Consumer Maize Meal Preferences in Zimbabwe: Survey Results and Policy Implications

A final report prepared for
Ministry of Lands, Agriculture and Water Development
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This report presents the results of a comprehensive survey of consumer maize meal preferences undertaken as part of the MLAWD/USAID *Grain Demand Analysis and Policy Reform Impact Assessment*. This final report was prepared by Lawrence Rubey (University of Zimbabwe).

Tobias Takavarasha (Deputy Secretary for Economics and Markets), Gordon Sithole (Chief Agricultural Economist), and Nancy Zitszanza in the Ministry of Lands, Agriculture and Water Development deserve much credit for supporting this collaborative policy research effort. The collaboration of Mrs. Zitsanza at various stages of this exercise was particularly vital.

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1. Introduction

Since the initiation of the Economic Structural Adjustment Programme (ESAP) in late 1990, the Ministry of Lands, Agriculture and Water Development (MLAWD), supported by USAID/Harare, has embarked on a series of grain marketing reforms. The eventual goal of these reforms has been to liberalize agricultural marketing and reduce budget deficits associated with agricultural marketing parastatals.

Yet throughout the reform process, concerns have arisen regarding the social costs of grain market reform, particularly the impact of the reforms on vulnerable groups such as grain deficit rural households and low-income urban consumers. The substantial increases in maize producer prices that have occurred since 1991 have provided the necessary incentives to boost domestic maize production. At the same time, budgetary pressures have resulted in the elimination of food subsidies and the end of food price controls. As a result, there have also been large increases in retail maize meal prices. Thus a critical issue facing Government policy-makers as the reform process proceeds is: **How can food prices be kept at tolerable levels for the rural and urban poor at a time when adequate producer incentives must be provided and subsidies have been eliminated?**

Over the next few years, as regulations which preserve the Grain Marketing Board's (GMB) single-channel marketing system are lifted, this dilemma will gradually be addressed. There is evidence that producer prices will be higher and consumer prices will be lower as regulations on handling, transport and storage, the tasks normally performed by state marketing boards, are relaxed to provide greater incentives for private trade.

However, recent research has demonstrated the potential for reduction in marketing costs at other stages in the marketing system not controlled by parastatals but which are nevertheless circumscribed by parastatal behavior and market regulations. In particular, it has become apparent that government policy has encouraged the development of a highly centralized and concentrated maize milling industry, which has in turn limited investment in hammer mills and restricted access by consumers to the products of small-scale mills. Changes in the grain marketing system which encourage the growth of the small-scale milling industry and informal marketing channels may, in the short run, help mitigate the food-price dilemma by permitting consumers access to lower-priced maize meal.

As a result, current GRZ (Government of the Republic of Zimbabwe) grain marketing reform proposals initiated by the MLAWD and supported by USAID have focussed on medium-term efforts to encourage the growth of the small-scale milling industry and informal maize marketing channels. **Yet the feasibility of meeting consumer demand for maize meal through the development of alternative grain marketing channels depends upon the potential demand for the products of small-scale mills.**

Although preliminary work has shown that there is demand for less refined maize meals, particularly among rural consumers, there is currently no empirical basis for predicting how consumers will alter purchases either when faced with changes in prices and incomes or when offered a greater range of maize products. Therefore, an intensive study of consumer grain preferences was conceived in order to answer these critical questions.

Section 2 outlines the objectives of the survey. The design process of the consumption questionnaire is described in Section 3. Section 4 contains an analysis of maize consumption patterns, including a socioeconomic overview and description of purchasing and production habits. Section 5 presents the results from an analysis of consumer preferences. Particular attention is paid to the potential demand for yellow maize and straight-run maize meal. Section 6 suggests a potential mechanism for implementing a targeted meal subsidy that reaches vulnerable groups with minimal leakage to richer households and without significant diversion of subsidized food into stockfeeds. Section 7 examines the implications of consumer preferences for the design of drought relief efforts. Finally, a summary of major conclusions appears in Section 8.

2. Objectives of the Consumption Survey

It has become part of the conventional wisdom in Southern Africa that urban consumers have a strong preference for highly-refined industrially-milled maize meals. In Zimbabwe, there is widespread belief that urban consumers have a strong taste preference for: 1) more refined maize meal over straight-run maize meal; and 2) white maize over yellow maize.

Low urban demand for the products of small-scale mills such as straight-run meal would explain why the urban hammer milling industry has failed to expand its marketing channels. A 1992 survey revealed that straight-run meal accounted for only 5 to 8 percent of total urban maize meal consumption and straight-run meal consumption was marked by a strong seasonal pattern (Jayne and Rubey, 1992).

This consumption survey has been based upon the hypothesis that **straight-run maize meal consumption is limited due to policy and regulatory restrictions that effectively restrict consumer access to straight-run meal in urban areas.** In other words, current consumption of straight-run meal is far less than the potential demand would be in the absence of these policy induced constraints.

According to this view, the negative effects of the removal of subsidies on industrial produced maize meal and falling real incomes may be ameliorated with the expansion of private, alternative marketing channels. Such channels provide low-income consumers with access to: 1) maize grain for custom milling; and/or 2) locally-milled straight-run meal at prices below the cost of commercial roller meal. Thus, in order to evaluate the effects of a relaxation of grain marketing restrictions, a large-scale consumption survey was initiated to explore the potential demand for alternative types of maize meal.

The consumption survey gathered information on current grain consumption patterns, income levels, and responses to a set of market simulations. Broadly speaking, the objective of the consumption study was to analyze consumer preferences for processed maize meal by degree of processing and color.

The specific objectives were to:

1. Analyze how changes in maize meal prices would affect the demand for different types of maize meal (differentiated by processing type and color).

2. Analyze how demand for various types of maize meal varies across income groups.

3. Evaluate potential mechanisms for implementing a targeted meal subsidy that reaches vulnerable groups with minimal leakage to richer households and without significant diversion of subsidized food into stockfeeds.

4. Examine the implications of consumer preferences and the structure of the grain marketing system on the design of drought relief programs.

3. Design of the Consumption Survey

The consumption survey was carried out in June and July of 1993. Three urban centers, representing 75 percent of the Zimbabwean urban population (and 20 percent of the total population) were chosen. Population estimates from the 1992 census and sample sizes are presented in Table 1:

TABLE 1: POPULATION AND SAMPLE SIZES FOR THE CONSUMPTION SURVEY

Urban Center	1992 Census Population Estimate (No. of Households)	Sample Size (No. of Households)
Harare	296,478	300
Bulawayo	145,948	128
Chitungwiza	62,959	64
TOTAL	505,385	512

The design of the consumption survey was preceded by a set of consumer focus group meetings in January and February. The focus group meetings helped inform the design of the consumption questionnaire by clarifying attitudes towards different types of maize meal, types of purchasing patterns and hypothetical price relationships. In late February and early March, the questionnaire underwent three rounds of pretesting with the eight Harare enumerators. The pretesting resulted in substantial changes being made in all sections of the questionnaire.

The individual households selected for the survey were randomly selected from 1992 census data stored at the Central Statistical Office (CSO). The selection procedure utilized a clustered and stratified random sampling procedure; each urban household had an equal probability of being selected for the survey. For ease of enumeration, it was determined that each "cluster" would comprise four households as this was judged the number of questionnaires that could be administered by an enumerator in one day. The selection procedure proceeded as follows, using Harare where a sample size of 300 was desired, as an illustrative example:

1. The 44 wards in the city were stratified into two groups, representing low-density and high-density wards. The sample was stratified since high-density households represent 77 percent of all Harare households (with low-density households comprising the remaining 23 percent) and it was judged important that the sample accurately reflect these proportions. The CSO further divides each ward into anywhere from 30 to 90 "enumeration areas" or EA's. Each CSO EA then consists of 200-350 households.

2. Since the population of each ward was known from the 1992 Census, 75 random numbers (desired sample size of 300 divided by cluster size of 4) were selected between 1 and 296,478 (the Harare household population). Each random number could be linked to a particular ward by the following procedure: Suppose Ward 21 was Mabvuku suburb. A cumulative total of Wards 1 through 20 would show that 134,131 households lived in these 20 wards. Since the Census data would show that the population of Mabvuku is 5072 households, Wards 1 through 21 would naturally have a population of 139,203 households. Thus, for each of the 75 random numbers generated that fell between 134,131 and 139,203, the Mabvuku suburb would be assigned a cluster. If random numbers 135,672 and 138,947 were selected Mabvuku would have 2 of the 75 clusters in the sample.

3. With the 75 clusters spread among the 44 wards selected (naturally many wards had more than one cluster), the next step was to randomly select the EA's within each ward. If Ward 21 (Mabvuku) had 67 EA's and two clusters needed to be selected from Mabvuku, two EA's would be randomly selected. Thus if the random numbers between 1 and 67 were 23 and 55, EA number 23 and EA number 55 within Ward 21 were identified.

4. With the 75 EA's selected (corresponding to the 75 needed clusters), the individual households within each EA were selected. Six households were selected from each of the 75 EA's: four original sample households and two replacements in the event that one or two of the original households could not be located after three visits. Thus, in the example, if EA number 23 in Ward 21 consisted of 294 households, six of these households were selected (four original plus two replacements).

The survey questionnaire had five components:

* Household demographic, socioeconomic, and income data.
* Household purchasing, production and food preparation behavior.
* Current grain preferences.
* "Willingness to pay" for alternative types of maize meal.
* Goal hierarchy tests to examine the demand for particular characteristics of maize meal (i.e processing type, color, packaging, distance to shop, price).

The household visits by interviewers began in May 1993. However, in late May, after completing 70 household visits, the GRZ announced a comprehensive set of maize pricing and marketing reforms. In particular, retail maize meal prices, formerly fixed by the GRZ were to be decontrolled as of June 1, 1993. Since the resulting price increases would compromise the uniformity of price responses in the sample, beginning in mid-June all 70 households were revisited. The survey was completed in all three

areas by the end of July.

In October 1993, as the growing importance of hammer-milled straight-run meal to urban food security became apparent, a second survey was carried out. This survey comprised 250 customers at urban hammer mills. Twenty-five hammer mills were randomly selected from a census list. Ten respondents were randomly selected at each mill: every hour, the enumerator asked to interview privately the last person in the queue.

Hammer mill customers were asked about grain acquisition, urban grain production, custom milling activities, grain and meal preferences, household demographic, monthly expenditures on food, and knowledge of the Food Money Programme. The data from this second survey is used to provide insights into the growth of straight-run meal consumption.

4. Maize Consumption Patterns

After a brief overview of the demographic and socioeconomic status of the survey households, this section presents a detailed look at urban household purchasing, production and food preparation behavior for maize products. The factors influencing a particular household's decision to consume straight-run meal are analyzed. Finally, the importance of urban maize production and transactions is examined.

4.1 Household demographic and socioeconomic overview

The purpose of this section is to provide a brief demographic and socioeconomic snapshot of the 512 households in the sample. It is important to stress that since this survey used stratified random sampling techniques and relied on CSO census data, the results can be easily aggregated to present an accurate representation of the demographic and socioeconomic characteristics of the 2,079,140 individuals residing in the three largest urban centers.

Average household size was 4.4 individuals, slightly above the figure of 4.2 individuals found in the 1992 CSO census. Assuming that there has been no change in household size, then this difference represents a sampling error of only 5 percent. For the purposes of this survey, a household was defined as a group of individuals that regularly eat and live together.

Slightly less than half of households (47 percent) rent or own the main house on a stand. A large percentage of households (38 percent) are "lodgers," individuals renting room(s) or occupying auxiliary structures on the stand. A further 12 percent of households reside in domestic quarters and the remaining 3 percent are squatters.

The interviews were conducted with the "primary food purchaser" of the household. The primary food purchaser was defined as the member of the household who makes the day-to-day decisions about what foods are purchased. If responsibilities were divided, interviewers were instructed to pick the person with the most responsibility for the day-to-day purchasing and decision-making related to food.

Primary food purchasers can be characterized as both "urbanized" and "experienced." On average the primary food purchaser has lived in Harare for 16.3 years. Only 18 percent have lived in urban areas for less than 3 years and 5 percent less than one year. Primary food purchasers have been responsible for making decisions about food purchasing for an average of 12.6 years. Only 24 percent have been making such decisions for less than 3 years and 7 percent less than one year.

