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Effects of Market Reform on Access to Food by Low-Income Households: Evidence from Four Countries in Eastern and Southern Africa

by

T.S. Jayne, L. Rubey, D. Tschirley,

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by

**T.S. Jayne, Lawrence Rubey, David Tschirley, Mulinge Mukumbu, Munhamo Chisvo,
Ana Paula Santos, Michael T. Weber, and Patrick Diskin**

September 1995

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SYNOPSIS:

- Basic changes in market regulation can provide an opportunity for low-income consumers to improve their diets and real incomes; and
- Information on variations in consumer preferences among income groups can be used to improve the cost-effectiveness of food aid programs, through use of "self-targeted" commodities.

BACKGROUND: Virtually all governments are confronted with the conflicting goals of maintaining food prices that are profitable for producers and affordable to consumers. In much of Africa, these goals have been historically pursued through controlled marketing systems in which food prices could be artificially raised for producers and lowered for consumers through subsidies. However, this practice became fiscally unsustainable in many countries, and has recently led to food market reform in over 20 African countries.

Food market reform in Eastern and Southern Africa has been particularly slow. Serious concerns have been raised over the effects of market reform and the elimination of food subsidies, particularly on the ability of low-income consumers to maintain access to maize meal, the dominant staple in the region. There has been a widespread perception that urban consumers strongly preferred the highly refined maize meal distributed and often subsidized through the official marketing channel in contrast

to less expensive whole maize meal, produced by small-scale hammer mills through the often illegal informal marketing systems. Prior to the reforms, over 90% of the maize meal consumed in urban areas was in the form of refined meal. The perception of low demand for whole maize meal made many policy makers reluctant to eliminate the subsidies on refined maize meal or to jeopardize the controlled marketing system that ensured its availability. However, under pressure from donors and international lenders, many governments eliminated the subsidies on refined maize meal in the early 1990s. In the short run, the elimination of food subsidies has raised the specter of sharp food price surges, falling real incomes for the poor, and political unrest.

OBJECTIVES: This report analyzes the effects of grain market reform and food subsidy elimination in Eastern and Southern Africa on access to food for low-income consumers. The report also assesses the potential to use "self-targeted commodities" (i.e., commodities purchased primarily by the poor) to improve vulnerable groups' access to food through market development strategies and food aid programs. While much research has been devoted to understanding how producers and traders would respond to reform of staple food markets, relatively little is known about the potential or actual responses by consumers. The report presents recent findings from six household-level surveys in urban areas of Zimbabwe, Kenya, Zambia, and Mozambique between 1991 and

1994. Secondary data from South Africa and Malawi are also presented where available.

FINDINGS: The report highlights seven conclusions with broader implications for targeting vulnerable groups:

1. Consumer subsidies on refined maize meal in Kenya, Zambia, Zimbabwe, Mozambique, and South Africa have not necessarily promoted food security, because they (and associated controls on maize marketing) have entrenched a relatively high-cost marketing system and impeded the development of lower-cost channels from developing.

The negative effects of eliminating subsidies on refined maize meal have been partially or wholly compensated by relaxing controls on private grain trade, which has raised consumers' access to less expensive whole maize meal distributed through the emerging informal markets. A 53% rise in the price of refined meal in Kenya (due to subsidy removal) has been estimated to raise household expenditures by less than 1% of total income for low-income groups, due to the widespread availability of cheaper whole meal since the reforms were initiated and low-income groups' tendency to substitute whole meal for refined meal at a price discount.

2. The conventional wisdom of rigid urban preferences for refined maize meal was greatly exaggerated by policy restrictions under the controlled marketing systems and subsidies on refined maize meal. The proportion of urban consumers in Nairobi, Lusaka, and Harare consuming whole meal has risen from pre-market reform levels of about 5% to 10%, to about 40% to 55% within a period of several years.

3. Since the removal of refined meal subsidies and controls on maize movement, retail prices of hammer-milled whole meal have ranged from 55% to 80% those of refined meal manufactured by large-scale millers. At observed purchase price levels, the availability of whole meal has

allowed cost savings to consumers equal to 4%-13% of household income among the lowest income-quintile in the capital cities of Harare and Nairobi. In Maputo, hammer-milled maize meals, whether white or yellow, are at least 15% less expensive than roller-miller products of the same color. These are significant cost saving for lower income consumers.

4. In all countries surveyed, there is an inverse relationship between whole meal consumption and household income, and a positive relationship between refined meal consumption and household income (see Table 1). These findings indicate that whole maize meal is a "self-targeted" commodity.

These results also indicate that the former refined meal subsidies were untargeted and that their benefits were actually inversely related to household incomes. In Nairobi, the 53% increase in the price of refined meal after the removal of subsidies in January 1994, other factors constant, was estimated to increase maize meal expenditures by 7% for the lowest household income-quartile, compared with 25% for the highest income-quartile.

5. New investment in hammer milling has increased rapidly since market reform. This corroborates household survey data indicating that consumption of hammer-milled whole meal has risen rapidly after market reforms. In Zambia, hammer mills have increased from an estimated 4,156 to around 6,000 between 1992 and 1994. The number of hammer mills operating in Nairobi has increased 80% between 1987 and 1993. Hammer mills operating in Harare have increased from 57 to 85 in 18 months between 1992 and 1994. In Maputo, at the beginning of the 1970's, official statistics list only 3 hammer mills in the city. In 1995, there are 155 licensed hammer mills operating, and over 90 percent of these came into operation since the inception of the governments' economic reform program.

6. Small-scale mills have a higher labor-to-investment cost ratio and labor-to-output ratio than large-scale milling. Evidence also suggests that small-scale milling technology has lower start-up costs and would promote greater growth linkages with other local sectors. Increased small-scale milling is expected to have positive effects on employment growth and income distribution.

7. Yellow maize, which is typically available at a price discount relative to white maize, also appears to be a "self-targeted" food. Consumption of yellow maize at the household level is negatively related to income in Mozambique. Contingent valuation surveys in Zimbabwe also suggest that yellow maize consumption would be consumed disproportionately by the poor, if available.

Yellow maize benefits from a well-functioning international commodity exchange, typically costs 10% to 20% less than the limited supplies of white maize on world markets, and is subject to much smaller price fluctuations. Yellow maize may provide the potential both to stabilize prices paid by consumers in the market during poor harvests and to increase the cost-effectiveness of food aid programs in the region through yellow maize's "self-targeted" character.

IMPLICATIONS FOR GOVERNMENTS AND DONORS: There appear to be major opportunities to promote household food security through the use of self-targeted commodities. By further promoting the performance of private production, distribution and processing systems featuring self-targeted commodities, low-income consumers can rely to a greater extent on the market for their food needs, thereby reducing the magnitude of resources required for targeting the needy through administrative food assistance programs. And food aid donors can increase the effectiveness and reduce leakage of their programs by maximizing the use of self-targeted commodities. These findings are especially rele-

vant in the current environment of fewer food aid resources available from major donor countries.

Inappropriate choice of commodities or distribution systems for relief and/or development purposes, in addition to transferring scarce donor resources to less-needy households, also depresses demand for food in local markets and exacerbates price unpredictability. This has been shown to adversely affect the development of local food markets. For example, the monetization and subsidization of maize food aid processed into refined maize meal through the official marketing channel during the 1992/93 drought in Zimbabwe created serious setbacks for the development of a competitive and low-cost private grain marketing system that donors were trying to encourage.

Governments and food aid donors can increase the benefits of limited food aid resources and market-oriented strategies to promote food security through the use of accurate information on how the demand for various foodstuffs varies by income group, especially the poor.

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1. INTRODUCTION

The recent wave of structural adjustment programs in Africa has put pressure on governments to eliminate costly subsidies on key food staples. In the short term, the elimination of food subsidies has raised the spectre of sharp surges in food prices, falling real incomes for the poor, and political unrest.¹ At the same time, governments strive to keep producer prices high enough to generate adequate food supplies, especially in landlocked countries with weak infrastructural links to world markets and where the staple commodity is thinly traded on world markets. In Eastern and Southern Africa, this classic food-price dilemma historically had been dealt with through controlled marketing systems, in which food prices could be artificially raised for producers and lowered for consumers through subsidies. The political expediency of subsidies underscores the historical reluctance of many African governments to relinquish control of politically sensitive food marketing systems.

However, domestic fiscal and external donor pressure for the elimination of unsustainable subsidies has forced many governments to revisit the food-price dilemma. In the long term, growth in farm productivity and non-farm employment may reduce the severity of the food-price dilemma. In the short term, however, governments' options for relieving the food-price dilemma are limited. Yet it is in the short term that the greatest need exists to cushion the poor from potentially adverse impacts of structural adjustment. A major political and social dilemma faced by numerous African governments over the past decade has been how to keep food prices at tolerable levels for the poor at a time when food subsidies must be reduced.

The objective of this report is to determine the effects of grain market reform on low-income consumers' access to food in Eastern and Southern Africa, and to assess the implications of these findings for food security policy. We focus primarily on shifts in maize consumption by urban households of different income groups in response to the introduction of new commodities that have been made more accessible to consumers through market reform. Some attention is also given to the impact of market reform on access to food by the rural poor. We then assess the scope and potential effectiveness of using market-based mechanisms to promote these vulnerable groups' access to food.

Concern with this issue originated from our observations in the late 1980s that the dominant staple food throughout Eastern and Southern Africa, white maize-meal, was consumed in a substantially more refined, higher priced, and less nutritious form in urban areas than in rural

¹ See Lele (1990), Oyejide (1990), Pinstup-Anderson (1988), and Cornia, Jolly, and Stewart (1987). These studies generally conclude that the short-term effects of structural adjustment have been particularly severe on the urban poor.

areas. Specifically, urban households primarily consumed a refined maize-meal (i.e., called "sifted," "roller," or "breakfast" meal, depending on the country) produced by large-scale urban processors, while their rural counterparts primarily consumed maize in the form of a cheaper, less-refined whole meal, generally processed by small-scale hammer mills, or in some areas, by hand-pounding. Only when rural households ran out of grain did rural purchases of refined meal rise. The large-scale milling firms, as part of the official marketing system, were generally given preferential access to the marketing boards' grain, and were granted monopoly or oligopoly rights to distribute maize-meal in urban areas. By contrast, small-scale hammer mills were part of the parallel, informal marketing system whose operation was typically suppressed by regulations that restricted urban operations or access to grain. Milling margins charged by the large-scale mills ranged from three to four times those of hammer mills, depending on the year and country. As a result, urban consumers paid 25 to 40 percent more in price for their staple food than those households that could acquire whole meal through informal marketing channels. This adversely affected access to food by the urban poor and rural households dependent upon market purchases of refined meal.²

This divergence in urban and rural consumption patterns in Eastern and Southern Africa had been conventionally explained in terms of strong taste preferences by urban consumers for refined, white maize-meal. This conventional wisdom led to the perception that policies blocking informal maize trade and processing in urban areas had no effect on urban food security, since urban consumers would not buy cheaper whole meal at any realistic price discount relative to refined meal. Thus, the removal of subsidies on refined meal would exacerbate food insecurity for low-income, urban households.

An alternative premise is that, in many countries, the dominance of refined maize-meal consumption in urban areas has been largely a manifestation of government policy. While consumption of the more costly refined meal is partially determined by attributes of the product itself, its perceived popularity may have been exaggerated by subsidies on refined meal and by decades of controls on maize marketing, which have restricted urban consumers' access to the less expensive, whole maize meal through informal trading and milling networks. The perception of strong preferences for refined meal may have been reinforced by substantial advertising by large-scale milling firms portraying refined maize-meal as a sign of modern, sophisticated living.

