor	Maputo Poor	Maputo Total	Rural South Consumption	Total Demand
Value (10^9 Mt)									
Yellow maize	0.00	49.12	3.94	53.06	15.62	16.15	31.77	21.29	53.06
White maize	15.07	16.97	7.67	39.70	18.29	6.35	24.64	15.07	39.70
Rice	3.72	42.31	26.22	72.25	54.80	14.54	69.34	2.91	72.25
Wheat	0.00	43.90	43.90	87.79	63.35	15.47	78.82	8.97	87.79
Vegetables	150.52	79.80	91.32	321.64	207.38	58.86	266.24	55.40	321.64
Meat	91.61	26.67	71.64	189.92	151.32	19.90	171.22	18.70	189.92
Export crops	4.80	-10.08	5.28	0.00	–	–	–	–	–
Nonfood	46.50	1076.70	–	1123.20	277.70	32.60	310.30	38.70	1123.20[c]
Total	312.22	1325.38	249.96	1887.56	788.45	163.88	952.33	161.04	1887.56[c]
Quantity (1,000 Mt)									
Yellow maize	0.0	128.1	–	128.1	37.7	39.0	76.7	51.4	128.1
White maize	79.3	38.4	–	117.7	28.5	9.9	38.4	79.3	117.7
Rice	10.1	57.4	–	67.5	47.1	12.5	59.6	7.9	67.5
Wheat	0.0	106.7	–	106.7	77.0	18.8	95.8	10.9	106.7

Notes: a Rural South production only.
b Includes marketing margins.
c Includes nonhousehold demand.

Source: FSC/CFNPP household survey, Mozambique unpublished national accounts table, IMF (1992) and authors' calculations.

Appendix Table 2.4 — Mozambique: Urban Nonpoor Demand Elasticities

Quantity	Yellow Maize	White Maize	Rice	Wheat	Vegetables	Meat	Non-agriculture	Income
	Price							
Yellow maize	0.000	0.026	0.280	0.058	0.581	0.347	0.253	-1.545
White maize	-0.046	-0.826	0.020	0.065	0.255	-0.077	0.214	0.394
Rice	0.022	-0.011	-0.672	0.141	-0.232	-0.276	-0.023	1.051
Wheat	-0.070	0.008	0.145	-1.073	-0.050	-0.084	0.223	0.902
Vegetables	0.021	0.036	-0.042	0.019	-0.545	-0.009	0.089	0.431
Meat	-0.043	-0.045	-0.165	-0.092	-0.225	-0.639	-0.293	1.504
Nonagriculture	-0.088	-0.013	-0.029	0.007	-0.143	-0.097	-0.975	1.338

Appendix Table 2.5 – Mozambique: Urban Poor and Rural Demand Elasticities

Quantity	**Yellow Maize**	**White Maize**	**Rice**	**Wheat**	**Vegetables**	**Meat**	**Non-agriculture**	**Income**
	Price							
Yellow maize	-0.552	0.013	0.080	0.014	0.213	0.034	0.026	0.172
White maize	0.004	-0.856	0.016	0.051	0.232	-0.102	0.145	0.510
Rice	0.019	-0.012	-0.668	0.143	-0.237	-0.276	-0.020	1.052
Wheat	-0.065	0.009	0.152	-1.077	-0.047	-0.097	0.228	0.897
Vegetables	0.054	0.031	-0.034	0.013	-0.617	-0.043	0.045	0.551
Meat	-0.166	-0.095	-0.321	-0.176	-0.491	-0.219	-0.514	1.980
Nonagriculture	-0.138	-0.018	-0.033	0.010	-0.189	-0.078	-0.977	1.423

Appendix Table 2.6 – Mozambique: Supply Elasticities

	White Maize	Rice	Export Crops	Vegetables	Meat	Nonagriculture	Fertilizer
				Price			
White maize	0.200	-0.025	-0.025	-0.100	0.000	-0.050	0.000
Rice	-0.101	0.250	0.000	-0.100	0.000	0.001	-0.050
Export crops	-0.079	0.000	0.400	-0.200	0.000	-0.021	-0.100
Vegetables	-0.024	-0.006	-0.015	0.300	0.000	-0.255	0.000
Meat	0.000	0.000	0.000	0.000	0.100	-0.100	0.000

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