As might be expected given the diversity of urban areas, reported household cash incomes exhibited a tremendous degree of

variation. Average monthly household cash income was $865 per month. However, the distribution is right-skewed: relatively few households with very high incomes raise the average considerably. Due to this skewness, perhaps a better measure of central tendency is the median. The median average household cash income is $550 per month. Complete income data was obtained for 422 households, with 90 households unwilling or unable to provide complete information on household income. In order to develop estimated income figures for the 90 households on whom income data was missing, a regression model was fitted to the data on existing households. For this model, household income was the dependent variable with food expenditures, education level, age of household head, household size and car ownership as regressors.

To facilitate analysis, the sample households were divided into five groups of equal size, or quintiles, according to per capita household income. The income quintiles derived are presented in Table 2.

TABLE 2: DERIVATION OF INCOME QUINTILES FROM PER CAPITA MONTHLY HOUSEHOLD CASH INCOME

Per Capita Income Quintile	Range of Per Capita Monthly Household Income
Income Quintile 1	$0.00 - $86.67
Income Quintile 2	$86.68 - $149.50
Income Quintile 3	$149.51 - $199.60
Income Quintile 4	$199.61 - $360.00
Income Quintile 5	Over $360.00

Average monthly expenditures on foodstuffs was $281 per month, with a standard deviation of $206. The average food share for all urban households was 35 percent of income. However, per capita food expenditures as a percent of per capita household income vary according to income group. Table 3 shows how significant this difference is. The bottom 20 percent (in terms of income) of the urban population spend over half their income on food, while the top 20 percent spent only 23 percent of their income on food.

Only 4 percent of household heads were described as "unemployed." Although this figure appears very low, previous studies of the informal sector in Zimbabwe have shown that most urban dwellers cannot "afford" unemployment and therefore, if no other options are available, obtain low-paid and/or part-time jobs in the informal sector are sought in order to make ends meet.

TABLE 3: EXPENDITURES ON FOODSTUFFS, BY INCOME QUINTILES

Income Quintile (based on monthly per capita household income)	Per capita monthly food expenditure ($)	Food expenditures as a percent of income (average for quintile)
Quintile 1 (less than $86.67)	$26.05	53 percent
Quintile 2 ($86.67 to $149.50)	$42.77	38 percent
Quintile 3 ($149.51 to $199.60)	$55.71	33 percent
Quintile 4 ($199.61 to $360.00)	$77.00	30 percent
Quintile 5 (greater than $360)	$129.02	23 percent

Source: Survey data

Average educational level of household head was 8.1 years, about equivalent to completing Form 1. The "primary food purchaser" (often a different person than the household head) had a educational level of 7.9 years.

Information on ownership of household durable goods was also obtained. Relatively few households own refrigerators (21 percent), automobiles (10 percent), TV's (31 percent) or bicycles (19 percent). Radios are owned by 58 percent of households.

4.2 Maize purchasing habits

All households selected in the survey sample were asked a screening question as to whether the household regularly purchased mealie-meal for itself. Just over 3 percent of households did not regularly buy maize meal and replacements were randomly selected.

Average household maize meal requirements for households that buy maize meal, as determined by the household, are 30.5 kgs per month. With an average household size of 4.4 members, this translates to 7 kgs per household member. Since this survey covered about 75 percent of the urban population (505,385 households) and since 3 percent of the urban population bought no maize meal, the total annual maize meal requirement of this portion of the urban population (i.e. Harare, Chitungwiza, and Bulawayo) is 179,420 tonnes. If the survey results are assumed to be representative of the remaining 25 percent of the urban population not covered, total annual maize meal requirements are 240,820 tonnes. If this annual maize meal requirement is consumed as roller meal, the roller meal extraction rate of 85 percent implies that 283,320 tonnes of maize grain are required to meet total urban annual requirements.

Naturally, these figures only represent maize meal requirements consumed within the households. Household members very often

consume maize meal outside the home, from urban "lunchtime" vendors, at school and at workplace canteens. Due to the great difficulties in quantifying maize meal outside the home, usually purchased in prepared form, this survey only examined in-home consumption.

At the time of the survey (June/July 1993), roller meal remained the dominant type of maize meal consumed in urban areas, with two-thirds of all households consuming it. The consumption of straight-run has apparently grown dramatically since early 1992. In early 1992, it was estimated that from 5 to 8 percent of urban consumption needs were met by straight-run meal (Jayne and Rubey, 1992). However, 18 months later, in June/July 1993, this survey found that 27 percent of urban households were consuming straight-run meal. The percentage of consumers eating straight-run meal has continued to grow. Preliminary results from a survey done six months later (November 1993) show that about half of the Harare area population was consuming straight-run meal[1].

Over 93 percent of those consuming straight-run in mid-1993 cited "cheaper/saves money" as the primary reason for consuming it. Clearly, with the removal of roller meal subsidies, the change in relative prices between roller meal and hammer milled straight-run meal was great. Also, since real incomes have fallen over the past two years, it is apparent that more consumers are investigating cheaper ways of procuring maize meal, such as procuring maize grain and having it milled for a fee at a local urban hammer mill.

Of purchased maize meal (excluding custom-ground straight-run meal), roller meal is naturally dominate comprising 92 percent of all purchases. Only 7 percent of purchases were of super refined maize meal. Clearly the proportion of super-refined has fallen significantly, from a near-high of 17 percent in 1991.

The two largest companies, National Foods and Blue Ribbon have a very large market share of the purchased maize meal market. As Table 4 shows, 92 percent of maize meal purchases were of products of these two companies. Only 4 percent of purchases of bagged maize meal were from small-scale production millers. This indicates that despite the increasing growth and expansion of small-scale millers, production millers have not yet gained a significant share of the purchased maize meal market.[2]

Large supermarkets near home (eg. TM, OK and Bon Marche) were cited by 44 percent of respondents as the type of shop where maize meal was purchased. Small grocery stores near home account

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[1] The Sentinel Surveillance Survey for SDA Monitoring carried out by the Inter-Ministerial Committee for Social Dimensions of Adjustment Monitoring

[2] "Purchased maize meal" excludes straight-run meal custom milled at hammer mills.

for 43 percent of purchases. Just over 9 percent purchased their maize meal from tuck shops. When asked their reason for buying at a particular shop, about 81 percent cited "near home." A further 8 percent chose the shop because of lower prices, while 5 percent chose the shcp because of service provided (eg. delivery).

TABLE 4: COMPARISON OF MARKET SHARE OF LARGE-SCALE COMMERCIAL AND PRODUCTION MILLERS

Company	Market Share
National Foods (large-scale)	57
Blue Ribbon (large-scale)	35
Midland (large-scale)	4
All small-scale millers*	4

* includes Takura, Shirichena, Murehwa, and Jati.
Source: Survey data

Walking to the shop was the most common type of transport (85 percent of respondents), with cars (5 percent), buses/taxis (5 percent, and bicycles (3 percent) much less common. About 14 percent of maize meal purchases were delivered by the shop, a service almost exclusively provided by small grocery stores. The average consumer spent 21 minutes travelling to the shop to buy mealie meal. Only 5 percent (those taking buses or taxis) incurred any transport costs. Of these consumers, transport costs averaged $3.56 for the round trip.

Respondents were asked for their reason for buying a particular type of maize meal at the shops (eg. roller meal versus super refined). The most common response (41 percent) was that it was cheaper. Over 17 percent cited some element of taste or satisfaction as their primary reason.

4.3 The decision to consume straight-run meal

Survey data shows that 27 percent of urban households were consuming straight-run meal in June/July 1993. The low price of straight-run meal relative to store-bought roller meal is cited by 93 percent of respondents for the reason for this behavior. An 18 kg bucket of maize grain can be purchased from informal vendors at many locations in urban areas. The price of a bucket of maize purchased from such vendors ranges from $15-20, with the lower price tending to prevail in June/July (immediately after harvest). With average milling charges of roughly $2.00 per bucket, the acquisition cost of 20 kg of straight-run meal ranges from $18.90 to $24.45. With a 20 kg bag of roller meal from the largest industrial millers selling for $34.65, households can realize substantial savings. Of course, a true cost-accounting would have to incorporate the value of the time to procure grain, bring it to the mill, and the wait in the queue at the hammer mill versus the relative ease of purchasing roller meal at a local shop.

As might be expected, survey data revealed that greater proportions of poorer consumers consume straight-run. About a third of the households in the bottom 40 percent of the population in terms of per capita income were consuming straight-run. Only 17 percent of the richest 20 percent were consuming straight-run. Table 5 presents a complete break-down of the type of maize meal consumed by income grouping.

TABLE 5: MAIZE MEAL CONSUMPTION BY TYPE AND BY INCOME QUINTILE

Income Quintile	Type of maize meal consumed (percentage of households)			
	Super-refined	Mudzvurwa	Roller meal	Straight-run
Quintile 1 (bottom 20%)	0	0	68	32
Quintile 2	1	0	66	33
Quintile 3	7	*	69	25
Quintile 4	6	*	73	21
Quintile 5 (top 20%)	13	0	70	18
All consumers	5	1	67	27

* less than one-half of one percent
Source: Survey data

A calculation of the income elasticity of demand of straight-run was made. An Ordinary Least Squares (OLS) regression was run using "kilograms of straight-run consumed per capita" as the dependent variable and a constant and "household income per capita" as an explanatory variable. The income elasticity of demand obtained was -0.1. This implies that a one percent increase in income can be associated with a 0.1 percent fall in the consumption of straight-run meal. Therefore, straight-run meal is an "inferior good." Consumption decreases as incomes go up, and likewise, consumption increases as real incomes fall.

In the regression calculation of the income elasticity, the coefficient for "household income per capita" was significant at the 5 percent level. However, the total explanatory power of the model was low (i.e. extremely low R-squared values). This implies that although income level does effect the quantity of straight-run meal consumed, other factors are also very important. Also, alternative models could be attempted to deal with the large number of households that consumed no straight-run meal.

In order to try and quantify the factors likely to affect a household's decision to consume straight-run meal, a Probit regression model was constructed. Probit models are used to estimate a binary (yes or no) variable. In this case, the dependent variable reflects the choice to consume straight-run meal. The dependent variable is zero if the household does not currently consume straight-run meal and one if it does. The explanatory variables are those in which one would expect to

influence the decision to consume straight-run meal. The results are shown in Table 6.

TABLE 6: PROBIT MODEL OF THE DECISION TO CONSUME STRAIGHT-RUN MEAL

Dependent Variable = "CURRENT HOUSEHOLD CONSUMPTION OF STRAIGHT-RUN" (0=No, 1=Yes)		
Explanatory Variables	**Coefficient**	**Significance level**
Constant	-0.6241787	5% level
Household income (in dollars)	-0.0002095	5% level
Household size (Number of members)	+0.0637066	5% level
Distance to nearest hammer mill (minutes)	-0.0050697	10% level
Does household grow maize? (dummy variable)	+0.1503732	Not significant
Log likelihood = -227.06020 Cases where HOUSEHOLD CONSUMPTION OF STRAIGHT-RUN = 0 is 107 Cases where HOUSEHOLD CONSUMPTION OF STRAIGHT-RUN = 1 is 298		

Household income, household size, distance to mill are all significant at least at the 10 percent level and all have the expected sign. That is, there is statistical support for the hypothesis that a higher household income and greater distance to a hammer mill reduces the probability of a household consuming straight-run meal. Likewise, a larger household size is associated with an increased chance of straight-run consumption. The only variable that was not statistically significant was a dummy variable for whether or not the household grew maize on urban plots (T-statistic = 1.42). One possible reason for this is that not all urban maize growers dry their harvest for subsequent milling; some consume the entire harvest as fresh maize on the cob. Also, there are alternative sources to urban production for maize for hammer milling, such as rural production and purchases from urban vendors.

The coefficients derived from this model can be used to predict the decision of a household to consume straight-run meal given the household income, size, and distance to mill. For example, using the coefficient, one can predict what the chances are of household with 4 members, total household income of $300, living 20 minutes from a hammer mill, consuming straight-run meal. As shown in Table 7, application of the coefficients from the Probit model predicts that such a household has 47 percent probability of consuming straight-run meal.