The relative importance of these two competing views has critical implications for the development of strategies to promote access to food by vulnerable urban households in an environment where food subsidies are no longer sustainable. In particular, if low-income consumers would readily purchase whole meal at some price discount relative to refined meal, then market reform programs that involved the elimination of refined meal subsidies, and concomitant measures to raise the efficiency of private distribution systems, might not adversely affect (and might even improve) household food security. By expanding low-income

² In cases where sifted flour prices were subsidized through treasury payments, the higher cost of sifted flour was paid by taxpayers.

households' ability to acquire their food requirements through the market, the needed cost and magnitude of "safety-net" food and income transfer programs would be reduced.

Ironically, while much research has been devoted to understanding how producers and traders would respond to a reform of staple food markets, relatively little is known about consumers' potential or actual responses. This report presents recent findings from six household-level surveys in the urban areas of Zimbabwe, Kenya, Zambia, and Mozambique between 1991 and 1994.³ Secondary data from South Africa and Malawi are also presented where available. We highlight seven conclusions with broader implications for targeting vulnerable groups in Eastern and Southern Africa:

1. Consumer food demand patterns can be largely policy-driven. In much of Eastern and Southern Africa, maize-meal consumption patterns appear to have been influenced by food policies affecting the price and convenience of procuring refined maize-meal compared to whole meal. Most consumers throughout the region appear to prefer to buy white, refined meal, if the prices are equal. However, prices for whole meal have been typically 25 to 40 percent less than refined meal in the absence of regulations blocking the operation of small-scale mills producing whole meal. Survey information from Kenya, Mozambique, Zambia, and Zimbabwe indicates that most low-income consumers either did consume lower-priced whole meal, or stated that they would have consumed it in the absence of regulations blocking its availability in urban areas.
2. Consumer subsidies on refined maize-meal in Kenya, Zambia, Zimbabwe, Mozambique, and South Africa have not necessarily promoted food security, because the subsidies and their associated controls on maize marketing have entrenched a relatively high-cost marketing system and impeded the development of lower-cost channels. Grain delivered to the state marketing boards was generally preferentially supplied to large-scale, urban roller-milling firms that charged, or were granted by the state, higher milling margins than those prevailing in the informal marketing channels. Controls on informal grain trading imposed higher milling costs on consumers, which often overwhelmed the effect of direct state subsidies to consumers. Findings from both Kenya and Zimbabwe indicate that the subsidy on refined meal during 1993 was approximately equal to the difference in the milling margins between the large-scale, roller-milling firms and informal hammer mills.
3. Consumption of whole maize-meal in Kenya, Zambia, Zimbabwe, and Mozambique is negatively related to household income, while refined meal is positively related to income (Mukumbu and Jayne 1994; Rubey 1993; Chisvo and Jayne 1995; Diskin and Sipula 1994; Tschirley and Santos 1994). These findings indicate that subsidies on refined meal were

³ The individual country-level findings are reported in Jayne et al. (1991); Rubey (1995); Chisvo and Jayne (1995); Mulinge and Jayne (1994); Tschirley and Santos (1994); and Diskin and Sipula (1994).

captured primarily by high-income consumers. These findings also suggest that whole maize-meal is, to some extent, self-targeting, i.e., it would be the product of choice for many low-income households. As governments seek to reduce budgetary expenditures on refined meal subsidies, our results seem to indicate that strategies to target vulnerable groups through making whole meal more accessible to urban consumers could ameliorate many of the negative effects of subsidy removal.

4. The time required to process or acquire whole meal appears to be an important factor influencing its consumption, highlighting the importance of convenience and competing demands on household members' time (Rubey 1995; Mukumbu and Jayne 1994).
5. Consumption of yellow maize, when available on local markets, is negatively related to income in Mozambique. While both yellow and white maize are not usually available at the same time in Zimbabwe and Zambia, stated preference data suggests that yellow maize is also negatively related to income. To the extent that yellow maize can sustain a price discount relative to white maize in liberalized markets, it will be a self-targeted commodity. The results also highlight the potential importance of extending market liberalization to the area of trade policy. Yellow maize is cheaper and far more readily available in world markets than white maize. This is especially true during the years of regional drought, as in 1992 and to some extent, 1995. Allowing traders to procure less expensive yellow maize on the world markets to satisfy the demand from low-income consumers, or to supply a broader market during drought years, will give policy makers one more important tool for responding to chronic poverty and the need to cost-effectively target vulnerable groups.
6. Small-scale mills have a higher labor-to-investment cost ratio and labor-to-output ratio than large-scale milling (Mukumbu 1992; Bagachwa 1992; Stewart 1977). Evidence also suggests that small-scale milling technology has lower start-up costs and would promote greater growth linkages with other local sectors. Therefore, increased small-scale milling would be expected to have positive effects on employment growth and income distribution.
7. Perhaps most important for future research, we stress the importance of *ex ante* analysis that informs decision makers regarding how consumer choices are influenced by policy, instead of viewing consumer choices as being immutable and formulating food policies around prevailing consumption patterns. When given a wider range of products differentiated by price, consumer choices may be more flexible than supposed by conventional wisdom. Improved knowledge regarding consumer behavior can widen policy makers' perceptions of feasible options that will protect vulnerable groups and increase receptivity to sustaining the recent food policy reforms in Africa. A corollary of this is that policy makers may feel less compelled to reimpose controls at a later stage.

We conclude that market reforms that allow consumer preferences to be better articulated through the food distribution system may facilitate (a) improvements in food access and

improvements in the nutritional content of the food consumed without a need for subsidies, (b) productivity gains in the food system through shifts in the choice of technique, and (c) growth in employment and income distribution from shifts in volumes through alternative marketing channels and their associated technologies. The findings indicate the potential to partially target vulnerable groups through the market, thereby reducing the magnitude of the resources required for targeting the poor through administrative food or income transfers. These findings are especially relevant in the anticipated future environment of much lower levels of food aid resources available from major donor countries due to the Generalized Agreement on Tariffs and Trade (G.A.T.T.) and the 1995 U.S. Farm Bill.

2. TYPOLOGY OF MAIZE MEAL

Maize meal, the flour from the ground maize kernel, is the dominant staple food throughout Eastern and Southern Africa. However, "maize meal" is not a homogeneous product. There are significant variations in the type of maize meal consumed in the region. Maize meal may be classified along several continuums: extraction rate, "dentiness" vs. "flintiness," and color. This section describes the various types of maize meal consumed in the region. We then trace the historical determinants of the variations in current maize consumption patterns across these countries.

2.1. Extraction Rate

Extraction rate refers to the proportion (by weight) of the maize kernel which is processed into meal. The maize kernel is composed of three parts: the bran, the germ, and the starchy endosperm. Refined meals are produced by removing all or part of the germ and bran, resulting in a lower extraction rate than whole meals. The extraction rate of a meal affects its nutritional content (Table 1). Whole meal produced from a hammer mill, when compared to refined and super-refined meal, contains 8 percent and 20 percent more protein, 17 percent and 150 percent more thiamin, 62 percent and 100 percent more riboflavin, 25 percent and 127 percent more iron, and 71 percent and 100 percent more calcium.

Starting with equal weights of meal, these nutritional differences are not substantial, in most cases, when compared to the daily human requirements. However, when starting with equal weights of grain, the quantity of whole meal produced may be 15 to 35 percent greater than the quantity of refined meal. Based on the difference in extraction rates, the additional nutrients, especially calories, available for human consumption from maize ground into whole meal may be substantial. On the other hand, the by-products from refined meals are typically used for animal feed. Yet much of the final nutrient value for human consumption is lost in the conversion of food from grain to animal products.

2.2. Dent vs. Flint

Dent and flint refer to the hardness (vitreousness) of the kernel. Flint varieties are composed of a hard, glassy endosperm, while the endosperm of dent varieties is softer (lower vitreosity). While the terms "flint" and "dent" suggest a categorical distinction, in reality all maize varieties lie along a continuum. A particular variety's location on this continuum is determined by its genetic phenotype. The varieties brought to Southern Africa by the Portuguese were on the flinty end (highly vitreous) of the continuum.

In Zimbabwe, South Africa, Zambia, and Kenya, dent varieties are most commonly grown now. The dominance of dent varieties in these countries is largely due to the importance of

the European-dominated maize production sectors and the success of colonial seed improvement and breeding programs based on dent-type varieties, initiated during the first

Table 1: Nutrient Comparison of Refined and Whole Maize Meal.

	Refined Meal		Whole Meal
	----- Extraction Rates -----		
	65%	85%	96-99%
Protein (%)	7.9	9.3	10.0
Fat (%)	1.2	2.4	3.8
Carbohydrates (%)	78.4	75.1	73.4
Fibre (%)	0.6	1.1	1.9
Ash (%)	0.5	0.7	1.3
per 100 grams:			
Calories (kilocalories)	334.0	341.0	343.0
Calcium (milligrams)	6.0	7.0	12.0
Iron (mgs)	1.1	2.0	2.5
Thiamin (mgs)	.14	.30	.35
Riboflavin (mgs)	.05	.08	.13
Niacin (mgs)	1.0	1.8	2.0

Source: West et al. (1987).

half of the 20th century. The emphasis on dent varieties has been a factor, along with the changing opportunity cost of female labor, in the shift away from hand-pounding in these countries.⁴ In most rural areas of the region, maize meal is hammer-milled and eaten in the form of whole meal. However, Mkandawire (1993) reported that many rural households in Malawi hand pound flinty maize to remove the germ, and then take it to small hammer mills to be made into a degermed maize meal.

Mozambique had a relatively small but important European producer sector, especially in the South and Center of the country, that grew mostly dent-type maize varieties from South Africa and Zimbabwe to feed their laborers and supply the cities (Miracle 1966; Companhia de

⁴ Hand-pounding dent varieties result in a higher fraction of the soft endosperm being lost than when hand-pounding flint varieties, resulting in a lower meal-from-grain extraction rate (Smale and Heisey 1994).

Mozambique 1934). In Northern Mozambique, African producers were responsible for most of the surplus grown, and they are believed to have used mostly flint and semi-dent varieties.

Malawi, by contrast, never developed a significant European-dominated maize production sector. Colonial seed improvement programs did not receive the same level of sustained commitment. Possibly for this reason, traditional, flinty-white varieties have persisted throughout these areas, and, to a lesser extent, in Zambia. These traditional varieties are slightly more difficult to process in a hammer mill than are the softer, denty varieties.⁵ Because of this factor, as well as the low income, and civil and economic instability after independence, the small-scale hammer milling industry never developed in the rural areas of Mozambique to the extent that it did in Zimbabwe, South Africa, Zambia, and Kenya. Due to market reform and, over a period of ten years, the sustained arrival of large volumes of denty, yellow-maize food aid, much of which was eventually marketed through informal marketing channels, the small milling sector developed rapidly in Mozambique. Since denty yellow-maize was most abundant in urban, not rural areas, the small-scale hammer milling industry grew most rapidly in cities and towns. With the arrival of peace, investments are beginning to be made in small hammer mills to process whole and degermed grain in rural villages and towns.

2.3. Color

Maize varieties in Southern Africa today range along a continuum from white to deep yellow. Consumer perceptions, however, tend to be dichotomous: a grain with any yellow in it is considered yellow, not white. Throughout the region, white maize has been preferred when priced the same as yellow maize. Yellow maize has been considered by many to be appropriate only for animal feed, or at least as being vastly inferior for human consumption to white maize. As a result, yellow maize typically has been consumed only during droughts, when insufficient white maize was available from regional and world markets.