TABLE 7: SAMPLE ESTIMATES OF THE PROBABILITY THAT HOUSEHOLD WILL CONSUME STRAIGHT-RUN MEAL (FROM 0 to 100 PERCENT)

Household Income ($)	Household Size	Distance to the nearest hammer mill (in minutes)			
		10 min.	20 min.	30 min.	40 min.
300	4	52%	47%	42%	37%
300	6	64%	59%	54%	49%
800	4	41%	36%	31%	26%
800	6	54%	49%	44%	39%
1500	4	26%	21%	16%	11%
1500	6	39%	34%	29%	24%

This model offers statistical support for the assertion that falling real incomes and the growth of urban hammer mill operators implies an increase in the consumption of straight-run meal. For example, there are three households with four members in Table 7. With an income of $800 and a 40 minute trip to an urban hammer mill, likelihood of straight-run consumption is 26 percent. Now if household income falls to $300 in real terms and a new hammer mill opens up 20 minutes from home, the likelihood of straight-run meal consumption rises to 47 percent.

4.4 Urban maize production and transactions

Urban maize production and rural-urban maize transactions are an important component of urban food security. By all accounts, maize production on small urban plots has grown dramatically in the past three years. In the 1991/2 and 1992/3 growing seasons, urban residents utilized vacant municipal land to grow maize. In both years, City authorities slashed maize growing on municipal land as open-land maize cultivation, was said to: 1) provide a refuge for thieves; and 2) lead to silting of dams when practiced near stream banks. For the 1993/94 growing season, virtually all vacant land in areas adjacent to high-density suburbs has been planted with maize. Obtaining maize or straight-run meal when visiting relatives in rural areas has also traditionally been a widespread practice.

According to the survey data, 56 percent of all households had received maize grain inflows over the preceding year. Grain inflows came from a number of sources. As Table 8 shows, just less than half of grain inflow "transactions" were from urban household production.

TABLE 8: SOURCE OF HOUSEHOLD GRAIN INFLOWS (MAY 1992-JUNE 1993)

Source	Transactions (percent of total)
Own household urban production	46
Purchased in urban areas	15
Gift from rural person(s)	11
Own household rural production	20
Gift from urban person(s)	7
Purchased in rural areas	3

Source: Survey data

Thirty-five percent of urban households said that they grew maize in urban areas during the 1992/93 growing season. Of these, only 62 percent harvested maize grain for drying and milling; the remaining 38 percent only harvested fresh maize on the cob (green mealies).

Interestingly, of those households consuming straight-run meal, only about 40 percent said they grew maize on urban plots. The rest relied on inflows from rural areas, gifts, or rural or urban purchases. Non-commercial rural-urban maize transactions are a significant source of maize for straight-run meal, accounting for 31 percent of all inflows. Only 18 percent of transactions were outright purchases. Finally, 73 percent of inflows occurred in the four month period March to June 1993, undoubtedly because of the paucity of grain during the 1992/1993 drought months.

Of the households that grew grain on urban plots and that could estimate their total production, the average urban maize grain production was 154 kilograms. For the typical household of 4.4 individuals, this translates to slightly over five months supply of straight-run meal.

5. Maize meal preferences

An analysis of the consumer preferences for different types of maize meal is presented in this section. The analysis centers on the willingness of consumers to substitute either white straight-run meal or yellow maize meal for white roller meal, by far the dominant product in the market. The section ends with an investigation into the relative values consumers attach to different characteristics of maize products.

In Zimbabwe, as in much of southern Africa, white maize is the predominant staple grain. As a result, the conventional wisdom is that: 1) consumers prefer more highly refined maize meals to less refined maize meals; and 2) consumers have a strong preference for white maize over yellow maize.

In 1992, when these surveys were first proposed, the widespread preference for refined maize meal was thought to be particularly strong in urban areas. The Commercial Millers' Association, in a 1992 press statement on maize meal pricing noted that "straight-run meal is an unsophisticated, unrefined product which normally sells at a price lower than that for roller meal ... as this product has never been popular its demise is no great loss ..." Clearly, roller meal was (and is) the dominant product on the market. In late 1991, roller meal had 83 percent of the purchased maize meal market, with super refined maize meal estimated to have the remaining 17 percent (Liddell, 1992). A negligible amount of straight-run meal was produced by commercial millers in 1991. By February 1992, with the trebling of the roller meal subsidy, straight-run meal production by commercial millers stopped completely. A complete description of the maize meal products produced in Zimbabwe is presented in Table 9.

Yet even in 1991, a number of urban consumers consumed straight-run meal, primarily by bringing their own maize to urban hammer mills and having in ground for a fee. A survey of small-scale urban hammer mills in Harare in early 1992 revealed that about 5 to 8 percent of the city's maize meal requirements were being processed by custom mills (Jayne and Rubey, 1992). By presenting evidence of the seasonal nature of demand for hammer milling services, that study hypothesized that straight-run consumption was constrained by grain movement restrictions which limited urban households' access to maize grain. Due to movement restrictions, the only source of maize grain for milling was urban production or illegal inflows.

TABLE 9: TYPES OF MAIZE-MEAL PRODUCED IN ZIMBABWE[3]

Type of meal	Description	Extraction rate	Produced by:	1993 Selling price per tonne ($/mt)
Super-refined	The bran (hull) and germ are completely removed; meal ground from the endosperm.	65%	Industrial and production millers	$ 2427
Roller meal	Most of the bran and germ are removed; meal ground mostly from the endosperm.	85% (industrial) to 92% (production)	Industrial and production millers	$ 1751
Mudzvurwa	The bran is removed before being milled; the germ and endosperm are retained.	90%	Production millers	$ 1498 - $1751
Straight-run	Meal processed from the whole maize kernel; the bran, germ, and endosperm are retained.	98%	Custom millers	Custom milled at $100-140 per tonne (exclusive of cost of grain).

This study was originally undertaken to examine the potential demand for straight-run meal in a completely liberalized trading environment. Latent demand was believed to be much greater than the existing figure of 8 percent due to a complex set of policy and regulatory restrictions that effectively restricted consumer access to straight-run meal in urban areas. A major objective was therefore to quantify what the actual demand for straight-run meal would be as these policy-related constraints were progressively dismantled. Second, since by June 1993 movement restrictions had (in practice, if not with a gazetted legal instrument) been lifted, the survey provided a excellent opportunity to examine the impact of movement and price decontrol on maize meal consumption.

5.1 Potential demand for straight-run meal

The prevailing "conventional wisdom" about consumer maize meal preferences (i.e. consumers strongly prefer the more refined white maize meals) has persisted because it does have some factual basis. When respondents were asked what type of maize meal they would buy to meet household needs if all prices were the same and all products were packed in plastic, a total of 69 percent of consumers said they would buy one of the more refined types of maize meal. Table 10 presents the complete results.

When the choice is limited between roller meal and straight-run, survey results show that, at the same prices, the majority of consumers prefer roller meal over straight-run. Almost 67 percent of respondents "strongly" or "somewhat" preferred white roller meal to white straight-run. On the other hand, 31 percent of consumers chose straight-run. The remaining 2 percent of respondents were indifferent or said the choice was irrelevant to them as they would always choose the more expensive super-refined meal. Thus, although two-thirds of consumers do prefer roller meal, one-third of all consumers prefer straight-run when

[3] Although prices are converted to a per tonne basis, a bag size of 10 kg is assumed.

given a choice between roller meal and straight-run and prices are equal.

TABLE 10: CONSUMERS PREFERENCES BY MEAL TYPE ASSUMING ALL PRICES ARE EQUAL AND ALL PRODUCTS ARE PACKAGED IN PLASTIC

Type of Maize Meal	Percent of consumers choosing this type (assuming all prices were the same)
Super-refined	24 percent
Roller meal	45 percent
Straight-run	20 percent
Mudzvurwa	11 percent

Source: Survey data

In the previous section, it was revealed that 27 percent of consumers are currently consuming straight-run meal. When these consumers were asked about their preferences by type of maize meal, only 35 percent said that they actually prefer straight-run. The rest of the respondents said they would, if possible, prefer to eat a more refined type of maize meal. Thus, many households are therefore consuming straight-run meal because of its price advantages, not because of an absolute preference for straight-run.

TABLE 11: PERCENT OF CONSUMERS THAT CURRENTLY EAT STRAIGHT-RUN MEAL AND THEIR PREFERENCES FOR ALTERNATIVE TYPES OF MEAL

Income Quintile	Percent of consumers that currently eat straight-run but prefer:			
	Super-refined	Mudzvurwa	Roller meal	Straight-run
Quintile 1 (bottom 20%)	13	4	54	29
Quintile 2	25	21	25	29
Quintile 3	6	6	39	50
Quintile 4	33	11	28	28
Quintile 5 (top 20%)	36	0	21	43
All consumers	21	9	35	35

Source: Survey data

Table 11 shows the preferences of straight-run consumers broken out by income quintile. Interestingly, the preference for straight-run meal generally rises for higher income consumers of straight-run. Lower income consumers are less likely to say that they prefer to eat straight-run rather than other types of meal.

Similar questions were asked of roller meal consumers. Table 12 shows the preferences of consumers that currently eat roller meal. Over half both eat and prefer roller meal. Twenty-two

percent consume roller meal but would prefer super-refined. Surprisingly, 15 percent of roller meal consumers actually prefer straight-run. Apparently this group of consumers do not consume straight-run meal either a) because they do not have access to traditional sources of maize grain (i.e rural or urban production); or b) the opportunity cost of time in procuring grain and hammer milling is actually higher than that of purchasing roller meal in urban shops. Since preferences for straight-run meal by roller meal consumers are concentrated in the lower income groups, the former explanation seems more likely.

TABLE 12: PERCENT OF CONSUMERS THAT CURRENTLY EAT ROLLER MEAL AND THEIR PREFERENCES FOR ALTERNATIVE TYPES OF MEAL

Income Quintile	Percent of consumers that currently buy roller meal but prefer:			
	Super-refined	Mudzvurwa	Roller meal	Straight-run
Quintile 1 (bottom 20%)	10	8	61	22
Quintile 2	21	12	54	15
Quintile 3	29	34	53	9
Quintile 4	19	13	57	11
Quintile 5 (top 20%)	29	10	50	13
All consumers	22	11	52	15

Source: Survey data

Yet a true analysis of the prevailing conventional wisdom must consider that straight-run, if available, would probably sell at a price below that of roller meal. That is, although consumers have a "pure" preference for more refined types of meals, at a certain price discount, they might actually "prefer" straight-run meal. Price is simply another one of the many considerations in a consumer's decision to purchase a particular type of meal. Thus, it may be useful to distinguish between a "pure" preference (if prices are equal) and a "price" preference-- the preference at a given price differential. Although a "pure" preference for more refined maize meals exists, what is the demand for straight-run at a given price differential between straight-run and roller meal? The survey sought information on potential demand at different prices to answer this question.

Consumers were given a hypothetical scenario and asked if they would purchase a straight-run meal at a particular price. If the respondent said "no," the price was lowered until the respondent said they would purchase the product. If the respondent agreed to purchase the product at the first price, the price was raised until the respondent refused to purchase it. In either case, the maximum willingness to pay by the respondent was obtained. In all cases, it was explained that both products were packed in plastic and available at the same shop.

This procedure, called "contingent valuation," has been used for years to value willingness to pay for environmental assets such as clean water. These techniques have been also shown to work fairly well for "everyday" products. In a study of the demand for fresh strawberries, Dickie, Fisher, and Gerking (1987) compared the estimation of demand functions based on actual transactions versus the demand estimation from hypothetical "contingent valuation" bids. They found that there was no statistical difference between the demand function estimated from a sample that was based on actual data and a consumer sample that reflected hypothetical responses.

Determining how quantity demanded changes with price is analogous to deriving a demand curve for a product. During the three-rounds of pre-testing, it became apparent that the demand for highly disaggregated types of meal (i.e. straight-run or roller meal), is discontinuous. That is, the demand for straight-run is zero at certain higher prices, then as the price falls below some threshold, quantity demanded jumps (or switches) to an amount to cover household needs.