Only in Mozambique has yellow maize continuously been consumed over the past decade by a large segment of urban consumers. Yellow maize has been available there due to the country's dependence on food aid, most of which is donated by the United States and the European Community. This extended presence of yellow maize in Mozambican markets has provided a unique opportunity to explore the nature of consumer preference for maize color. In South Africa, large-scale millers have been mandated by the government to mix yellow and white maize in the milling stage during domestic white maize shortfalls. The maize industry has also attempted to increase the acceptability of yellow maize for human consumption

⁵ Small hammer mills in Maputo charge a premium to mill domestic flinty varieties as opposed to imported denty varieties (mostly yellow maize from food aid).

through advertising. However, illegally-manufactured pure white-maize meal often fetches a 50 percent or more premium over the mixed varieties.

2.4. Milling Technology

There are two maize milling technologies: one in which the grain is directly ground without any pre-processing, and one in which the grain is ground and then different components "sifted" out. The former process yields whole meal, which contains the bran, germ, and endosperm in the proportions found in the whole kernel. The latter process yields a large range of partially or fully degermed meals.

Whole meal is produced by three types of mills (stone, plate, and hammer), but we focus exclusively in this paper on hammer mills, because this is by far the most common technique for making whole meal in Eastern and Southern Africa. Hammer mill technology does not separate the bran, germ and endosperm, but simply shears and grinds the whole kernel or whatever part of it is fed into the hopper. The broken grain is sheared in the milling chamber until its size is sufficiently reduced to pass through the holes of a screen surrounding the hammers. A range of screens is available for the production of a variety of grades of ground maize. The most typical whole meal product (96-99 percent extraction rate) is variously called "posho" meal (Kenya), "mgaiwa" (Malawi), and "mugayiwa" (Zimbabwe). Hammer mill technology can also produce a degermed maize meal if the maize is first dehulled (either mechanically or hand-pounded). Some hammer millers in the region first dehull the maize grain mechanically and then process the cracked endosperm. Confusingly, in Zimbabwe, many hammer-millers who market a degermed maize-meal have begun to refer to it as "roller meal." Depending upon the extraction rate and mill capabilities, this "roller meal" produced by small-scale hammer millers with dehullers can be very similar to the "roller meal" produced by large-scale millers. This partially degermed product is also sometimes called "Number 1" in other countries.

Roller milling technology is generally larger-scale in nature, and is used by large, urban milling firms in Eastern and Southern Africa. Roller mill technology involves a continuous process of shattering the kernel and mechanically sifting out the separate bran, germ and endosperm components. The concentration of milled bran and germ in the milled endosperm determines the extraction rate of the maize meal. Maize meals with very low levels of bran and germ are variously called "super-refined" (Zimbabwe), "super-sifted" (Kenya, Tanzania, and South Africa), and "breakfast" meal (Zambia). For the purpose of clarity, the term "super-refined" meal will be used in this paper to designate any of these highly-refined meals. Products with slightly higher levels of bran and germ are referred to as "sifted" meal (Kenya, Tanzania, and South Africa), or "roller meal" (Zimbabwe). Again, in this report, the single term "refined" meal will be used to refer to this intermediate grade of maize meal that encompasses the categories of both "sifted" and "roller meal." If all of the bran and germ are re-mixed back with the milled endosperm, this product is often called "straight-run meal," and

is similar to the "mugaiwa" or "posho" whole meal produced from hammer mills. The major types of maize meal produced in Eastern and Southern Africa are presented in Table 2.

Until recently, roller-milled meal was the "traditional" form of maize meal in urban Zimbabwe, Kenya, and Zambia. Before independence, roller-meal was also a major

Table 2: Major Types of Maize Meal Produced in Eastern and Southern Africa

Type of Meal	Description	Extraction Rate	Produced by	Ratio of Observed Milling Margins/Custom-Milled Whole Meal Using Hammer Mill
Super-Sifted (South Africa, Kenya); super-refined (Zimbabwe); breakfast meal (Zambia); farinha matabicho (Mozambique)	The bran and germ are completely removed; meal ground from the starchy endosperm	60-70%	roller mills	3.0 to 5.0
Sifted (Kenya, South Africa, Tanzania); roller meal (Zimbabwe, Zambia); farinha sem farelo (Mozambique)	Much of the bran and germ are removed, meal ground mostly from the endosperm	80-85%	roller mills	2.5 to 4.5
Hammer-milled "roller meal" (Zimbabwe); Number 1 (Kenya)	Much of the bran and germ are removed, meal ground mostly from the endosperm	75-95%	hammer mills using dehulled maize before processing	1.5 to 3.0
Straight-run meal, mugayiwa (Zimbabwe), posho (Kenya), dona (Tanzania); farinha com farelo (Mozambique)	By hammer mill: The meal is processed from the whole maize kernel, with the bran, germ and endosperm retained.	96-99%	hammer mills	na
	By roller mill: The bran and germ are added back after the milling and sieving process.		roller mills	1.0 to 2.0

Source: Modified from Jayne and Chisvo (1992).

(probably the dominant) maize-meal product in Maputo. In rural areas where households grow their own dent-type maize, custom-milling is most common (i.e., households pay a fee for having their grain processed by a hammer mill). In Mozambique and parts of Malawi and Zambia, where flinty varieties are still in use, hand-pounding is commonly undertaken to separate the bran and germ from the endosperm, with the endosperm then subsequently hammer-milled into flour. For some households in urban Mozambique, hand-pounding methods continue to compete with industrially-produced meal.

3. HISTORICAL DETERMINANTS OF CURRENT MAIZE CONSUMPTION PATTERNS

Failure to take account of history, as Kuznets (1941) stressed, may lead to a misunderstanding of current economic problems by investigators who have not realized that their generalizations rested upon transient circumstances (Fogel 1994, p. 369).

It is commonly understood that strong preferences for refined white-maize have existed in Southern Africa since the Portuguese introduction of this crop to the continent. However, it is likely that the British starch market, European farm lobbying, and other temporally remote processes occurring in the early 20th century were the deciding factors in determining the color and milling attributes of current maize consumption patterns in Southern Africa. An accurate understanding of the historical processes shaping existing maize demand patterns in the region requires an understanding of how African maize consumption adapted to European maize production patterns, including seed varietal choice and processing technology. The main factors linking European production choices and African consumption, as shown below, were land alienation, wage employment on European farms, mines, and industrial concerns, rising urban populations after WWII, and the highly-controlled maize marketing systems designed to articulate the interests of European maize farmers.

The general conclusion of this section is that current consumption patterns (and levels of household insecurity) have been influenced by political decisions of prior decades. Most of these decisions were meant to achieve other goals, and were probably not deliberately designed to mold African consumption patterns. However, the organic evolution of the maize systems in the region provides an example of how current demands for particular food products can be only partially explained by the current relative prices and income levels. Allowing for a certain degree of habit formation and the formation of vested interests to sustain the status quo, it is apparent from the cases below that temporally remote processes may exert enduring effects on consumption patterns and food security.

3.1. Early Export Market Considerations

The Portuguese brought numerous types of maize to Southern Africa from the Americas. Anecdotal evidence suggests that, around 1900, maize of yellow, white, blue, and orange were commonly grown (Rusike 1995). Weinmann reports that in Zimbabwe⁶ "by 1906/7, a number of both white and yellow varieties of maize were grown" on commercial farms (p. 19). However, the fledgling maize sector was informed by the Secretary of the London Corn Exchange that Rhodesian maize exports required better grading and uniformity of variety (p. 20). As early as 1911, it became clear that "the British trade was expecting better prices for white than for yellow maize and that there was an increasing demand for white maize," apparently because North America, which grew predominantly yellow maize, had a decisive transportation cost advantage in supplying Britain.

Weinmann notes that as early as 1910, there was "uncertain local demand for yellow maize" among the African population in Zimbabwe (1972). However, African demand was a relatively small consideration in the European maize varietal choice. After subtracting the maize used for animal feed consumption, about half or more of the European maize production in Kenya, South Africa, and Zimbabwe was exported. Overseas demand requirements were considered more exacting and less malleable than those for the local market. Evidence from early records suggests that the preferences of overseas importers were a more important factor in

⁶ Prior to the transition to majority rule in 1966 and 1980, respectively, Zambia and Zimbabwe were known as Northern and Southern Rhodesia, respectively. However, for simplicity, the report refers to these areas by their current names.

driving maize varietal improvements than African consumer preferences were.⁷ Referring to maize production in the 1920s in Southern and Central Mozambique, Miracle quotes a British Foreign Office report: "... Cultivation has been stimulated in the last few years by the action of the Portuguese Government in commandeering the whole of export for European consumption, and by the satisfactory system of grading and testing instituted in Beira in 1914 by the maize expert of the Mozambique Company" (Miracle 1966).

The perceived need for standardization also favored the dominance of white maize in the colonies. It was found that yellow and white maize grown in close proximity could lead to hybridization, undesirable "mixed grains" and color tainting, which rendered this maize unsuitable for export. Varietal mixing also handicapped the efforts of progressive farmers, who tried to improve their yields and the resulting quality by using pure strains. Since the overseas market provided a premium for white maize, local legislation required that only white dent-maize be accepted for export to Great Britain. Emphasis was also given to the soft dent-type maize favored by the British starch market, as this was less injurious to the processors' equipment. The Rhodesian Maize Authority passed a resolution in 1923 stating that the introduction of yellow breeds of maize into the Territory will be "a vital danger to the maize growing industry," and urged all growers to abstain from planting yellow varieties. In 1925, the "Maize Act" was passed in Zimbabwe, remaining in effect until 1970. It enabled growers to petition the Government to restrict the growing of maize in their area to a specific variety and color.

The general emphasis on denty white-maize is in contrast to other areas of Southern Africa where colonial maize farming interests have been less pronounced, such as Malawi and Northern Mozambique. In these areas, European maize production was relatively unimportant compared to Zimbabwe, Southern and Central Mozambique, Kenya, Zambia, and South Africa. There was little organized European farmer interest in maize seed improvements and standardization for export markets (Smale and Heisey 1994), with Africans continuing to produce the bulk of these nations' maize. As a result, the traditional flinty varieties continued to predominate, being more appropriate to smallholders' existing hand-pounded processing and storage technology.

So far, this description only explains how maize production on European farms evolved, but implies very little about maize consumption patterns of Africans. This missing link is provided by a combination of factors: (a) land alienation; (b) extensive employment of African labor on European farms, mines, and industry, using maize as an in-kind payment; (c) rising urban African populations; and (d) controls on informal maize movement as part of the broader, controlled maize marketing systems that evolved since the early 1930s. We explore these factors in more detail below.

3.2. Land Alienation

The issue of African land expropriation by Europeans has received extensive treatment and will not be repeated here.⁸ Our main purpose here is to underscore the effect of extensive land alienation during the early colonial periods on Africans' dependence on the newly-established European food marketing and wage labor systems. The forced removal of Africans from the majority of high-potential farm lands, and their relocation to less-productive regions, in many cases eroded Africans' capacity to feed themselves (Iliffe 1990).⁹ This dependence

⁷ See, for example, Official Yearbook of the Colony of Southern Rhodesia, No 1., 1924, Salisbury, 1924.

⁸ For accounts in Zimbabwe, Kenya, South Africa and Zambia, see Rukuni 1990; Mosley 1983; Bundy 1979; and Jansen 1977.

⁹ Iliffe contends, however, that despite chronic undernutrition in many of Zimbabwe's reserves, the colonial farming system did succeed in mitigating the effects of famine.

was, and remains, most noticeable in the low-rainfall "communal lands" that remain generally unable to provide the food or income requirements to support the population in a self-sufficient manner, given existing technology. The Africans' inability to subsist on the communal lands thus generated the labor pool for European employment. Srivastava and Livingstone (1985) discussed a similar land alienation and dependency strategy existing in the southern provinces of Mozambique: "In the nexus of poverty reinforced by falling subsistence production, low wages in latifundios and forced labor, the socio-economic system encouraged migration as a way of life" (p. 261).

3.3. European Employment and African Maize Consumption

The widespread migration of African labor to work on European mines, farms, and industrial plants, starting around 1900, was of major importance in creating a demand for maize and in changing the traditional farming systems in Kenya, Mozambique, South Africa, Zambia, and Zimbabwe (Mosley 1983; Srivastava and Livingstone 1983; Bundy 1979; Jansen 1977; Shopo 1985).¹⁰ A variety of colonial government policies induced labor flows off the African "reserves" to engage in wage employment. For example, land appropriation and head taxes in Kenya, Zimbabwe, South Africa, and Zambia accelerated the shift to maize consumption by inducing African labor migration to European employment.¹¹ Food consumption patterns for the laborers in mines, commercial farms, and industry were greatly influenced by the rations that employers made available as in-kind payments to the laborers. Arrighi (1983) and Shopo (1985) contended that diets adapted in a self-generative process, as "people get used to what they consume" (Arrighi, p. 1983).

Shopo noted that millet and sorghum were the staple foods in Southern Africa before European farming became predominant (1985, p. 19). European producers favored maize, however, because (a) it required low capital costs and less technical skill than that required for cotton and tobacco, and was thus open to even low-resource and newly immigrated white farmers; and (b) maize apparently gave higher returns to land than the small grains, as well as requiring lower labor requirements relative to output (Weinmann 1972). By the 1920s, maize accounted for approximately 80 and 60 percent of the European cropped area in Zimbabwe and Zambia, respectively. The rise of European maize production created a source of in-kind payments for the rapidly increasing African labor force.

Maize made further inroads by the early 1900s with the advent of the hammer mill, which provided a labor-saving procedure on the existing hand-pounding technology for processing grain (Shopo 1985).¹² Hammer mills clearly favored processing maize over small grains, since maize simply could be dumped into the hopper for grinding, while millet and sorghum husks required dehulling first. Second, maize varieties generally have a shorter growing season than most millets and sorghums. Third, maize involves less labor time than sorghum and millet. When growing in the field, maize is protected from bird damage by its leafy covering, whereas the exposed sorghum and millet grains require substantial time for scaring away birds. With the rapid rise of off-farm wage employment, the need for crops with lower labor input meant that maize was preferred over small

¹⁰ Nairobi, Lusaka, and Harare (formerly Salisbury) did not exist before 1890. Nairobi was a railway workers' camp at the beginning of the 20th century.

¹¹ According to Cliffe (1979), over 60% of the adult males in parts of Zambia were working away from their villages by the early 1940s (cited in Howard 1994).

¹² The appropriate technology depends in part on the opportunity cost of women's labor, since grain processing has been viewed as a woman's task in most of Southern Africa. See Bagachwa for a detailed cost comparison of hand-pounding vs. hammer mill technology.

grains (Low 1986). Fifth, as noted by Guyer (1984) and Richards (1939), there were important, ritualized, gender-specific labor tasks associated with millet and sorghum production. Mens' social role of land clearing, planting, and fencing for small grains provided an increasing constraint on small grains cultivation in much of Southern Africa, due to the rise in male labor migration. There were apparently no such gender-specific labor requirements or rituals associated with maize cultivation, which was not as fully entrenched in the social fabric as the more traditional, small grains. Finally, and perhaps most importantly, was the Africans' increased dependence on the emerging European-structured food marketing system. When African households could not produce enough food, partially due to substantial labor migration off-farm, food purchases rose in importance. In Mozambique, for example, Portuguese retailers, or "cantineiros," constituted the main source for purchased food in rural areas. Since the European-designed food marketing system featured the distribution of maize meal to African areas (see below), African consumption patterns began to shift accordingly.

3.4. The Rise of Controlled Marketing Systems

The fundamental reason for the development of controlled, maize marketing systems in Zimbabwe, Kenya, Zambia, and South Africa was the former white governments' goal of ensuring the viability of European farmers (Mosley 1983; Bundy 1979; Jansen 1977; Keyter 1975). This required, to varying degrees, the suppression of African maize production and trade. The system of controls had a major side-effect on urban maize consumption patterns in the region, specifically the shift from hammer-milled whole meal to more expensive, refined roller-milled meal.

Until the 1930s, the most essential factor of production which the European economy required from the African, apart from labor, was food (Mosley 1987). The grafting of mines, plantations, and cattle enterprises onto the local economy expanded the demand for food in the country. Available estimates suggest that, at least into the 1920s, African farmers accounted for the majority of the food produced and marketed to the urban centers of Kenya, Zambia, and Zimbabwe. The nascent European maize industry was profitably exporting both overseas and locally until the 1930s, and there was no strongly perceived competition from African farmers.

As the number of Europeans engaged in farming rose over time, African farmers were increasingly perceived as being a threat. Substantial evidence from Kenya, Zambia, and Zimbabwe indicates that African maize surpluses were capable of being generated at prices below the production costs for most European farms, and that the organized European farm organizations successfully lobbied in the colonial legislatures for protection, on the grounds that they could not successfully compete without it.¹³ The depression of the early 1930s brought this problem to a head, since plummeting world grain prices suddenly robbed the European maize farming sector of its profitable export market, and brought the sector to the brink of disaster. The colonial governments responded with the Maize Control Acts of the 1930s in Zimbabwe and Zambia, and the Native Produce Ordinance in Kenya in 1935.

¹³ See, for example, Keyter (1975), Mosley (1975), and Jansen (1977). In Kenya, one 1934 source indicated that the cost of European maize production was 6.05 shillings per bag, compared with 2.43 shillings for the African crop (Legislative Council Debates 1934). According to the Secretary of Agriculture of Rhodesia in 1934, without protection, "the extinction of the European farmer through native competition must be merely a question of time" (National Archives of Zimbabwe: S1542/M2, Darwin to CNC, July 1934).

Perhaps not surprisingly, the protection of the European maize producers was initially strongly opposed by white consumer interest groups in both Kenya and Zimbabwe, primarily animal feeders and plantation farmers, on the grounds that this would substantially raise the cost of maize.

These Acts shared several common features: (1) the creation of state crop-buying stations in European farming areas without parallel investments in African farming areas; (2) higher prices for European farmers than for Africans, by levying a "rake-off" tax on the latter, or by a two-tiered pricing scheme; and (3) establishing restrictions on grain movement from African areas to towns, mines and other demand centers where African production could otherwise undercut European-produced goods.¹⁴

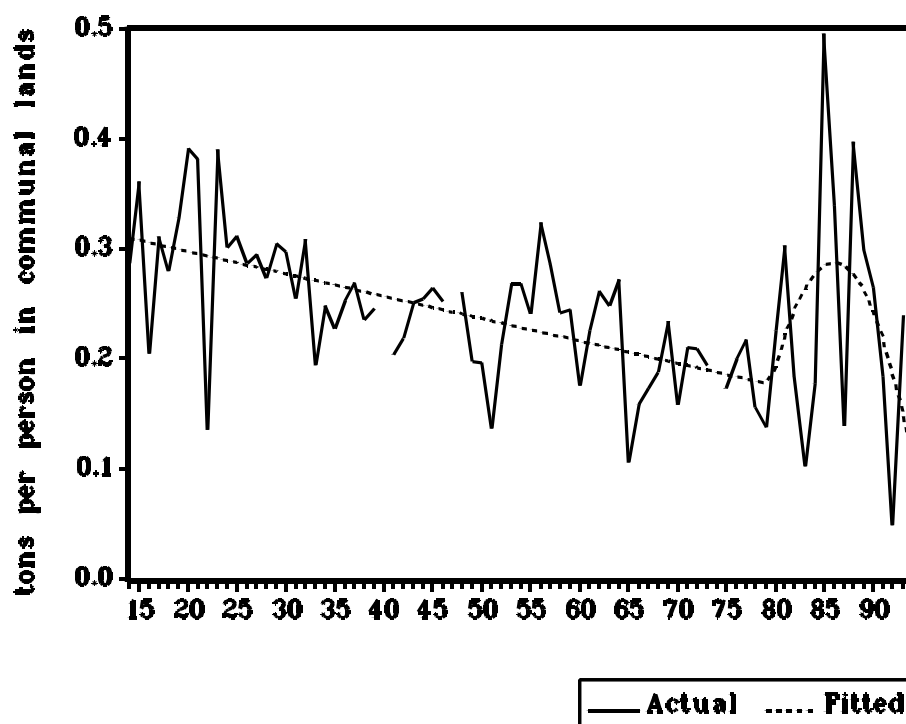
Other colonial regulations, not related specifically to maize, were also passed to reinforce the Europeans' dominance of the market. These included the continued forced removal of Africans from the majority of the country's high-potential farming lands and their relocation to less-productive "reserves" with poor infrastructure and market access, as well as various taxes levied on African households to increase the incentive to move off their farms and work as wage laborers. The combination of maize legislation, land evictions, and fiscal policies eroded the Africans' dominance over food marketing and simultaneously contributed to the growth of European agriculture in Kenya, Zambia, and Zimbabwe after 1935 (Figure 1). African smallholders were not allowed to sell directly to the Grain Marketing Board in Zimbabwe until 1960, and even then they received lower prices than the European farmers did, due to a levy applied to sales by Africans (Rukuni 1990).

3.5. Shifts in Urban Maize Consumption Patterns: A Manifestation of Consumer Sovereignty or Political Choice?

The controlled market structure that evolved from the colonial policies designed to protect European farmers affected more than just farm production. Tight controls on maize distribution into urban areas made urban consumers dependent on the state marketing system for their staple food needs. These marketing systems were not neutral with respect to consumer incentives. While individuals chose among the options available to them, subject to their budget constraints, the range and cost of options available were greatly shaped by policy. While some portion of the population apparently did prefer the attributes of refined, white meal — other factors remaining equal — this section indicates that the evolution of consumption patterns more likely represents a suppression of consumer choices through a politically-manipulated marketing system. The critical aspects of the systems in this regard were: (1) uniform spatial pricing and subsidies to fulfill important government objectives;

¹⁴ Occasionally, when exogenous shocks constricted food supplies relative to national requirements, the state temporarily took steps to stimulate African food production (such as the Master Farm Program), but this program was periodically discontinued when food supply gluts reduced farm prices, and colonial officials had to "declare publicly that they never intended to 'teach the natives to grow maize in competition with European producers'" (Phimister, p. 235, quoted in Binswanger and Deininger, p. 5).

Figure 1: Per Capita Grain Production in African Communal Lands, Zimbabwe 1914-1994.



Source: Data from the Annual Reports of the Chief Native Commissioner, presented in

Mosley 1983.

(2) controls on the private movement of maize grain and meal; and (3) the suppression of urban hammer millers through zoning laws or regulations restricting access to maize grain.

3.5.1. Consumer Response to Maize Pricing and Marketing Policies

Throughout Eastern and Southern Africa, the rise of centralized, state maize marketing boards also engendered the development of centralized, concentrated maize milling industries. The urban African population was increasing rapidly, due to the post-World War II industrial development. In the mid-1950s in Kenya, Zimbabwe, and Zambia, starting in the mid-1950s and solidified by the 1960s, state maize marketing boards and large-scale, roller milling firms became either vertically integrated in a single agency, or the state marketing boards served as *de facto* procurement agents for several licensed, private, large-scale milling firms.¹⁵ Some large mills even had conveyor belts directly linking them into the marketing boards' silos.