That is, pre-testing showed that the choice of a particular type of maize meal is an "all or nothing proposition." It appears that, for the most part, consumers limit themselves to one type of maize-meal. Only 3 percent of respondents reported buying a combination of meal types. Maize meal preparation is very time and fuel consuming, which precludes preparation of two different types. Exceptions might only be made if household members had strongly differing preferences or two different types of meal were mixed in the same pot. Although some households may buy a higher quality maize meal to serve to guests, pretesting revealed the occurrence of such behavior to be rare.

The demand data from the "willingness to pay" responses was analyzed using MicroTSP, a regression and forecasting software package. The first step was to aggregate the sample data using 1992 CSO population data: each sample household represented 987 households in the urban population. With the prices at which the household would "switch" to another type of meal known from the survey data, price-quantity relationships were then derived. A simple regression equation was then constructed to "fit" the data to a demand curve. Quantity of straight-run meal was expressed as a function of the price difference between roller meal and straight-run and a constant. The resulting equation was:

QUANTSR = 70,517 + 19,294 x (PRICEDIFF)

(Adjusted R-squared = .88)

where:

QUANTSR	=	The quantity of straight-run meal demanded by all urban consumers (in metric tonnes per year)
PRICEDIFF	=	The price difference (expressed in Zimbabwe dollars) between 10 kg bags white roller meal and white straight-run meal

The model derived from the survey data implies that a one dollar increase in the price differential between a 10 kg bag of roller and straight-run will result in an increase in quantity demanded of straight run of about 19,294 tonnes. Therefore, the equation can be used to calculate the amount of straight-run demanded at any price differential. For example:

1. Suppose white straight-run meal were sold at $15.00 per 10 kg bag (packed in plastic and available in shops).
2. The price difference between straight-run and roller would be $3.40.
3. Using the above formula: 70517 + (19,294 x 3.40) = 136,117.
4. Approximately 136,117 tonnes of straight-run meal would be sold to urban consumers
5. Since total annual urban maize meal demand is estimated to be 247,860 tonnes, 55 percent of urban consumption would be of straight-run meal.

Of course, this model does make two important assumptions. First, the model may be inaccurate for extremely large price changes. For example, the actual survey data show that if straight-run were $5.00 per 10 kg bag, consumption would be 233,822 tonnes per year. However, the model estimated consumption of 309,763 tonnes at such prices. Alternative functional forms might improve the "fit" of the model. Second, since the respondent was limited to choosing between packaged straight-run or packaged roller meal from a shop, the estimated consumption amount does not necessarily imply that actual purchases of straight-run would be as high. Naturally, a proportion of consumers might continue to procure their own grain and have it hammer milled rather than buy straight-run from the shops, even if packaged straight-run were available. Such consumers would be consuming straight-run, but might not enter the market for purchased straight-run meal.

Lastly, an OLS regression was run with a "log-log" specification to attempt to estimate the price elasticity of demand for straight-run maize meal. Unlike most elasticity estimates, since this estimation used the price-quantity relationships generated from responses to hypothetical price scenarios, it does not represent observed changes in demand. Rather it represents expected changes in consumer demand at various price levels based on the market simulations. The results are presented in Table 13.

TABLE 13: PRICE ELASTICITY OF DEMAND FOR STRAIGHT-RUN MEAL (ASSUMING EITHER WHITE STRAIGHT-RUN OR ROLLER MEAL IS CONSUMED)

Dependent Variable = "LOG OF QUANTITY DEMANDED OF STRAIGHT-RUN MEAL"		
Explanatory Variables	**Coefficient**	**T-statistic**
Constant	18.1302	17.37
Log of price of straight-run (Z$)	-2.6564	6.73
Adjusted R-squared = .49 Number of observations: 49		

The price elasticity estimated is -2.7 which implies that a one percent decrease in the price of straight-run meal will increase consumption by 2.7 percent. As expected, demand for straight-run is price elastic, since there are close substitutes for straight-run maize meal.

5.2 White versus yellow maize

The second part of the conventional wisdom on maize meal preferences--consumers strongly prefer white to yellow maize--is difficult to reject. Eighty-nine percent of respondents said that they "strongly prefer" white roller meal to yellow roller meal. Only 1 percent were indifferent, with 8 percent "strongly" preferring yellow and 2 percent "somewhat" preferring yellow. Less than 1 percent of households preferred a mix of white and yellow maize, mostly to accommodate differing preferences within the household.

Furthermore, there is evidence that the small proportion (10 percent) that do prefer yellow are recent converts to yellow maize. About 63 percent of those preferring yellow maize admitted that they would not have wanted yellow maize one year ago. Clearly, the drought-induced or "forced" consumption of yellow maize during the 1992/93 marketing year resulted in a change in preferences for a small proportion of the population.

Of course, just as in the case of straight-run meal, the true measure of the potential demand for yellow maize should incorporate the fact that yellow roller meal, because of the higher yields of yellow maize, would probably sell at a price below that of white roller meal. Thus, a major question is: what would be the demand for yellow maize meal if it were offered a price discount to white maize meal? Just as in the case of straight-run meal, the survey sought information on potential demand for yellow maize at different prices to answer this question.

The method developed to measure the potential demand for straight-run was used for yellow maize. Consumers were given a hypothetical scenario and asked if they would switch from white roller meal to yellow roller meal at a particular price differential. Prices were altered until the maximum willingness to pay was located.

After converting the survey data to price-quantity relationships for the entire population, MicroTSP was used to plot a hypothetical demand curve. The demand for yellow roller meal was expressed as a function of the price difference between white and yellow roller meal. The resulting equation was:

QUANTYELL = 31,543 + 16,913 x (PRICEDIFF)

(Adjusted R-squared = .93)

where:

QUANTYELL = The quantity of yellow roller meal demanded by all urban consumers (in metric tonnes per year)

PRICEDIFF = The price difference (expressed in Zimbabwe dollars) between 10 kg bags of white roller meal and yellow roller meal

The results indicate that a one dollar increase in the price differential between white roller meal and yellow roller meal will result in an increase in quantity demanded of yellow roller meal of about 16,913 tonnes. At any given price differential, the equation can be used to calculate the amount of yellow maize meal demanded.

A comparison of this equation with the one derived for straight-run meal reveals that grade preferences (roller versus straight-run) are more sensitive to price changes than color preferences. That is, consumers are willing to switch from white roller meal to white straight-run at a relatively lower price differential compared to the switch from white to yellow roller meal. By looking at the intercepts, one can see that if there were no price differential, over twice as much straight-run would be demanded than yellow roller meal (in pair-wise comparison with white roller meal). Yet, the slope in each formula is roughly similar. A one dollar price differential between white straight-run and white roller meal is associated with a change in annual purchases of straight-run of 19,294 tonnes. Similarly, a one dollar price differential between white and yellow roller meal is associated with a change in annual purchases of yellow maize of 16,913 tonnes.

Finally, a similar OLS regression to the one for straight-run meal was used to attempt to estimate the price elasticity of demand for straight-run maize meal. Again, unlike most elasticity estimates, this estimation does not use observed changes in demand, but instead uses expected changes in consumer

demand at various price levels based on the market simulations. As expected, demand for yellow roller meal is also somewhat price elastic, since there are close substitutes for yellow roller meal. The results are presented in Table 14.

TABLE 14: PRICE ELASTICITY OF DEMAND FOR YELLOW ROLLER MEAL (ASSUMING EITHER YELLOW ROLLER MEAL OR WHITE ROLLER MEAL IS CONSUMED)

Dependent Variable = "LOG OF QUANTITY DEMANDED OF YELLOW ROLLER MEAL"		
Explanatory Variables	**Coefficient**	**T-statistic**
Constant	15.6723	29.94
Log of price of yellow roller (Z$)	-1.8059	8.69
Adjusted R-squared = .66 Number of observations: 40		

The price elasticity of demand was estimated to be -1.8 which implies that a one percent decrease in the price of yellow roller meal will increase consumption by 1.8 percent.

5.3 Preferences for alternative maize meal characteristics

Economic theory usually takes tastes as given; consumers possess static preferences and simply allocate budgetary resources to purchase goods which provide the greatest satisfaction. However, some modern theories of consumer behavior deviate from traditional notions of consumer behavior. For example, Lancaster (1971) argues that people choose to consume a particular good because of the **characteristics** of that good rather than the good itself. Although this emphasis on the characteristics of goods appears to be an eminently reasonable argument, it was originally considered revolutionary.

Thus the choice to consume white maize meal can be viewed as based on a complex set of product characteristics, including product price, acquisition time and costs, grain color, processing technique, general cleanliness of the product, and packaging and presentation. If there is a change in preferences for maize meal, this change can be seen in terms of changes in preferences for certain characteristics.

The problem is that changes in preferences, as well as changes in demand for characteristics are very difficult to examine, much less quantify, empirically. This survey used a "goal hierarchy" format in an attempt to quantify consumer preferences for different characteristics. For example, Harmon et al. (1972) used this technique to evaluate the multiple "goals" (increase

profits, increase leisure time etc.) that a farmer may seek. Six different characteristics were tested. The respondent was offered pair-wise comparisons and then selected which of the two characteristics was more valued. The six different characteristics tested were:

1. White (not yellow) color (COLOR)
2. High nutrition (NUTRITION)
3. How refined it is" (REFINED)
4. Low price (20 percent discount) (PRICE)
5. Hygienic packaging (PACKAGE)
6. Short distance to shop (10 min. travel time) (TIME)

From the survey results a frequency matrix was derived. The frequency matrix simply describes the proportion that chose a particular characteristic over another in a pair-wise comparison. Although the characteristics are somewhat qualitative, such comparisons can give a rough indication of the characteristics valued by consumers. The preference ordering of consumers may have important implications for the on-going development of alternative marketing systems.

Table 15 suggests that of the six characteristics tested, two can be considered most important to maize meal consumers: high nutrition and low price. For example, from the Table 12 it is apparent that 61 percent of the population would prefer the characteristic of high nutrition over the characteristic of white grain. Similarly, 69 percent of the population would prefer low price (20 percent discount) to "how refined" the meal is.

TABLE 15: FREQUENCY MATRIX ACCORDING TO RANK ORDER OF PRODUCT CHARACTERISTICS

	NUTRITION	PRICE	PACKAGE	REFINED	COLOR	TIME
Rank Order	1	2	3	4	5	6
NUTRITION	--	.50	.39	.23	.39	.22
PRICE	.50	--	.44	.31	.37	.21
PACKAGE	.61	.56	--	.41	.30	.31
REFINED	.77	.69	.59	--	.48	.36
COLOR	.61	.63	.70	.52	--	.49
TIME	.78	.79	.69	.64	.51	--

Source: Survey data

These results provide some evidence to suggest that white grain color and more refined meals are less important to consumers than nutrition and price. Such evidence contradicts the conventional wisdom that "refinedness" and color are the key determinants of maize meal preferences. From this evidence, "refinedness" and color rank fourth and fifth respectively in terms of characteristics valued by consumers.

The strong preference for "high nutrition" must be contrasted against consumers' actual nutritional knowledge. By virtually all measures, straight-run meal has greater nutritional value than roller meal or super refined. Straight-run meal contains 8 percent more protein, 17 percent more thiamin, 62 percent more riboflavin, 25 percent more iron, and 71 percent more calcium than moderately refined maize meal (i.e roller meal). The nutritional difference between straight-run and super refined meal are even more pronounced. Straight-run meal contains 20 percent more protein, 150 percent more thiamin, 100 percent more riboflavin, 127 percent more iron, and 100 percent more calcium than super-refined meal (West et al., 1987).

Yet the survey revealed that exactly half of all consumers did not know that straight-run meal has more nutrition that roller meal or super-refined. Given the value consumers place on nutritional characteristics suggested by this data, more widespread knowledge of the nutritional superiority of straight-run might significantly boost consumption.

The strong consumer preference for "low price" can be confirmed by responses to other questions during the survey. When asked the reason for purchasing roller meal, by far the most common response (44 percent) was the lower price than super-refined. Over 80 percent of customers of hammer mills cite "cheaper/saves money" as their primary reason for visiting the hammer mill rather than buying maize from the shops.