Uniform, spatial maize pricing was adopted by the maize boards in Kenya, Zimbabwe, Zambia, and South Africa. Uniform spatial pricing gave milling firms' incentives to concentrate their plants in areas of high-density demand. The rise of a concentrated, centralized milling industry also suited the colonial governments,

¹⁵ Examples of the former may be found in Tanzania, Malawi, Kenya, and Zambia; examples of the latter, in Zimbabwe, Kenya, and South Africa.

because this reduced the per-unit transaction costs (compared to selling small amounts to numerous small buyers) and, more importantly, facilitated the implementation and monitoring of price controls on maize meal. Therefore, the rise of a few, large-scale maize processors, linking downstream processing and retailing activities into the official marketing system, created a convenient and easily-managed system for supplying the growing urban population with staple food at prices easily controlled by the state.¹⁶

However, roller-mill technology involves larger unit-milling costs than hammer-mill technology (Stewart 1977; Mulinge 1992; Bagachwa 1992; Rubey 1994). While there were movement controls on grain during the period of initial investments in roller-mill technology, there were no formal controls on the movement of maize meal. The large roller mills were therefore potentially vulnerable to cheaper whole meal transported into food-deficit areas from maize surplus districts. Whether it was for this or other reasons, controls were imposed on the inter-district movement of maize meal sometime between 1953 and 1966 in Kenya, and in 1966 in Zimbabwe.¹⁷

To further depress potential competition from the informal marketing system, the colonial governments typically subsidized the marketing board and milling margins for grain marketed through the official system. A "cheap food policy" was also favored by most local industrial sectors because a cheap wage good relieved upward pressure on wages. However, the cheap food policy only pertained to food that was distributed through the official marketing system; preferential subsidies narrowed the margin within which non-registered (i.e., small-scale, informal) traders and millers could operate, effectively suppressing their development. In Zambia, over the period of 1967 to 1985, consumer subsidies averaged 70 percent of the retail price of refined and super-refined meal (Kean and Wood 1992). In some cases, hammer mill operations in urban areas were banned by regulation. Within this policy environment, the subsequent pattern of urban, maize-milling investments was largely predetermined.

There was a somewhat similar pattern in Mozambique. During the 1960s and early 1970s, the Cereals Institute (the government grain marketing board) sold over 80 percent of its annual maize acquisitions to relatively large maize mills in Maputo (Instituto Dos Cereais de Moçambique 1973), who in turn manufactured roller-meal for sale in Maputo, and other urban and rural areas of Southern Mozambique. At the end of the 1960s in Maputo, official industrial statistics listed only three hammer mills in this district (Mozambique 1970). When the Frelimo Government began receiving large quantities of white and yellow maize food aid in the late 1970s and early 1980s, they tried to channel the majority of imported supplies through the then-nationalized, roller-meal factory Maputo/Matola for urban consumers in Maputo. The belief was clearly that Maputo's urban consumers preferred roller-meal.

In the early 1990s, there were five large-scale commercial millers operating in Zimbabwe. The largest, National Foods, handled about 65 percent of the market. In Kenya, there are about 20 registered roller millers, but controls on inter-district movement create regional oligopolies. The largest firm in each district controls from 30 to 70 percent of the local market share for refined meal. Official data for Zambia and Mozambique are unavailable. Unofficial estimates for Mozambique indicate that there are currently only three industrial maize mills in the country.

¹⁶ This system imposed high prices on urban maize meal consumers, who, along with African farmers, cross-subsidized commercial farmers for the state-supported price they received.

¹⁷ i.e., these controls went into effect in Kenya between the writing of the Ibbotsen Report (1952), stating that controls on maize will end with the ex mill sale of hammer-milled meal, and the Report of the Maize Commission of Inquiry (1966), by which time maize-meal trade was controlled. In Zimbabwe, the 1966 Grain Marketing Act prohibited individuals from transporting more than one 90 kg bag of meal at a time.

The regulated, official pricing system usually provided the commercial millers with incentives to sell the most refined type of meal. The pricing structure imposed on commercial millers often provided substantially higher gross margins per-ton of super-refined meal produced than for that of refined meal. The gross margin was especially high when compared with whole meal. In Zimbabwe, the commercial millers stopped producing whole meal in convenient bag sizes in 1979, citing a lack of demand. With the suppression of the informal marketing system, milling margins for refined meal rose three to six times those levels observed for custom-milled, whole meal produced by hammer mills.

However, in addition to a policy environment favoring large-scale, roller-milling firms, we do not wish to underemphasize the taste and cooking attributes of refined meal that at least some percentage of the urban population found preferable over whole meal. The removal of the germ and pericarp makes refined meal look whiter, last longer, and taste sweeter than whole meal.¹⁸ The preference for refined meal over whole meal — price being equal — has also been confirmed by recent household surveys in Zimbabwe, Zambia, Mozambique, and South Africa. However, consumers make choices subject to a budget constraint. Consumers' behavior under historical price conditions does not necessarily reflect preferred choices under a less regulated marketing environment that would accurately reflect differences in the cost of production between various consumer products. For several decades, the ability of urban consumers to make this choice has been impeded, to varying extents, in Kenya, Mozambique, Zimbabwe, South Africa, and Zambia, been impeded by government policies.

Within a span of three decades (1955 to 1985), consumption of maize meal in urban Mozambique (mostly Maputo), Zambia, Zimbabwe, Kenya, and South Africa switched almost entirely from whole maize to refined meal. Many policy makers perceived this shift as an articulation of consumer preferences for refined meal. As consumption patterns quickly shifted, the general public began to view urban consumption of refined meal as a phenomenon of urbanization, modernity, and technological progress, rather than as a response to a complex and poorly understood set of policies.

The hypothesis that roller milling firms were able to shape consumer preferences through advertising is supported by statements of large-scale millers themselves. Stewart (1977) quoted the general managers of two major, refined maize-meal manufacturers: "The refined maize meal was something my Company pioneered in this country, and it has created a market for itself" (p. 213), and "...we have considerable advertising and pains and personal contacts and what-not to pick up a good market" (p. 213).¹⁹ These and related statements support Stewart's observation of "the inherent contradiction between taking consumers' preferences as the ultimate guide to production decisions and welfare, and spending money on determining these tastes" (p. 213).

3.5.2. A Conceptual Model of Interactions Between Government Policy and Consumer Behavior

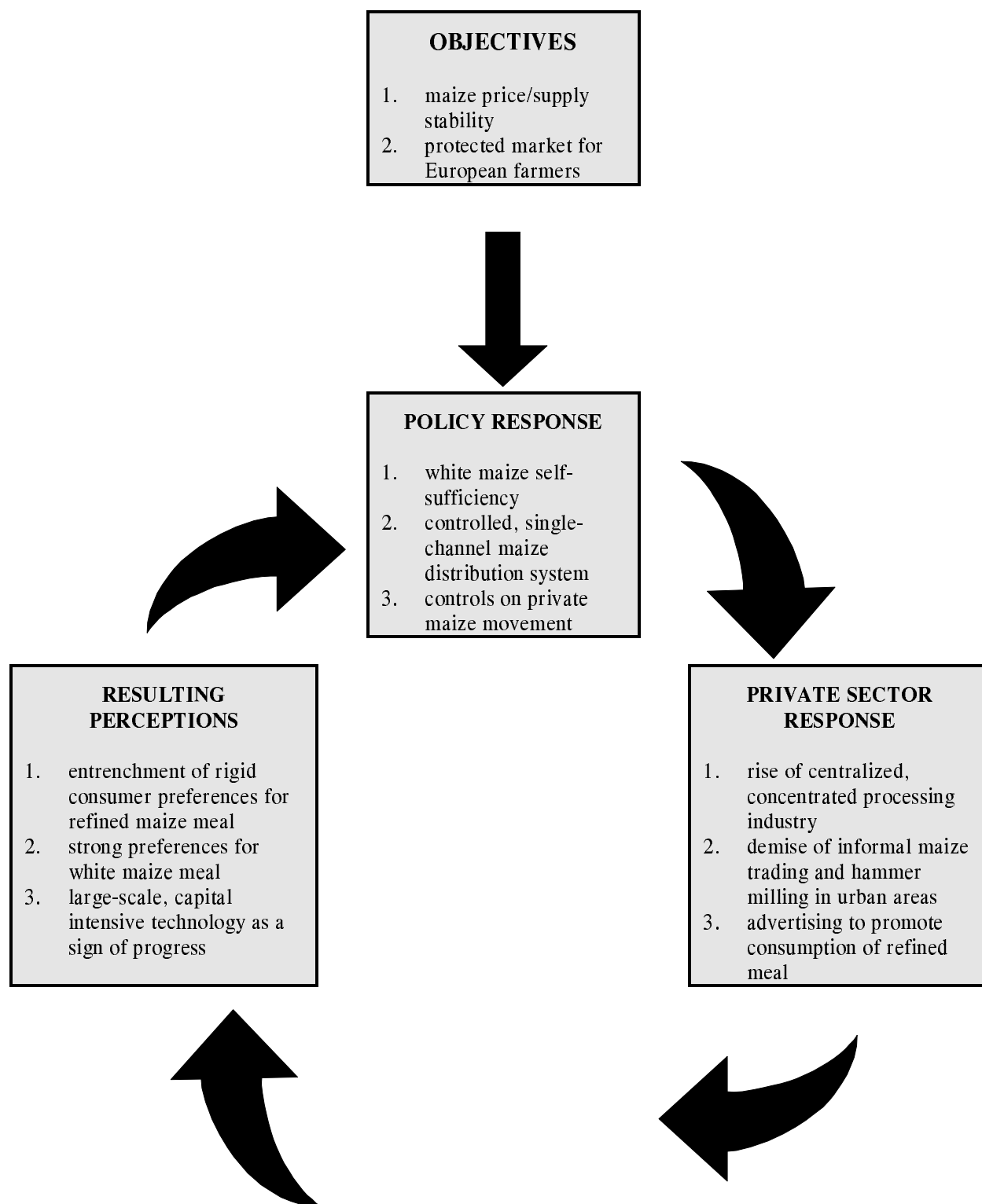
¹⁸ Some analysts have also contended that households may be averse to posho meal because of its shorter shelf life (posho meal contains oil from the maize germ). While this may be a problem in the humid lowland areas of Africa, it does not appear to be a problem in the drier highlands characterizing much of Eastern and Southern Africa. According to the Nairobi respondents who consumed it, posho meal has an average shelf life of 3.7 weeks. For a family of three adult-equivalents in terms of consumption, and a rate of maize-meal consumption of 1.68 kgs per-adult-equivalent per-week, as determined by the survey results, a 10-kg bag of posho would be consumed in two weeks. The shelf-life problem is probably more relevant to potential commercial manufacturers of whole meal, who would have to be concerned about timely distribution to retail outlets after milling in order to avoid spoilage.

¹⁹ Stewart cited evidence from one inquiry in Kenya indicating that advertising expenses account for as much as one-third of the roller mill production costs.

The above section suggests that the historical evolution of refined-meal consumption in Eastern and Southern Africa may be better accounted for by a model that treats consumer choices as an outgrowth of political choices. The policy-driven aspects of this model are presented schematically in Figure 2.

Figure 2 highlights the interactions between government objectives, political decisions that have structured market behavior and determined the nature of investment in the maize

Figure 2: Interactions Between Maize Sectoral Policies and Evolution of Maize Meal Consumption Patterns in Urban Kenya, Zimbabwe, Zambia, and South Africa, 1955-1980



CONSUMER RESPONSE

1. buyers shift from hammer-milled whole meal to refined meal
2. habit formation

system, consumption patterns, and the resulting political support for the maintenance of the newly-evolved market structure. The visible manifestation of this process was a rapid shift to refined, relatively expensive, maize meal. To some extent, it appears that this consumption shift signalled to policy makers the rising political importance of refined maize-meal and the need to closely control its price, thereby reinforcing the perceived need to maintain the controlled marketing system.

The model can be used as a partial explanation for the slow and sporadic pace of maize market reform over the past decade in Zimbabwe, Mozambique, Kenya, Zambia, and South Africa. If the conventional view of strong, inherent preferences for refined maize-meal is to be accepted, then food market reforms emphasizing a greater role for informal marketing (including hammer mills), and an elimination of subsidies on refined meal, would impose substantial hardship on the urban poor and would be politically dangerous. Informal hammer millers' ability to produce whole meal for the same price as highly-subsidized refined meal would appear largely irrelevant, due to the conviction that urban consumers would not accept hammer-milled whole meal. This perception may have narrowed policy makers' view of the feasible set of food market reform options, especially those involving removal of subsidies on refined meal, and the promotion of competitive small-scale maize trading and milling networks in urban areas.

For example, in 1986, the Zambian government, facing a maize subsidy-induced budgetary crisis, decided to remove subsidies on super-refined meal, while keeping subsidies for the relatively inferior, refined meal (Pearce 1991). It was assumed that most high-income consumers, being less price-sensitive, would continue to buy super-refined meal, while lower-income households would buy refined meal. Thus, this strategy was thought to serve the twin objectives of reducing government spending while continuing to provide poor urban consumers with cheap food. The strategy failed, however, as assumptions about maize-meal supply and demand patterns proved incorrect. Demand for refined meal rose more sharply than expected, as consumers tried to avoid increased super-refined meal prices, with a consequent rapid depletion of refined meal supplies.²⁰ As a result, consumers (including low-income) were forced to purchase super-refined meal, which was not only more costly in the first place, but was at an even higher price because of the subsidy removal. This situation led to urban riots and ultimately to the resumption of super-refined meal subsidies. When faced with similar budgetary crises during structural adjustment in the early 1990s, policy makers in Zimbabwe and Kenya frequently referred to the "lessons of the Zambia situation" as a reason to exercise extreme caution in removing subsidies on refined meal.

²⁰ There were also allegations, however, that the mills reduced their production of roller meal during this period.

Hammer-milled whole meal is the primary staple food in the grain self-sufficient rural areas of Kenya, Zambia, and Zimbabwe.²¹ The distinct difference in urban and rural maize consumption patterns over the past three decades is puzzling in light of the fluid relationship between these two groups. Of the 828,000 people enumerated in Nairobi's 1979 census, only 26 percent were born within the city precincts, and only 5 percent of the African population over the age of 15 was born within the city precincts. A similar situation exists for Harare and Chitungwiza, the two largest cities in Zimbabwe (CSO 1985). It is also well-established that some portion of the population moves seasonally between rural and urban areas in response to part-time seasonal job opportunities and crop cultivation schedules. These figures attest to the continued importance of rural-urban migration, and the relatively short time spent in urban areas by much of the urban population. Despite a well-developed distribution system for refined meal in most countries of Southern Africa, rural demand for refined meal has been significant only in the less-productive areas where grain production was insufficient to meet the local requirements (Jayne and Chisvo 1991; Hedden-Dunkhorst 1990). One may therefore question how consumer choices in urban areas could differ substantially from those of their rural counterparts. The fact that the swelling cities of Eastern and Southern Africa are filled with so many recent immigrants from the countryside is one of the most serious problems with the assumption that there is little willingness to substitute whole meal for refined meal based upon relative prices. Such an assumption is especially tenuous, since consumption of refined meal is negligible in rural diets, except in areas where local grain shortages require inflows of meal.

With the pressure for state deficit reduction associated with structural adjustment in the late 1980s and early 1990s, the elimination of costly food subsidies became the focus of major attention. However, serious concerns were voiced within the governments of Kenya, Zimbabwe, Zambia, Tanzania, and Malawi over the social consequences of food subsidy elimination. Many politicians remembered the 1986 riots in Zambia after the elimination of food subsidies. Assurances by some advocates of food market reform that private trade would fill the void left by the state's retreat from the market was generally unconvincing to politicians and policy makers in the region because (a) there was disagreement between the "experts" as to how fast the private sector could develop viable, low-cost food trading channels in a less regulated trading environment (this view emphasized the numerous non-policy related barriers to private investment and competitive, private trading systems), and (b) most people in Southern Africa have never witnessed a deregulated, private food-trading system in their lifetimes, the history of controls dating back to the 1930s in Zimbabwe, Kenya, and Zambia.

3.6. Research and Policy Issues Arising from Historical Analysis

This historical review suggests that the dramatic shift from whole to refined maize-meal consumption from 1950 to 1990 in the urban areas of Eastern and Southern Africa may be largely policy-driven, rather than a reflection of some underlying notion of "consumer sovereignty." This hypothesis can be examined empirically by assessing the latent demand for whole meal by urban consumers, and the potential shifts in urban maize consumption patterns resulting from the maize market reforms in Zimbabwe, Kenya, and Zambia that eliminated key controls on informal grain marketing and hammer milling in urban areas.

²¹ In rural grain-deficit areas of Zimbabwe and Kenya, by contrast, the historic restrictions on inter-district grain trade have blocked the informal movement of maize grain into these areas. Due to these restrictions, a circuitous flow of grain has evolved in which marketed surpluses flow out of rural areas through the official marketing channel to be processed by large-scale urban millers, and then flow back into grain-deficit rural areas in the form of expensive, refined maize-meal. Reliance on refined, roller meal to satisfy residual consumption requirements in grain-deficit rural areas is in spite of evidence stating that most rural households would have preferred whole meal (Jayne and Chisvo 1991). This transportation-intensive system has effectively reduced incomes among low-income rural consumers in Zimbabwe by as much as 30 percent (Jayne and Chisvo 1991). Wilcock et al. (1990) noted a similar policy-induced flow of meal into the grain-deficit rural areas of Kenya.

Specifically, we present two alternative premises for empirical examination:

1. The removal of selected food marketing controls (i.e., the elimination of refined meal subsidies and controls on the private grain movement) would not raise the demand for hammer-milled whole meal in the urban areas of Eastern and Southern Africa, due to strong urban preferences for refined meal that have dominated urban consumption over the past three decades; or
2. The removal of selected food marketing controls would significantly raise the demand for whole meal in urban areas.

The implication of the first premise is that the elimination of food market controls and subsidies would adversely affect urban food security, particularly for low-income groups. The availability of cheaper whole meal would not appreciably cushion the impact of higher refined meal prices because of limited substitutability between the two meals. On the other hand, if the second premise is true, food market reforms may not result in higher food prices for the urban poor (and may even result in lower prices), even if food subsidies conferred through the official marketing system were eliminated.²²

The remainder of the report describes the research surveys designed and implemented in the early 1990s to examine these issues, and to provide both *ex ante* and *ex post* estimates of the effects of food subsidy elimination and decontrol of maize movement on household food security, especially among low-income consumers.

²² Though this section has not reviewed the historical development of the preference for white over yellow grain in the region, we will present evidence from Mozambique showing how consumer choice has been affected over the past eight years by the sustained presence of yellow grain (and whole meal) in the liberalized markets.

4. METHODS AND DATA

The methods employed in the country-level analyses were designed to both uncover the determinants of existing maize consumption patterns and to test for latent, unarticulated demand for grain products whose accessibility to consumers is impeded by policy barriers. The general approach of the surveys in Zimbabwe, Kenya, Zambia, and Mozambique was to elicit from survey respondents a combination of revealed and stated preference information, described below. This approach is relevant to situations commonly found in developing countries, where panel data on observed consumption behavior is limited, but where information on expected behavioral responses is necessary in order to meaningfully inform future policy options.

4.1. Revealed and Stated Preference Data

As is frequently the case in developing countries, little secondary data on consumer behavior was available to evaluate the effects of food market reform. Household surveys were the only means to generate this information. Where sufficient time and resources were available, follow-up surveys were implemented to document changes in consumer behavior over time. Yet in an effort to inform policy decisions in a timely way during periods of intense debate regarding the effects of market reform on household food security, it was not feasible to wait until after the reform had been implemented to measure and document consumption shifts, *ex post*. But without data on the changes in consumption in response to price variations between the relevant products, it is not possible to estimate, *ex ante*, the effects of market reform on shifts in consumption between refined and whole meal, and the resulting implications for food security. Without price variation, identification of price coefficients in demand functions is not possible. Yet expected consumer responses to future, policy-induced changes in prices are often critical to guide the policy process.

To overcome this problem, survey respondents were asked to state which maize meal they would purchase under various hypothetical price scenarios. Data from this type of survey question is known as stated preference (SP) data. In contrast, survey respondents' statements about actual market purchases are revealed preference (RP) data. By combining these two data types, we can uncover the effects of prices on product choice. In analogous situations, revealed and stated preference data have been combined in environmental economics (Adamowicz, Louviere, and Williams 1993), transportation economics (Ben-Akiva and Morikawa 1990; Hensher and Bradley 1993), and marketing (Swait and Louviere 1993).

Prior to the stated preference question, respondents were asked about the quantity of maize meal or grain they consumed during a specific time period, generally a week. They were also asked to break this quantity down into whole meal and refined meal, and white and yellow maize in situations where this option existed. Then, consumers were presented with different sets of hypothetical prices reflecting plausible price scenarios following the elimination of subsidies on refined meal. For each price scenario, consumers were asked how they would reallocate their total weekly consumption across refined and whole meal. Both products were generally familiar to respondents, although the availability of whole meal in urban areas had been constrained due to regulations. There was some variation in the questionnaire structure across the four countries.²³ Details as to survey methods and samplings are presented in Rubey 1995; Mulinge and Jayne 1994; Tschirley and Santos 1995; and Diskin and Sipula 1994.

²³ For example, in the Kenya and Zambia survey, respondents were not asked to re-adjust their total quantity of flour in response to price changes. Pre-test results indicated that many respondents found this difficult and confusing. Thus, it was felt that survey results would be more reliable if the total quantity consumed was held constant. This was not deemed to be a major problem, since the available information on Kenya and other East African countries indicates very low own-price elasticities of demand for maize as an aggregate (Pinckney; Gerrard).

4.2. Testing for Differences in the SP and RP Data

A potential criticism of SP questions is that people may not respond to them in the same way that they react to market choices. There is extensive literature on the potential biases of SP techniques, particularly in the area of resource economics. Much of this concern pertains to valuing non-market or non-use goods with which respondents have very little familiarity.²⁴ In such cases, questions arise as to whether respondents have a clear, uniform perception of the product in question. The use of stated preference techniques for marketed goods that are familiar to respondents is not prone to the same critiques applied to non-marketed goods. The former category clearly characterizes urban consumers' knowledge of the various types of maize grains and meals in Eastern and Southern Africa. All of the households in the Kenya, Mozambique, Zambia, and Zimbabwe sample regularly purchased maize meal or grain, and all stated that they were familiar with both refined and hammer-milled, whole maize-meal.

There are other potential biases associated with stated preference techniques, e.g., payment vehicle and strategic response bias, etc. A discussion of stated preference techniques and their applicability in eliciting maize-meal preferences is presented in Rubey (1995).