Finally, the moderately high ranking of "hygienic packaging" (rank order 3) has important implications for the development of the small-scale milling industry. Consumers either prefer to bring their own grain for immediate milling or prefer packaged maize meal. This result indicates that the scope for sales of already processed, yet unpackaged, maize meal is limited. Thus, for a small-scale custom miller wishing to sell grain or meal, current consumer preferences suggest that the options are to either: 1) sell maize grain (the grain can then be inspected by the consumer) and then have the consumer pay for "while you wait" milling services; or 2) obtain plastic bags and a bagging machine and sell packaged maize meal. Indeed, a survey of hammer millers conducted after the consumption survey shows that small-scale custom millers interested in expanding have chosen one of these two alternative paths.

6. Implications for targeting vulnerable groups

Zimbabwe is faced with what Timmer et al. (1983) have termed a "food-price dilemma." That is, the GRZ is caught between the need to offer producers remunerative prices and the desire to assure both urban and rural consumers affordable food prices. Over the next two to three years, removal of movement restrictions should induce the development of a network of private grain traders and small-scale hammer millers who can provide low-income consumers with a less expensive maize meal product.

Yet in the short run, options are limited. Until June 1993, the GRZ assured consumers access to a staple product at a below-market price through a large subsidy on roller meal. Since roller meal was consumed by over 80 percent of the urban population, the subsidy was untargeted. The fiscal costs of the roller meal subsidy were enormous, and its cost was the major reason the subsidy was discontinued in June 1993. According to the Minister of Industry and Commerce which oversaw the subsidy scheme, subsidies paid for the production of roller meal amounted to $463.7 million for the period January 1992 to May 1993 (The Herald, 1993). For the period February 1992 to August 1992, the subsidy was $390 per tonne of roller meal produced. The subsidy was increased to $562 per tonne of roller meal in August 1992 and remained at that level until the end of May 1993 when it was removed.

Yet with many of the expected benefits of structural adjustment not yet realized, real incomes among urban dwellers continue to fall. Thus, the challenge is targeting maize meal subsidies to the poor in a manner that is financially sustainable and does not undermine improvements in food security over the long term by disrupting the ability of formal or emerging alternative marketing channels to supply the rest of the population.

This section explores three possible options for ensuring urban consumers have access to a low-cost maize meal product. The options are:

1. Continue to encourage the consumption of white straight-run meal custom-milled at hammer mills.

2. Implement a "self-targeted" subsidy on yellow roller meal.

3. Implement a "self targeted subsidy on yellow maize grain intended for custom-milling at hammer mills.

By excluding some portion of non-needy households, targeting improves the cost-effectiveness of subsidy schemes by reducing the degree of "leakage," ideally without sacrificing coverage to needy groups. However, the administrative costs of targeting increase as the targeting efforts to further reduce leakage

intensifies. At some point, the increased administrative costs are greater than the cost savings from reducing benefit leakage to non-needy households. Identifying vulnerable households requires obtaining significant amounts of data on the economic and/or nutritional status of individual households as well as the administrative capacity to carry out the scheme. A general consensus exists that many nations lack these prerequisites for the continual collection of highly disaggregated information and the effective administration targeting of food subsidies (Rogers, 1989).

Given the limitations of administratively targeted schemes, "self-targeting" mechanisms are particularly attractive. One common type of self-targeted" subsidy is a subsidy on an "inferior good," a less preferred staple that is primarily consumed by the poor. As incomes rise, consumers voluntarily choose to consume less of these foods. Self-targeted subsidies have the potential to be very cost-effective and offer the hope of reaching the food insecure with minimal leakage and without complicated administrative requirements.

For effective self-targeting, there must be some degree of product differentiation so the possibility for significant diversity in the consumption patterns of different income groups exists. With only white maize meal products, product differentiation is limited. Availability of both yellow and white maize meal would effectively double the available options. Furthermore, at least one stage of the marketing system must be sufficiently centralized to allow a place to "attach" the subsidy.

Yet subsidies are not always required to ensure that low-income consumers have access to an inexpensive maize meal product. As the next section (Section 6.1) demonstrates, market liberalization can lead to the expansion of lower cost marketing channels and permit urban households to procure household maize meal needs at lower cost than in the "formal" system.

6.1 The growth of white straight-run meal consumption

On June 1, 1993, the removal of the roller meal subsidy boosted the retail price of roller meal 53 percent overnight. Yet six months later, many of the poor have been cushioned from the full impact of this price increase. To avoid paying high prices for store-bought roller meal, many consumers have been able to procure their own white maize grain and bring it to one of many urban hammer mills for custom milling. Section 4.3 describes the economic rationale for the growth of this behavior.

In June/July 1993, when this survey was undertaken, 27 percent of urban consumers were consuming straight-run meal. Furthermore, Table 16 demonstrates that consumption of straight-run meal was more prevalent in the lower income quintiles. About a third of the poorest 40 percent of urban population were eating straight-run versus only 18 percent of the richest 20 percent.

TABLE 16: STRAIGHT-RUN MEAL CONSUMPTION, CONSUMPTION PREVALENCE AND QUANTITIES CONSUMED PER CAPITA BY INCOME GROUP

Income Quintile	Percent of households consuming straight-run meal	Monthly maize meal requirements obtained by household (kgs per capita)
Quintile 1 (bottom 20%)	32	7.0
Quintile 2	33	7.0
Quintile 3	25	7.8
Quintile 4	21	6.9
Quintile 5 (top 20%)	18	6.6
All consumers	27	7.0

Source: Survey data

Furthermore, the survey revealed that there was scope for further growth of straight-run meal consumption. A further 10 percent of the urban population said that they were eating roller meal but would actually prefer to eat straight-run meal if they could. These finding are confirmed by some preliminary results from a November 1993 survey done by the Inter-Ministerial Committee for Social Dimensions of Adjustment Monitoring.[4] This survey of 540 households found that about half of the Harare area population was consuming straight-run meal. Clearly, the increased reliance on straight-run meal has protected consumers from the increased in retail roller meal prices. Consumers are able to procure grain and have it milled at a hammer mill at a price below that of purchased roller meal.

Yet the growing reliance of the urban population on less-expensive straight-run meal only became a possible option with the removal of movement restrictions that limited access to maize grain in urban areas. In April 1993, following a good 1992/93 growing season, trading restrictions on white maize were effectively lifted throughout the entire country (GRZ, 1993). Anyone was permitted to buy and sell white maize without restrictions, with the exception of five major milling firms who were still required to purchase from the GMB. The GMB continued to operate as a residual buyer in all areas by defending the mandated floor and ceiling prices for white maize (GRZ, 1993).

These market liberalization measures, namely the relaxation of marketing and movement restrictions, benefited maize consumers by providing incentives for a greater private sector role in grain trading during the 1993 season. As a result, private grain trading and small-scale grain milling blossomed and GMB sales fell to an all-time low. Whereas during the 1992 drought GMB maize sales averaged 140,000 tonnes per month, August 1993 maize sales were 19,200 tonnes (Agritex, 1993).

[4] The Sentinel Surveillance Survey for SDA Monitoring

A follow-up random survey of 250 hammer mill customers in October 1993 further confirms the growth in the use of alternative marketing channels and small-scale hammer mills. Over 58 percent of respondents had "never" visited a hammer mill two years earlier (1991). A further 18 percent "rarely" visited a hammer mill, "almost always" relying on store-bought maize meal. Only 11 percent "almost always" visited the hammer mill in 1991.

The "success story" of straight-run meal consumption in urban areas in offering an alternative to higher roller prices has induced many observers to explore methods of further reducing the price of straight-run meal through some form of targeted subsidy. Table 16 demonstrates that straight-run meal is an "inferior good"-- as household income goes up, consumption of straight-run meal declines. "Inferior" staple foods are often good candidates for a subsidy since the richer consumers voluntarily exclude themselves from the subsidy. Yet the major problem with implementing a subsidy on straight-run meal is determining where to attach the subsidy. If the subsidy were directed to the major industrial millers and a handful of production millers only, the current producers of straight-run meal--small-scale custom mills --would be severely affected.

Yet with literally thousands of small-scale custom millers, allowing certain buyers to purchase maize intended for milling as straight-run at a price discount would mean leakage due to diversion of subsidized grain to animal feeds. In order to minimize leakage, one option would be to facilitate the distribution and sale of 20 kg bags of white maize grain at retail outlets. In order to reduce leakage, however, the price would have to be at or very near the GMB selling price (i.e. $1070 per tonne or $21.40 per 20 kg bag). Since private urban grain vendors are already providing maize grain below this price, little demand can be envisaged.

6.2 Yellow roller meal and "self-targeting"

In many circles in Zimbabwe, human consumption of yellow maize is symptomatic of a major agricultural policy failure. In this view, yellow maize is a "drought food," to be consumed in the event of insufficient domestic production and an inability to procure white maize on international markets. For example, due to extremely poor rainfall during the 1991/92 growing season, Zimbabwe, like most southern African nations, imported an unprecedented amount of maize. The thin international market for white maize meant that the bulk of maize imports were yellow maize from the Americas. Imports of yellow maize for the 1992/3 marketing year were over 2 million tonnes. A good white maize harvest in 1993 brought a request from the GRZ for the GMB to stockpile a three-year supply of white maize. According to this view, the high costs of storage could be justified due to the strong preference for white maize.

The conventional wisdom is that there are strong consumer preferences for white maize meal products among all segments of the population. Indeed, survey results show that almost 89

percent of the urban population "strongly prefer" white maize meal to yellow maize meal. Yet an analysis of the price sensitively of lower income consumers to the differential between white roller meal and yellow roller meal suggests that the conventional wisdom regarding yellow maize is too simplistic. In particular, at a given price differential, a significant proportion of consumers say they would switch from white to yellow roller meal in a "dual-option" simulation.

Given that households have the option of buying a 10 kg bag of white roller meal at $17.40, Table 17 shows the proportion of households in each income quintile that would shift from white roller meal to yellow roller meal at two hypothetical prices for a 10 kg bag: $15.10 (a 13 percent discount) and $12.85 (a 26 percent discount). As shown by Table 17, consumers in the lowest income quintile are much more likely to switch from white to yellow roller meal at a specified differential. When yellow roller meal is 13 percent lower than white roller meal, 32 percent of the poorest fifth would switch, while only 20 percent of the richest fifth would switch. This suggests that yellow roller meal has the characteristics of an "inferior good."

TABLE 17: PERCENT OF CONSUMERS SWITCHING FROM WHITE ROLLER MEAL TO YELLOW ROLLER MEAL AT A SPECIFIED PRICE, BY INCOME QUINTILE, IN A "DUAL-OPTION" SIMULATION

Income Quintile	Percentage of households that would switch to yellow roller meal	
	$15.10 (13% discount)	$12.82 (26% discount)
Quintile 1 (bottom 20%)	32 percent	62 percent
Quintile 2	19 percent	44 percent
Quintile 3	25 percent	58 percent
Quintile 4	20 percent	46 percent
Quintile 5 (top 20%)	20 percent	39 percent
All consumers	23 percent	50 percent

This trend is further explored in Table 18 which summarizes the average prices at which consumers in the five income groups said they would switch. Lower income consumers are likely to switch with a smaller price differential than higher income consumers. Table 18 also provides a comparison between white straight-run and yellow roller meal. It is clear from the table that yellow roller meal is less preferred than white straight-run. Consumers need less of a price discount to induce them to switch from white roller meal to straight-run than to switch to yellow roller meal.

TABLE 18: AVERAGE PRICE AT WHICH CONSUMERS WOULD SWITCH FROM 10 KG BAG OF WHITE ROLLER MEAL TO 10 KG BAG OF STRAIGHT-RUN AND YELLOW MAIZE MEAL, BY INCOME QUINTILE

Income Quintile	Average price at which consumer would switch from white roller meal ($17.40 per 10 kg bag) to:	
	Straight-run	Yellow roller
Quintile 1 (bottom 20%)	15.12	13.08
Quintile 2	15.24	11.48
Quintile 3	16.79	11.66
Quintile 4	13.82	10.62
Quintile 5 (top 20%)	13.61	9.47

The costs of a "self-targeted" subsidy on yellow maize would be significantly lower than the blanket subsidy which existed on all roller meal until June 1993. Since the subsidy would apply only to yellow maize, higher income groups (presumably the less needy) groups would choose to consume white maize meal, thereby voluntarily excluding themselves from the subsidy scheme.