Evidence in support of the reliability of SP methods has been demonstrated in numerous applications. In a comparison of stated demand for strawberries with the respondents' actual choices, Dickie, Fisher, and Gerking did not find any statistical difference between the parameters of demand functions estimated with the two kinds of data. Other authors have found evidence of different parameters in discrete choice models estimated using the two kinds of data. However, when the variance in the two types of data were allowed to differ, differences in the estimated parameters were no longer significant (Adamowicz, Louviere, and Williams 1993; Ben-Akiva and Morikawa 1990; Hensher and Bradley 1993; and Swait and Louviere 1993).²⁵ Finally, as will be shown below, stated preference estimates of the market share for whole and refined meal under market reform in Zimbabwe gave fairly close estimates of the actual market shares as estimated by subsequent post-reform surveys (Rubey and Lupi 1995).

4.3. Country-Level Surveys

This report discusses findings from six surveys.

4.3.1. Zimbabwe

Survey Z1: A rapid appraisal, non-random samples from 587 households in Harare, during April 1991 (Jayne et al. 1991). The aggregate results from this survey cannot be considered representative of aggregate consumption patterns in Harare, as the households were not appropriately weighted. The rapid-appraisal survey was intended to provide an order of magnitude estimate of the differences in household maize-meal demand patterns across income groups in both existing and hypothetical scenarios.

²⁴ Well-known questions that fall into this category include asking respondents how much money they would be willing to pay to avoid future oil spills in Alaska, or how much they would pay to have clean rivers in a part of the world that they never expect to visit.

²⁵ In the Kenya study, differences in the parameters based on responses from SP and RP questions were explicitly tested (see Jayne, Lupi, and Mulinge 1995). The authors found no evidence of any differences in the estimated parameters across the SP and RP data. In all cases, the tests were evaluated at the 10 percent level of significance, which is a weak criteria favoring the hypothesis that there were differences in the data.

Survey Z2: A random sample of 512 households in Harare and Bulawayo taken during June and July 1993 (Rubey 1993). This survey sample was drawn from three urban centers representing 75 percent of the Zimbabwean urban population and 20 percent of the total population. The 512 urban survey households were randomly selected from 1992 census data from the Central Statistical Office. Interviews on maize consumption patterns and socioeconomic characteristics were carried out with the "primary food purchaser" from each household.

Survey Z3: A random sample of 430 households in Harare, gathered during February 1994 (Chisvo and Jayne 1995). Surveys Z2 and Z3 are comparable, having been drawn from the same master sample of households in the Central Statistics Office Sampling Frame. Interviews on maize consumption patterns and socioeconomic characteristics were carried out with the "primary food purchaser" from each household.

Survey Z1 was implemented before any major deregulation of maize trade and processing had been undertaken. Controls on informal maize movement into urban areas were still in force, the Grain Marketing Board was the sole seller of maize in the urban areas, and four large-scale milling firms had preferential access to the GMB's maize stocks. Informal hammer millers were relegated to custom-milling the limited amounts of grain grown by households on urban plots.²⁶ In addition, the maize meal manufactured by the large-scale millers was subsidized by Z\$42 (Zimbabwe dollars) per-ton of grain purchased between April 1991 and March 1992; by Z\$352 per-ton between February 1992 and June 1992; and by Z\$562 per-ton from June 1992 to June 1993. This amounted to 7, 47, and 49 percent, respectively, of the total retail price for refined meal during these periods.

Survey Z2 was implemented immediately after the refined meal subsidy was eliminated in June 1993, but while controls were still officially in force on informal maize movement into the urban areas. However, in practice, the Grain Marketing Board appeared to allow or ignore informal grain movement into the urban areas. Survey Z2 was also implemented at a time when substantial, imported yellow maize was still being distributed through the official marketing channels, due to the domestic white-maize shortfall after the 1992 drought. Most of the maize meal sold by the large-scale millers at this time was yellow, refined meal. Finally, Survey Z2 was implemented directly after the 1993 harvest, when white maize-grain from urban plots and surrounding peri-urban areas were relatively plentiful.

In August 1993, the Government of Zimbabwe abolished all controls on informal maize movement into urban areas. The 1993/94 marketing year was the first time in decades that urban households that did not grow maize could purchase grain with relative ease and custom-mill it at local hammer mills. Large-scale, urban millers were still obliged to purchase grain from the GMB, however. Survey Z3 was implemented six months after the official abolition of restrictions on urban maize movement, and ten months after the 1993 harvest.

4.3.2. Kenya

A random sample of 344 households was surveyed in Nairobi, in October 1993 (Mulinge and Jayne 1994). The sample was derived from the Central Bureau of Statistics Income and Expenditure sampling framework, which is designed to be representative with respect to population and average household income for each of Nairobi's 30 estate areas (see CBS 1989 for details).

The Nairobi survey was implemented after official restrictions on informal maize movement were reimposed in February 1993, following a series of partial, halting liberalization efforts. Informal traders were not allowed to transport more than eight 90-kg bags of maize across district boundaries. Maize prices in many deficit areas,

²⁶ In 1991, Harare's urban plot production was estimated at 5,000 to 10,000 tons, compared to about 150,000 tons of maize purchased by the large-scale mills for milling and distribution in Harare (Jayne et al. 1991).

including Nairobi, experienced a sharp increase in response to the reimposition of controls (Soroko 1993). Thus, the price of maize in informal markets was artificially inflated relative to the selling price of the National Cereals Produce Board (NCPB), the state marketing board from which the registered large-scale millers procured the bulk of their maize. At this time (October 1993), the mandate forcing large-scale milling firms to purchase 80 percent of their maize from the NCPB was not a binding constraint, because the NCPB selling price for maize was lower than in most wholesale markets of the country, including Nairobi. It can be concluded, therefore, that the survey was implemented during a time when large-scale millers had a maize procurement-cost advantage relative to hammer millers or individuals seeking to custom-mill maize into whole meal.

4.3.3. *Zambia*

Data was collected from a non-random sample of 134 households in Lusaka during January 1994 (Diskin and Sipula 1994). The sample was drawn from six different neighborhoods representing three income levels, identified according to the quality of the housing. Neighborhoods were not chosen randomly, but, rather, were deliberately chosen such that two neighborhoods were surveyed from each of the income areas, so that the neighborhoods covered a wide range of the city. The aggregate results from this survey should not be considered representative of the aggregate consumption patterns in Lusaka, as the households were not appropriately weighted. Rather, the rapid-appraisal survey was intended to provide an order of magnitude estimate of the differences in household maize-meal demand patterns across income groups in both existing and hypothetical scenarios.

The Zambia survey was implemented in January 1994, almost three years after the government legalized private maize trade, but less than one year after the subsidy on parastatal-manufactured maize meal was abolished.

4.3.4. *Mozambique*

A random sample survey of 400 households in eight *bairros* (neighborhoods) of Maputo was implemented during April and May 1994. Bairros were purposively selected to be representative of the relatively low-income areas of urban Maputo and its peripheries. Within each bairro a self-weighting sample of *quarteirões*²⁷ was selected, followed by a self-weighting sample of households within each quarteirão. The resulting sample was statistically valid for the group of eight bairros, and these bairros were believed to be representative of the low-income areas that dominate the city of Maputo.

By the time of this survey, urban consumers had been exposed to a wide variety of maize products at market prices for at least five years. Mozambique began to liberalize its economy in earnest in 1987, with the adoption of the Economic Rehabilitation Program (ERP). The Government of Mozambique initially maintained its commitment to centralized food distribution in major cities. The *Novo Sistema de Abastecimento* (NSA) was created in Maputo in 1981 and in Beira in 1986. Officially, all monetized maize food aid was channelled to large millers who produced a refined, yellow maize-meal for sale at controlled prices in the NSA. This system initially provided a subsistence ration of staples to a large proportion of urban and peri-urban residents. With the increased immigration of rural residents to the cities in the early 1980s, the capacity of the system began to be strained, and by the early 1990s it had virtually collapsed. The progressive decline of the NSA coincided with the vigorous growth of informal food marketing activities. By 1989, informed observers estimated that no less than 25 percent, and as much as 80 percent of the maize meant for distribution in Maputo through the NSA was, in fact, being sold in informal markets (USAID/Maputo 1990).

²⁷ A *quarteirão* is an administrative division below the level of *bairro*; one *bairro* contains several *quarteirões*.

The emergence of the informal food marketing system brought with it important changes in the types of food available to urban consumers, changes that began in neighboring countries several years later. Previously, the NSA had sold a refined, maize meal produced by large millers in Maputo and Beira. As in other countries of the region, production costs were relatively high; to make this product accessible to poor consumers, its sale price was subsidized in the NSA. Market liberalization spurred the growth of the small-scale, maize milling industry²⁸ that was based on hammer mill technology, and which produced whole meal at much lower production cost than the large millers.

²⁸ As of early 1994, 93 percent of all hammer mills in operation in Maputo (Beira) had been purchased in 1987 or later, i.e., since the inception of the ERP (Santos and Tschirley 1993).

5. HOUSEHOLD SURVEY FINDINGS FROM FOUR COUNTRIES

This section presents the results of household survey data from Kenya, Zambia, Mozambique, and Zimbabwe, and secondary information on milling margins and maize-meal prices. The section is divided into four sections, examining (1) observed differences in whole and refined-meal prices, and milling margins; (2) differences in whole- and refined-meal consumption by household income; (3) the impact of refined-meal subsidy elimination on household food security; and (4) the potential to promote vulnerable households' access to food by increasing the availability of yellow maize in the market place.

5.1. Maize Milling Margins and Maize Meal Prices: Whole Meal vs. Refined Meal

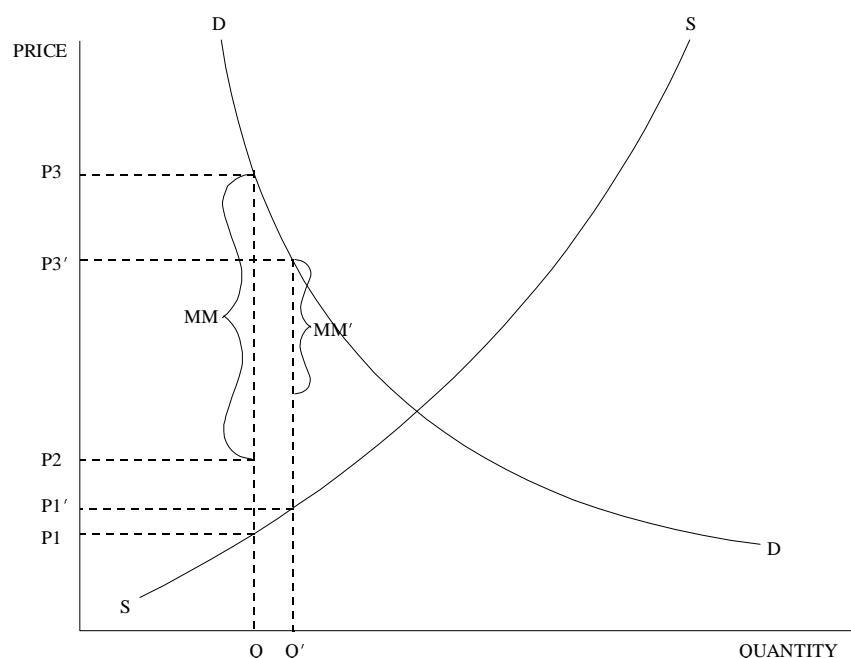
There have been two major benefits of food market liberalization on urban food security in Zimbabwe, Kenya, and Zambia: (1) The ability to procure staple maize meal more cheaply than the price of refined meal, after subsidies on the latter had been eliminated; and (2) Increased competition from hammer millers has apparently resulted in lower milling margins for the large-scale, refined-meal manufacturers. At the same time, lower milling margins have put upward pressure on maize producer prices, benefiting surplus farmers. These points are first shown conceptually, and then empirically, based on the available price data since the reforms.