During the first five months of 1993, the $562 roller meal subsidy cost 134.1 million, or at least $322 million on an annualized basis. Naturally the level of the subsidy depends on the quality of the harvest; with a poor harvest substantially more rural consumers buy roller meal. Table 19 shows what the annual cost of a roller meal subsidy of $562 have been in previous years, had it been in operation. For example, assuming a good rainfall year (i.e. 1989/90), total roller meal sales of 326,199 tonnes in conjunction with a roller meal subsidy of $562 per tonne would necessitate budgetary outlays of $183 million per year.

Table 19 shows that national demand varies from year to year depending on rural demand which is in turn dependent on the quality of the harvest. However, urban demand for purchased roller meal is relatively constant; it is only in the past six months that straight-run meal from hammer mills has become widespread (i.e. 27 percent of consumption in June 1993). Based on survey data, total urban household maize meal requirements are estimated to be 240,820 tonnes. Assuming that 85 percent of consumers consume roller meal, the treasury costs of the urban portion of the roller meal subsidy would be roughly $115 million per year.

TABLE 19: HYPOTHETICAL COST OF A $562 PER TONNE SUBSIDY IN VARIOUS AGRICULTURAL MARKETING YEARS

Marketing Year	Maize sales to millers (tonnes)	Amount of maize devoted to roller meal production* (tonnes)	Estimated roller meal sales** (tonnes)	Hypothetical annual cost of $562 per tonne subsidy
1989/90	513,053	383,764	326,199	$183.3 million
1990/91	659,501	493,307	419,311	$235.7 million
1991/92	745,269	557,461	473,842	$266.3 million
1992/93	1,050,596	878,298	746,554	$419.6 million

* Assumes 12 percent of maize purchases by millers are for products other than maize meal. Also assumes super-refined accounted for 15 percent of sales from 1989-1992 and 5 percent of sales in 1992/93.

** Extraction rate of roller meal is 85 percent and extraction rate of super-refined is 65 percent.

Source: Figures on maize sales to millers from GMB files

Although the GRZ policy of controlling retail maize meal prices ended in June 1993, the four large industrial millers have agreed on a set of recommended retail maize meal prices and have been successful in maintaining these prices at the retail level. The August 1992-May 1993 roller meal pricing structure and the current pricing structure are presented in Table 20. With a subsidy of $562, the final retail price of roller meal was $1140 per tonne. With the subsidy lifted, treasury costs are currently zero, but consumers have seen a 53 percent increase in the price of roller meal.

TABLE 20: COMPARISON OF CURRENT ROLLER MEAL PRICING STRUCTURE AND ROLLER MEAL PRICING STRUCTURE WITH ROLLER MEAL SUBSIDY OF $562 PER TONNE[5]

	Aug 92-May 93	June 93-present
GMB selling price per tonne (a)	$1070	$1070
Maize milling costs (large-scale)		
Factory costs (b)	188	188
Mark-up (.2270 percent of a+b)	286	286
Distribution allowance	62	62
Ex-mill price (delivered to retailer)	1606	1606
(minus subsidy to large-scale millers)	(562)	---
Ex-mill price (delivered to retailer)	1044	1606
Retailer's margin (9 percent)	96	145
Final retail selling price (per tonne)	1140	1751

[5] Calculations based on consumer purchase of 10 kg. bag

Currently yellow maize is not being milled for human consumption. When domestic production of white maize became available in April and May 1993, some yellow maize meal was sold at a price discount. However, industrial and production millers quickly switched completely to white maize for maize meal manufacture. There was little support from major millers for continuing to offer a yellow maize meal product at a price discount. One commonly cited problem was the very poor quality of the yellow maize that arrived in the early months of 1993. Eventually most GMB yellow maize stocks were disposed of through: 1) swaps of 1.16 tonnes of imported yellow maize for one tonne of white maize; 2) sales to stockfeeders at $880 per tonne; or 3) re-exporting yellow maize at a large loss.

The analysis presented here suggests, however, that a subsidy on yellow roller meal could be a much more cost-effective mechanism for protecting the poor and vulnerable groups than a blanket subsidy on white roller meal. Table 21 presents a pricing structure with a targeted subsidy on yellow roller meal. This example assumes a producer price of yellow maize of $720 per tonne. Without any subsidy, the GMB selling price would be $890, reflecting a operating margin of $170. In this example, a subsidy of $170 is assumed, equal to the GMB margin. Therefore the GMB selling price for yellow maize would be $720.

TABLE 21: ROLLER MEAL PRICING WITH A TARGETED SUBSIDY ON YELLOW ROLLER MEAL OF $170 PER TONNE[6]

	White	Yellow
GMB selling price per tonne (a)	$1070	$720
Maize milling costs (large-scale)		
Factory costs (b)	188	188
Mark-up (.2270 percent of a+b)	286	206
Distribution allowance	62	62
Ex-mill price (delivered to retailer)	1606	1176
Retailer's margin (9 percent)	145	106
Final retail selling price (per tonne)	1751	1282

At a price of $12.82 for a 10 kg bag of yellow roller meal, Table 17 shows that about 51 percent of the population would switch to yellow roller meal when their other option is white roller meal at $17.40. The total cost to the GRZ would depend upon rural demand for purchased maize meal. However, the urban portion of the subsidy would amount to $20.9 million. This is far below the $115 million the urban portion of the white roller meal cost the GRZ.

Yet, even in the absence of a targeted subsidy, setting a lower producer price for yellow maize could also result in cost savings to consumers. Since new yellow maize hybrids have significantly

[6] Calculations based on consumer purchase of 10 kg. bag

higher yields than existing white maize hybrids, the GRZ would not need to apply a subsidy, and there would be no treasury losses.

The effects of a lower yellow maize producer price to reflect the yield differential on consumer prices is analyzed in Table 22. In this example, the 25 percent higher yields of yellow maize over white maize are used to justify a lower producer price for yellow maize. With a producer price that reflects the 25 percent yield advantage of yellow maize, the GMB selling price for yellow maize would be $720. With a GMB margin of $170, the GMB selling price would be $890 (see Table 22). When given two options, Table 17 shows that about 23 percent of urban consumers would switch from white roller meal at $17.40 to yellow roller meal at the cheaper price of $15.10 per 10 kg bag. In this case, there is no subsidy--the lower retail price is possible due to higher yellow maize yields and a lower producer price--and thus treasury losses are zero.

TABLE 22: ROLLER MEAL PRICING ASSUMING A LOWER YELLOW MAIZE PRODUCER PRICE TO REFLECT YIELD ADVANTAGES OF YELLOW MAIZE

	White	Yellow
GMB selling price per tonne (a)	$1070	$890
Maize milling costs (large-scale)		
Factory costs (b)	188	188
Mark-up (.2270 percent of a+b)	286	245
Distribution allowance	62	62
Ex-mill price (delivered to retailer)	1606	1385
Retailer's margin (9 percent)	145	125
Final retail selling price (per tonne)	1751	1510

A major dilemma is where in the system to attach the yellow maize subsidy. If the subsidy is provided only to manufacturers of yellow roller meal, it would have an adverse impact on small-scale millers. One option would be to offer a yellow maize grain price discount only to registered "millers/traders" who would be obligated to procure yellow maize grain from GMB depots only for human consumption. Any miller (small or large) or private trader who supplies such millers would be eligible for registration. The GMB selling price for maize meal manufacturers would be $720. Stockfeeders would pay the full price for all grades. Although maize meal manufacturers would have to be monitored to prevent diversion of subsidized yellow maize grain into stockfeeds, there would be little incentive for consumers or farmers to purchase yellow roller meal at $1510 or $1282 per tonne and divert it to animal feed. After all, with the decontrol of yellow maize trading, yellow maize grain would be available at a much lower price than yellow roller meal.

6.3 Yellow maize grain subsidy options

The previous section (Section 6.2) examined the benefits of a targeted subsidy on yellow roller meal versus the former subsidy on white roller meal. At a given price discount, it was found that a proportion of consumers would switch from white roller meal to yellow roller meal. Consumers that indicated they would switch to yellow roller meal tended to be concentrated in the lower-income groups. Thus, due to this inherent self-selection, it was concluded that a yellow roller meal subsidy would be better targeted than a white roller meal subsidy, thereby reducing subsidy costs.

One assumption underlying the previous analysis was that the consumers had a choice between two products: white roller meal and yellow roller meal. Yet it has become apparent over the past 6 months, that increasing numbers of consumers are switching from white roller meal to white straight-run meal. The lower price of custom-milled straight-run meal was cited by 93 percent of hammer mill customers as the reason for this decision.

As discussed in Section 4.3, excluding the opportunity cost of time spent travelling and queuing, the cash price of 20 kg of straight-run meal ranges from \$18.90 to \$24.45[7] versus \$34.65 for a 20 kg bag of industrial roller meal. For many households, the actual cash costs of maize grain are even lower. About a third of hammer mill customers planted maize on urban plots; maize grain was thus harvested and available for hammer milling with a minimum cash outlay. Also, 26 percent of respondents at hammer mills said that the maize grain that was brought to the hammer mill was a gift from rural relatives. Almost 79 percent of urban households receiving gifts of maize grain from rural relatives said that they had supplied these same rural relatives with maize grain or meal during the 1992 drought. Clearly, rural->urban and urban->rural transfers are an important part of both rural and urban household food security strategies.

The bottom line is that many urban consumers are obtaining white straight-run meal with relatively low c sh outlay. Because of the growth of this low-cost option over the last six months, the initiation of a yellow roller subsidy may not induce the proportions of consumers predicted in Section 6.2 to switch to yellow roller meal. Even at a subsidized price of \$12.82 for a 10 kg bag, yellow roller meal would still be more expensive than the cash price of straight-run meal (i.e. the cost of buying maize grain from urban vendors and having it milled).

To test this possibility, the responses of consumers to 10 different maize meal options is presented in Table 23. Consumers were shown a card with 10 different products at their prices and asked to pick the product they would buy most often. Since not all of the 10 products on the card were available to consumers in June/July 1993, estimates were made of what the price would be if the product were manufactured.

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[7] Based on the purchase of 18 kg of maize grain at \$15-20 and a milling charge of \$2.00.

As Table 23 shows, with white straight-run maize meal available at a shop (for $15.50) or hammer mill (for $13.75), relatively few consumers (7 percent) would be willing to pay slightly more ($15.70) for yellow roller meal when it is one of 10 options. That is, even though yellow roller meal is cheaper than white roller meal, consumers opt for one of the white straight-run meal products that are even cheaper.

TABLE 23: PERCENTAGE OF CONSUMERS CHOOSING EACH TYPE OF MAIZE MEAL PRODUCT AT SPECIFIED PRICES IN A "MULTI-OPTION" MARKET SIMULATION

Type of maize meal	Color	Price ($)	Percent of consumers choosing to buy this product:
Super refined (at shop)	White	24.27	9
Roller meal (at shop)	White	17.50	29
Mudzvurwa (at shop)	White	16.50	10
Straight-run (at shop)	White	15.50	16
Straight-run (at local mill)	White	13.75	18
Super refined (at shop)	Yellow	21.00	1
Roller meal (at shop)	Yellow	15.70	7
Mudzvurwa (at shop)	Yellow	15.00	1
Straight-run (at shop)	Yellow	14.00	2
Straight-run (at local mill)	Yellow	12.25	7

The results from this "multi-option" simulation presented in Table 23 contrast sharply with the results from the "dual-option" simulation presented in Table 17 (Section 6.2). Looking back to Table 17, when given a choice of only two options, one of which was white roller meal at $17.40, 23 percent of respondents said they would switch to yellow roller meal if it were 13 percent cheaper. Apparently, the inclusion of straight run meal at lower prices ($13.75 and $15.50) has drawn consumers away from yellow roller meal.

In Table 23, a total of 34 percent of respondents chose one of the white straight-run meal products. Therefore, the question is "how many of these respondents would switch to yellow roller meal if it were cheaper than white roller and white straight-run and they had multiple options". That is, how does the "dual-option" simulation in Table 17 compare with the "multi-option" simulation when the price of 10 kg of yellow roller meal is 26 percent cheaper than white roller meal (i.e $12.82 not $15.70 per 10 kg bag) and the respondents have the other options (i.e straight-run meal).

Further market simulations along the lines of Table 23 with the same sample yielded an answer. In the "multi-option" simulation, when the price of yellow roller meal fell to $12.82, 42 percent of consumers said the would switch to yellow roller meal. When combined with the 7 percent of respondents that had already chosen yellow roller meal at $15.70, the "multi-option"

simulation predicts that 49 percent of consumers would purchase yellow roller meal if the price fell to $12.82. Therefore, at low prices, the "multi-option" simulation yielded the same results as the "dual option simulation" (49 percent versus 50 percent).

The implication of this simulation is straight-forward. If yellow roller meal is to attract consumers, it will have to be sold at below the effective price of white straight-run meal; few consumers will buy yellow roller meal if the effective price of white straight-run meal is significantly lower. Furthermore, the sample prices used in the "multi-option" simulation may have over-estimated the effective price of white straight-run meal to consuming households.

As a result, a third targeting option may be subsidizing the GMB selling price of yellow maize grain intended for human consumption. As Table 23 shows, when given multiple options, 7 percent of consumers chose the cheapest product: yellow straight-run at $12.25 per 10 kg bag. Simulation results show that at even lower prices, a greater number of consumers would switch to yellow straight-run.

However, as alluded to in Section 6.1, the highly decentralized nature of the straight-run meal production and marketing system would complicate the use of yellow maize grain as a "self-targeted" staple food. Again, given the highly decentralized nature of small-scale custom milling, allowing certain buyers to purchase yellow maize grain for milling as straight-run at a price discount could mean large leakages as grain is diverted to animal feeds.

Yet, assuming lower GMB acquisition costs due to higher yields, yellow maize grain could be sold at a cheaper price than white maize grain. With a GMB selling price of $890 (to reflect higher yellow maize yields), and a $140 per tonne subsidy, yellow maize grain could be sold for $750 per tonne (or 15.00 per 20 kg bag). Conceivably, during certain demand periods, the GMB could establish selling points for the sale of 20 kg bags of yellow maize grain. Purchases could be limited to two 20 kg bags per customer.

What is the possibility that there will be leakage of subsidized yellow maize to animal feed? Since yellow maize is a decontrolled crop, any buyer can sell yellow maize at any price. Assuming a GMB producer price of $720, stockfeeders would probably be able to procure yellow maize grain directly from producers on a contract basis at a price somewhere between $720 and $890. Since the selling price of subsidized yellow maize would be $750 and bulk purchases would be prohibited, leakage to major stockfeeders would be minimal. There would, however, be no mechanism for preventing diversion of subsidized yellow maize grain to small, "backyard" poultry operations.

In good rainfall years, abundant supplies of white maize may mean that demand for yellow maize grain is very low. Demand for low-priced yellow maize grain would most probably also vary seasonally, peaking when own or relatives production is

exhausted. Yet, in the event of a poor harvest, a yellow maize grain subsidy, albeit imperfect, is one way of protecting vulnerable households.

Ultimately, any subsidy is vulnerable to leakage to non-needy groups. Even accounting for leakage to animal feed, a small yellow maize grain subsidy would cost less than the former roller meal subsidy. The previous analysis has shown that, at a price discount, some consumers (particularly low-income consumers) would be willing to purchase yellow maize meal. In the event that the subsidized price of yellow maize grain is still "too high" relative to white maize meal, the end result would be low consumer purchases--hardly a major policy failure.

6.4 Agricultural productivity, food security and yellow maize

Given potential consumer demand for yellow maize when offered at a price discount, there is scope for the resolution of two agricultural policy dilemmas exacerbated by the perceived preference for white maize.

1. Since new yellow maize hybrids have significantly higher yields than existing white maize hybrids, increased production of yellow maize for human consumption could lead to productivity gains. Essentially, it would free resources currently allocated to white maize to the production of alternative crops.

2. The belief that there is a strong "pure" preference for white maize (i.e. demand for yellow maize is low or nonexistent even at a price discount) leads the GRZ to pursue a food self-sufficiency policy at all costs. An emphasis on food self-sufficiency may lead to inefficient allocation of productive resources. Consumer acceptance of yellow maize at a price discount could provide the GRZ with greater flexibility in the pursuit of its food policy objectives.

Yellow maize has primarily been produced by large-scale commercial farmers. Until 1985, it was a relatively minor crop. Average area planted to white maize by commercial farmers during the 1980-84 period was over 230,000 hectares, while area planted to yellow maize during this period was under 5,000 hectares. However, with the introduction of new yellow maize hybrids, the area planted to yellow maize has undergone a phenomenal expansion to 61,000 hectares, while the area devoted to white maize has fallen by almost half. The reason for this tremendous expansion in yellow maize production is readily apparent: yellow maize yields are significantly higher than those of white maize, while producer prices were the same until recently. For example, over the 1985-89 period, yellow maize yields per hectare averaged 13 percent higher than white maize on large-scale commercial farms. The yield gap has continued to grow. During the 1991 growing season, yellow maize out-yielded white maize by nearly 40 percent. But from 1983/84 until 1989/90, the producer price of

class A yellow maize was the same as for class A white maize.

Faced with rising yellow maize production, MLAWD adjusted producer prices to keep the "right balance" between the prices of white and yellow maize and not create "an over expansion of yellow maize at the expense of white" (GRZ, 1992). Thus, in 1990/91, the GMB white maize producer was 18 percent higher than the GMB yellow maize producer price. Yet if there is demand for yellow maize by consumers, a major issue becomes how to balance need for white maize with a need for a given proportion of yellow maize. Clearly, to the extent that consumer demand for yellow maize can be met, the greater the improvements in allocative efficiency will be for the agricultural sector as a whole. Given the higher yields of yellow maize, a smaller area planted can meet domestic maize needs, freeing resources that can be devoted to alternative crops.

Naturally, if research efforts on improved white maize hybrids lead to the development of a white maize variety that can match the yields of the new yellow maize varieties, the efficiency gains will be transitory. However, even with such developments, there is still scope for yellow maize as a subsidized "self-targeted" staple grain.

Acceptance by the GRZ of the potential role of yellow maize would also give the GRZ greater flexibility in its pursuit of a comprehensive food security policy. Rather than relying on a food self-sufficiency policy at any cost, the GRZ would be free to pursue a policy of food self-reliance. Food self-reliance, based on the concept of comparative advantage, entails meeting national food needs through a cost-minimizing combination of domestic production, imports, and an appropriate stockholding policy.

The considerable variability of annual rain-fed maize production in Zimbabwe has disrupted the *de facto* pursuit of food self-sufficiency during the 1980's. Over the past decade, a clear pattern of maize price and production cycles has emerged. In years of bumper harvests, the Grain Marketing Board (GMB) must borrow to pay out large sums to farmers. With large GMB stocks, there is little incentive to maintain producer prices, leading to a drop in real producer prices. Lower maize prices induce shifts out of maize to more profitable crops. Lower production and falling stock levels persist until poor weather causes domestic shortages. Faced with high cost imports, there are pressures to increase producer prices dramatically in the following seasons. However, with a bumper harvest, the cycle begins again (Muir and Blackie, 1988).

In essence, the large differential between export parity and import parity helps create these policy dilemmas. Surplus maize production places a strain on GRZ fiscal resources due to limited export opportunities. High transport costs to overseas markets and protectionist agricultural policies in Europe and North America limit the scope for overseas exports. Regional markets in white maize are limited since the occurrence of bumper harvests generally tends to coincide in the region. When maize producers in Zimbabwe experience good harvests, most producers

in neighboring countries do as well. Limited consumer acceptance of yellow maize would provide the GRZ with greater flexibility in the pursuit of its food policy objectives. Rather than relying on a food self-sufficiency policy, a policy of food self-reliance would permit maize imports when the total costs of imported maize was below domestic production and storage costs.

However, the existence of demand for yellow maize, at a given price discount, does not ensure that the demand will be met. Complementary actions may be required in promoting the availability of yellow maize to emerging millers. Although the government no longer mandates the setting of milling margins, the four large commercial millers currently agree, in cartel-like fashion, on ex-mill prices and provide recommended retailing margins. The price setting behavior is legal and, by and large, retailers accept the recommended prices of the commercial millers. Since commercial millers receive higher margins (in absolute terms and as a percent of final ex-mill price) for more expensive products, there may be a natural incentive to reject the proposition that there is demand for yellow maize meal at a given price discount. In other words, given the strong positive correlation between the final value of a particular maize meal product and the net revenue per unit received by the miller, there are strong incentives to manufacture higher value maize meal products, such as white maize meal and super refined maize meal.

In coming years, the higher yields of yellow maize should mean that the raw material price to commercial millers for yellow maize will be below that of white maize. Yet since commercially-produced yellow roller meal would be a low-priced maize meal product, it would provide commercial millers with a low net revenue per unit sold. To the extent the large commercial millers still dominate the maize meal market, consumer preferences for a low-cost yellow maize meal product may not be articulated through the system. Access to the types of maize meal demanded by consumers may require select interventions by government to promote the use of yellow maize by emerging small-scale millers.

7. Implications for the provision of drought relief

This section provides an examination of the implications of consumer preferences and the structure of the grain marketing system on the design of drought relief programs.

7.1 Drought relief efforts in 1991/92

During periods of drought, declining harvests mean that household grain retentions in most communal areas are depleted within months of harvest. Even in relatively good rainfall years, many households exhausted their grain stocks before the next harvest and are net-buyers of food (Jayne and Chisvo, 1991). Thus, as the experience of 1991/92 demonstrated, during drought years the dependence of rural households on either drought relief allocations from government or NGO's and/or purchased market supplies can be enormous.

Although drought relief and child feeding programs are an integral part of strategies to provide rural households with access to grain during drought years, not all eligible households which apply for drought relief supplies can be accommodated in the program due to fiscal constraints. In 1992, the number of households registering for drought relief but not receiving any allocations was quite substantial. In May 1992, only 46 percent of those registered for food relief were actually fed (Herald, 1992). Of those receiving drought relief, allocations were limited to 5 kg per person per month from September 1992 onwards. As a result, many rural households found market purchases of maize a necessity. Despite drought-induced crop failure, rural households had access to cash income from sources such as remittances and non-farm income. Also many households resorted to sales of assets for cash to buy grain. In urban areas, maize purchases are also a vital component of household budgets.

During the 1991/92 drought, for the large number of households dependent to some degree upon commercial purchases of maize-meal, the only source of purchased maize was industrially-produced roller meal. That is, with low production, little or no maize was marketed by producers, either through the GMB or through informal channels; virtually all output was retained on-farm. There was little or no whole maize being marketed in smallholder or peri-urban areas. Industrial roller meal (and super refined meal), manufactured from imported maize obtained from the GMB, was virtually the only form in which maize is available for purchase.

From February 1992 to June 1993, when the effects of drought were most severe, the GRZ greatly increased the subsidy on industrial roller meal. As a result, a 50 kg bag of processed roller meal was cheaper than the price of a 50 kg bag of maize grain purchased by an individual from the GMB. The principal objective of the subsidy was to ensure that consumers had access to a low-cost source of maize-meal. However, the subsidy had two drawbacks:

1. The subsidy had a detrimental effect on an emerging group of small-scale hammer millers who had carved out a market niche by providing consumers with straight-run meal. The subsidy effectively eliminated the margin within which small-scale millers can operate.

2. The budgetary ramifications of the roller mill subsidy were enormous. As Section VI explained, the roller meal subsidy cost the GRZ $464 million for the 17 months from January 1992 to May 1993.

7.2 An improved maize distribution strategy for drought years

Drought is an inevitable part of the policy landscape. However, the 1992 drought can be viewed as an opportunity for renewed development of strategies to minimize the effects of future droughts. The measures proposed here are a natural outgrowth of recent policy statements from MLAWD. The MLAWD policy statement for the 1992/93 production year affirmed that it will make "every effort to encourage emergent traders to provide marketing services throughout the country's communal, resettlement and small-scale commercial areas."

Survey results show that many low-income households in rural areas would prefer to purchase either whole grain (which could be brought to a local hammer mill for custom-milling) or locally-milled straight-run from a retail shop, rather than buy roller meal. In May 1993, 300 rural households in five different provinces were asked what they would prefer to purchase if they ran out of their own production. Table 24 shows that 60 percent would purchase 10 kg of maize grain at $12 and have it milled at their local hammer mill. Only 12 percent said they would prefer to purchase roller meal at $17.50 per 10 kg when maize grain was available at $12.

TABLE 24: RURAL HOUSEHOLD GRAIN/MEAL PURCHASING PREFERENCES AT SPECIFIED PRICES

Choices of maize grain and maize meal products offered to rural households (all in 10 kg packets)	Percent of rural households that chose this particular type of maize grain/meal at the given prices
Maize grain at $12.00	60 percent
Straight-run meal at $15.50	26 percent
Roller meal at $17.50	12 percent
Super refined meal at $24.50	2 percent

Source: Survey data/Probe Market Research

Interestingly, respondents under the age of 25 were twice as likely to prefer roller meal (20 percent) than were respondents over 25 years (only 10 percent).

Since many consumers prefer straight-run meal which can be processed at low cost by small-scale hammer millers, one option for providing a low cost maize meal to low-income consumers without a subsidy would be to encourage the sale of maize grain, rather than roller meal.

Yet during the 1991/92 drought, GMB depots restricted sales of maize grain thereby promoting consumption of the relatively more expensive roller meal in rural areas. A special order prohibited GMB maize sales to non-registered private buyers (i.e. anyone but the registered industrial millers) to one 90 kg bag per month. As a result, small-scale traders and hammer millers found it very difficult to obtain grain. Moreover, fixed prices at each stage of the roller meal distribution network meant there was little incentive for rural transport of roller meal beyond a certain distance.

The ostensible reason for restrictions on private purchases from GMB depots was the fear of maize shortages, as occurred in February and March 1992. According to this logic, restricting maize sales from GMB depots is a rationing measure to prevent private entrepreneurs from exploiting consumers by charging high prices for maize grain.

The savings to the GRZ of encouraging sale of maize grain rather than roller meal during drought are substantial. For example, a sample calculation of the savings to the GRZ if rural demand had been met with maize grain rather than subsidized roller meal can be made:

1. The assumption is made that maize sales to millers during April to July 1989 represent the urban and year-round demand for maize during a normal year. Given the good harvest during 1988/89 and the very stable demand for maize from the industrial millers during this time, this is a plausible assumption. During April to July 1989, the four months immediately after a good harvest, maize sales to millers averaged 37,600 tonnes per month.

2. During the 1992/93 marketing year monthly GMB maize sales to millers averaged 87,550 tonnes per month, reflecting high rural consumption due to drought. Thus, rural consumption in the drought year increased by 49,950 tonnes (87,550-37,600 = 49,950).

3. Converting for the 85 percent extraction rate for roller meal, rural consumption of roller meal averaged about 42,460 tonnes during the 1992/93 marketing year. This amount is the additional rural consumption of roller meal that can be directly attributed to drought.

4. Assuming a $562 per tonne subsidy on roller meal, the cost to the GRZ was about 23.9 million per month (or 286.3 million per year). Therefore, if instead of subsidizing roller meal, the GRZ had sold maize grain to rural households at the GMB selling price of $1070 per tonne, the GRZ would have saved over $280 million.

What would have been the effect on consumers? Instead of buying subsidized roller meal at $22.53 for a 20 kg bag, assume they could have bought maize grain at the GMB selling price, about at $21.40 per 20 kg bag. With milling charges of about $1.50 per bucket, the total cost to the rural consumers would have been $22.90, or only about $0.37 more than subsidized roller meal. Therefore, the net loss to consumers would have been about $785,500 per month ($1.61 * 50 * 42,460 tonnes). Naturally, by slightly reducing the GMB selling price, even this small loss to consumers could be avoided. Of course this calculation assumes that the GMB's required operating margin is the same for sales of small quantities to consumers as it is for industrial millers. GMB sales of small quantities may require the establishment of a network of selling points and higher administrative costs, necessitating a higher margin. Nevertheless, even if the GRZ were to subsidize GMB operations to account for these higher operating costs, the cost of subsidizing distribution of maize grain would be far below that of the former roller meal subsidy.

Finally, contrary to statements by the industrial millers, small-scale custom millers have the capacity to meet urban demand for maize meal under virtually all policy reform and weather scenarios. Surveys of custom millers in Harare and Chitungwiza have revealed that during the peak month of operation at each mill in 1993, the mean throughput of maize was 90 tonnes per month. If all 81 hammer mills were operating at their peak, 7287 tonnes of maize meal per month could be processed.

Based on the above mill throughput figures and estimated consumption requirements, about 66 percent of Harare/Chitungwiza demand for maize meal could be met by local hammer millers. Since this figure assumes that each mill operates about 70 hours per week (the current average), an even greater percentage of consumption requirements could be met with a longer working day or implementing continuous, rather than batch, processing.

Thus, there is a persuasive case that, instead of restricting access to grain by the private trade, the government should make every effort to encourage the development of a competitive private grain trade, particularly to improve grain distribution during drought years. With maize supplies procured from the GMB, private traders can play a critical role in supplementing movements of drought relief and roller meal supplies by moving grain to consumers in rural and urban areas. By purchasing grain and visiting one of many small-scale custom millers, consumers will be ensured of straight-run meal at a price significantly below the unsubsidized cost of roller meal.

8. Major Conclusions

The purpose of this study was to inform the on-going process of grain marketing reform by assisting MLAWD with analysis of maize demand patterns and providing USAID/Harare with programmatic assistance for their Grain Marketing Reform Support Program.

A number of policy-relevant conclusions can be drawn from the analysis presented in this report.

* The conventional wisdom--that urban consumers have a strong preference for white refined maize meal--needs to be amended. To many consumers, "low price" is very important. If yellow maize meal or straight-run meal is available at a price discount, a substantial portion of consumers will switch from white roller meal. The demand for yellow roller meal and white straight-run meal is very price elastic. Price elasticity of demand estimates show that a one percent fall in the price of straight-run will result in increased consumption of 2.7 percent. Similarly, a one percent fall in the price of yellow roller meal straight-run will result in increased consumption of 1.8 percent.

* The market for purchased and packed maize meal continues to be dominated by two industrial milling companies that have 92 percent of the market. Only 4 percent of purchases of bagged maize meal were from small-scale production millers. Despite the increasing growth and expansion of small-scale millers, production millers have not yet gained a significant share of the purchased maize meal market.

* As of mid-1993, 27 percent of urban households were consuming straight-run meal custom milled at local hammer mills. The growth of straight-run meal consumption has cushioned consumers from the 53 percent increase in the roller meal price that occurred in June 1993 due to the removal of the roller meal subsidy. The survey data also predicts further growth of straight-run consumption: 15 percent of those consuming roller meal would have preferred to eat straight-run even if it were at the same price as roller meal. This prediction is borne out preliminary results from a survey done by the Inter-Ministerial Committee for Social Dimensions of Adjustment Monitoring in November 1993 that found that about half of the Harare area population was consuming straight-run meal.

* Over 93 percent of straight-run meal consumers said they were consuming straight-run because it was cheaper or saved money. But only 35 percent of straight-run consumers said that they would actually prefer straight-run if they could have a more refined meal at the same price. Thus, straight-run meal consumption does not, for the most part, reflect an absolute preference for straight-run. Rather, it appears to be a coping strategy resulting from falling

real incomes. The implication is that improved macroeconomic performance that led to rising real incomes would depress demand for straight-run meal as more consumers would be induced to switch back to roller meal.

* Market liberalization, mainly the removal of maize movement restrictions, has also contributed to the growth in straight-run meal consumption. The actual cash price of straight-run (the procurement costs of maize grain plus the custom milling charge) is far below the prevailing retail price of roller meal. Purchases from urban maize grain vendors and inflows comprise a growing portion of household maize grain inflows. Maize from urban plots has become a less important source of maize grain. Only 34 percent of hammer mill customers surveyed in October 1993 had planted maize in urban plots.

* There is strong evidence that the decision of a household whether to consume straight-run meal is determined by household income, household size, and the distance to a hammer mill. Higher household income and greater distance to a hammer mill reduces the probability of a household consuming straight-run meal, while a larger household size is associated with an increased chance of straight-run consumption.

* Of six different product characteristics tested in a qualitative framework, "high nutrition" and "low price" were the most important to consumers. Yet while consumers had a strong preference for maize meal with high nutritional value, half of all consumers did not know that straight-run meal has more nutrition that roller meal or super-refined meal. Therefore, more widespread knowledge of the nutritional superiority of straight-run meal might significantly boost consumption.

* Yellow roller meal and white straight-run meal are both "inferior goods." That is, as household income rises, consumption of these goods decreases. As a result, yellow roller meal and white straight-run meal have potential as a vehicle for a "self-targeted" subsidy. However, the subsidy would have to be carefully designed to minimize leakage of grain to animal feeds.

* A targeting subsidy on yellow roller meal would be a much more cost-effective mechanism for protecting vulnerable groups than the former blanket roller meal subsidy. The urban portion alone of the roller meal subsidy was estimated to cost $115 million per year. On the other hand, the urban portion of a yellow roller meal subsidy (one that would ensure retail yellow roller meal price of $12.82 per 10 kg bag) would only cost $21 million per year. However, to attract consumers, a subsidized yellow maize meal product would have to be cheaper than the effective price of white straight-run meal from custom milling.

* Yellow straight run meal may be the most attractive vehicle for a "self-targeted" subsidy as it is certainly an "inferior" good. However, the highly decentralized nature of the straight-run meal production and marketing system would seriously complicate the subsidization of yellow maize grain. Without costly, and perhaps impractical, safeguards, selling yellow maize grain at a price discount for eventual consumption as straight-run meal could mean large leakages as grain is diverted to animal feeds. Yet, even without a subsidy, the yield advantages of yellow maize mean that the unsubsidized yellow straight-run meal could be obtained by low-income households at a price below that of white-straight-run meal.

* An expanded role for yellow maize in a national food security strategy would give the GRZ greater flexibility in its pursuit of food security. Rather than relying on a food self-sufficiency policy at any cost, the GRZ would be free to pursue a policy of food self-reliance. Furthermore, increased production of yellow maize for human consumption would increase agricultural productivity and free resources currently allocated to white maize for the production of alternative crops.

* During periods of drought, the GRZ should facilitate the sale of maize grain rather than roller meal. Purchases of maize grain can ensure that both rural and urban consumers have access to maize meal at a price significantly below the unsubsidized cost of roller meal. If during the drought, instead of subsidizing roller meal, the GRZ had sold maize grain to rural households at the GMB selling price of $1070 per tonne, the GRZ would have saved over $280 million in roller meal subsidies without appreciably hurting consumers.

* There is sufficient small-scale hammer milling capacity to meet demand for straight-run meal under virtually all policy reform and weather scenarios. For example, without changing current operating hours, Harare/Chitungwiza hammer mills have the capacity to mill 66 percent of Harare/Chitungwiza maize meal requirements.

The results presented here should be viewed as a first step in continuing efforts to collect empirical information about consumer preferences so that such information is incorporated into the on-going implementation of GRZ agricultural reforms. Knowledge of consumer preferences can be viewed as a prerequisite to the reform process since it permits the analyst to identify products for which latent consumer demand cannot be articulated "backwards" into other stages in the marketing system. Latent consumer demand also highlights key areas of intervention for the policy-maker.

Continued analysis of this database by Ministry of Lands, Agriculture, and Water Development analysts in the Economics and Markets Branch can help ensure that future policy actions in the maize sector are empirically based. Without knowledge of demand conditions, there is no way for policy-makers to predict *ex-ante*

the likely effects of lifting policy constraints which inhibit the development of alternative marketing channels.

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