5.1.1. *Who Benefits From Lower Milling Costs?*

Over the past decade in Southern Africa, the costs of maize milling and meal distribution to retail shops have accounted for fully half of the total financial value of maize meal to consumers. By contrast, the maize producer price in these countries has ranged from only 25 to 40 percent of the total consumer value of meal. A 10 percent reduction in milling and retailing costs would be expected to have a larger impact on consumer prices than a 10 percent productivity increase in farm yields.

The relative benefit to producers and consumers from lower milling margins in the maize sector depends on the elasticities of supply and demand in a particular region. This is illustrated heuristically in Figure 3. SS and DD are the supply and demand curves for maize in a given region. P1 is the producer price and P2 the wholesale price of maize (the price at which traders or the marketing board sell to millers), and P3 is the retail price of maize meal. The demand for maize by millers is viewed as a derived demand for maize meal by consumers. Then, P2-P1 is the trader or marketing board margin, while P3-P2=MM is the mill-to-retail margin. If the mill-to-retail margin declines from MM to MM' in response to market reform, then the farm price rises to P1', while the consumer price falls to P3'. The more price inelastic is supply relative to demand, the greater the increase in farm prices in response to a decline in marketing margins.

Figure 3: Impact of Lower Mill-to-Retail Marketing Costs on Maize Producer and Consumer Prices.



5.1.

2

Empirical Evidence of Falling Prices and Milling Costs Since Market Reform

An assessment of the relative costs between hammer mills and roller mills must first explain the differences in product and marketing services provided. As described in Section 2, whole and refined meal differ in the proportion of the ground bran and germ contained in the meal. Consumers can clearly differentiate between the two products. Secondly, most small-scale millers specialize in "custom milling," whereby the raw grain and containers are provided by the customer. Large-scale roller millers, by contrast, distribute their meal in plastic packages to retail shops. The cost comparisons presented below account for the packaging costs for hammer mills, to help standardize the comparison, although in general, custom-milling does not involve such costs since people provide their own bags. The cost comparisons do not include the cost of consumers' time involved in procuring the maize and standing in the maize queue. A complete cost accounting would have to consider the customers' opportunity cost-of-time in visiting the miller.

The custom-milling option clearly involves less marketing services provided to the consumer, who must provide the bag and time herself. In a low-income environment, many consumers may prefer to forego some marketing services (such as packaging or convenience) in order to receive a less expensive product. Market reform has greatly expanded the consumers' ability to make this choice. Therefore, products having a lower level of marketing services attached to them may be preferable to some consumers.

Price trends. With the termination of the NSA for Maputo and Beira, both yellow and white maize have been generally available in the open markets in Maputo. Given the easy import possibilities of white, roller-meal products from South Africa and Swaziland, the market place in Maputo provides perhaps the best indicator in the Southern Africa Region of what maize-meal markets might look like with relatively few subsidies and restrictions. This market provides an especially unique opportunity to examine market-determined price differentials over time for white roller and whole meal, as well as for yellow whole and roller meals. Figure 4 shows the retail-level market prices for white roller and whole meal, as well as for yellow roller and whole maize-meal in Maputo since June 1994. Observe first that white roller and whole meals track each other very closely, with white whole meal maintaining a price approximately two-thirds that of white roller meal. Because the industrial, maize-milling factory in Maputo/Matola did not operate until mid-1995, the white, roller meal in the Maputo market came primarily from imports. The least expensive product in the market is yellow, whole maize-meal. Yellow, roller meal disappears from the market and then reappears, because the industrial mill in Maputo has not been operating. In late June and July, 1995, all four products were openly available in the market, and were clearly price differentiated.²⁹

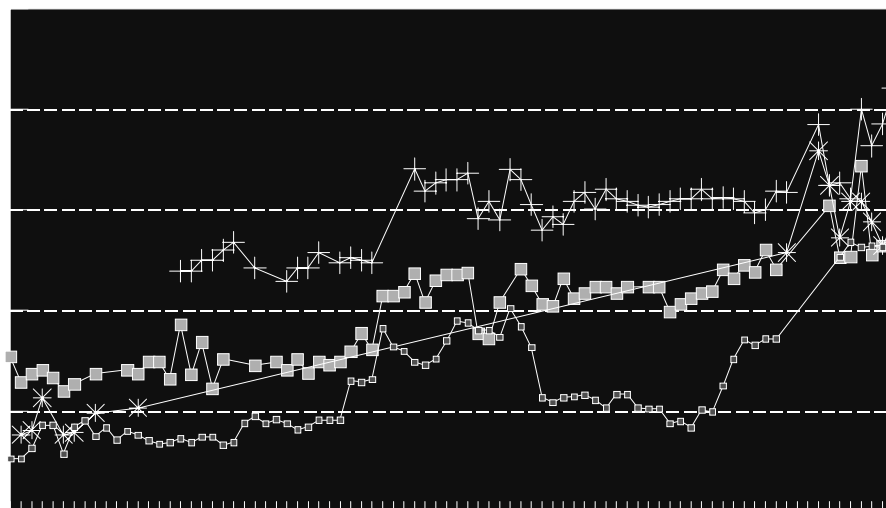
Table 3 shows the changes in refined and whole meal prices in Harare between 1991 and 1994. Several emerging trends are indicated. First, maize grain prices plus custom milling fees (i.e., the financial cost of procuring whole meal) have ranged from 60 to 85 percent the price of refined maize meal in Harare since the elimination of grain movement controls into urban areas .

These price ratios between whole and refined meal are consistent with those reported since the elimination of refined meal subsidies in Lusaka (FAO/MMAP 1994) and Nairobi (Jayne, Lupi, and Mukumbu 1995). In Lusaka, the imputed financial costs of whole meal was 63 and 69 percent that of refined maize meal in January 1994 and July 1994, respectively. In Nairobi, whole meal could be obtained at 55 to 65 percent the price of refined meal.

Much of the price advantage for whole meal in all three countries has been because large-scale millers have continued to procure most of their grain through the official or "quasi-official" marketing channels, where grain prices have tended to be higher than through informal channels. Some of the price discount observed between refined, roller-milled and whole, hammer-milled meal therefore reflects the fact that whole, hammer-milled grain is

²⁹ For an in-depth analysis of the yellow-maize situation in Mozambique, see Tschirley (1993 and 1995).

Figure 4: Open-Market Prices of White and Yellow Whole- and Roller-Maize Meals in Maputo and Mozambique, December 1993-July 1995



typically procured through informal channels in Zimbabwe, Kenya, and Zambia. It is anticipated that this procurement cost advantage for hammer mills will be narrowed as large millers progressively diversify their sources in the newly-liberalized, grain marketing systems in these countries.

Refined meal costs also appear to have declined in real terms since the elimination of movement controls in 1993. In constant 1994 Z\$, refined meal prices (including direct subsidies to millers) have declined from Z\$3,114 per-ton in 1992, to Z\$2,200 per-ton in 1993, to well under Z\$2,000 per-ton in 1994. Falling refined-meal prices are presumably due to increased competition from hammer millers in urban areas and to average-to-good harvests in 1993 and 1994. However, after the poor 1995 harvest, it is noteworthy that refined meal prices in April 1995 were reported at Z\$1,988 per-ton, or Z\$1,807 per-ton in 1994 Z\$, assuming an inflation rate of 10 percent between 1994 and 1995.

Table 3: Comparison of Refined Meal and Whole Meal Costs in Zimbabwe, 1991 - 1994

Year	Type of Meal (a)	Cost of Meal (Z\$/mt) ^e (b)	Consumer Price Index (1994=1) ^f (c)	Cost of Maize Meal (1994 Z\$/mt) (d)=(b)/(c)	Exchange Rate (Z\$/US\$) (e)	Maize Meal Cost (US\$/mt) (f)=(b)/(e)
1991 ^a	Refined meal	620 (662)	0.50	1,240 (1,324)	3.6	172 (184)
	Whole meal (custom milled)	425	0.50	850	3.6	118
1992 ^b	Refined meal	1,140 (1,775)	0.57	2,000 (3,114)	8.0	143 (222)
	Whole meal (custom milled)	na		na		na
1993 ^c	Refined meal	1,700-1,775	0.80	2,125-2,219	8.0	213-222
	Whole meal (custom milled)	1,050-1,375	0.80	1,312-1,718	8.0	131-172
1994 ^d	Refined meal	1,745-1,850	1.00	1,745-1,850	8.2	213-225
	Whole meal (custom milled)	1,330-1,570	1.00	1,330-1,570	8.2	162-191

Source: Jayne, Hajek, and van Zyl (1995).

^aApril 1991 to February 1992; ^bAugust 1992 to May 1993; ^cJune 1993 to March 1994; ^dApril 1994 to December 1994. ^eCost of refined meal represented by retail price of refined meal plus direct subsidy to millers (in parentheses, when conferred). In 1993 and 1994, retail prices were decontrolled and hence ranges are reported. The cost of whole meal (custom-milled) is the informal retail price of maize grain in Harare, plus a milling fee (compiled by M. Chisvo 1995). Whole meal figures used were Z\$ per-16-kg bucket, plus a custom-milling fee in Harare.

Consumer price index, standardized for 1994, assumes 14 percent inflation from 1991-1992; 40 percent inflation from 1992-1993; and 25 percent inflation from 1993-1994.

Since the food market reforms in these countries have occurred relatively recently, it is not possible to definitively isolate the effects of reform from other possible factors accounting for declining margins. Therefore, these emerging trends should be interpreted cautiously.

Maize milling/retailing margins. This section presents emerging evidence on changes in the mill-to-retail marketing margins in the post-food market reform period. The gross margin between the retail price of maize meal and the marketing board selling price of maize accrues to millers and distributors in the official marketing system. The formula used to calculate the mill-to-retail margin was:

$$(1) \quad PMM - PS/z + PB/z + S$$

where *PMM* is the retail price of maize meal; *PS* is the selling price (the price at which millers buy maize grain from the marketing board); *z* is the average extraction rate (i.e., tons of meal produced from one ton of grain, 0.80 in the case of Kenya refined meal); *PB* is the value of maize by-products per-ton; and *S* is the direct subsidy given to millers, if applicable. The mill-to-retail margin thus represents the margin which millers, distributors, and retailers receive for processing one ton of maize into meal and then distributing this meal to retail shops. The mill-to-retail margin has accounted for about 50-70 percent of the retail value of refined maize meal over the past decade.

Milling margins were calculated from equation 1 for Kenya, Zimbabwe, and South Africa (Figures 5, 6, and 7, respectively). In general, custom-milling margins for hammer-mill technology have ranged from 25 to 50 percent those of the large-scale firms using refined mill technology. In Kenya, since the initiation of grain market reforms in 1986/87, the mill-to-retail margin in the official marketing channel has declined 20 percent from about 5,000 Ksh per-ton to about 4,200 per-ton (in constant 1995 Ksh) since 1990. The evidence suggests that declining margins are at least partially due to increased competition from informal grain marketing systems. Hammer mill margins have been considerably lower over this same period, although this margin does not include distribution to retail shops or packaging. This margin is simply the fee paid by the consumer for custom-milling her grain at local hammer mills. Custom-mill charges at Nairobi's hammer mills have been relatively constant in real terms since 1990.

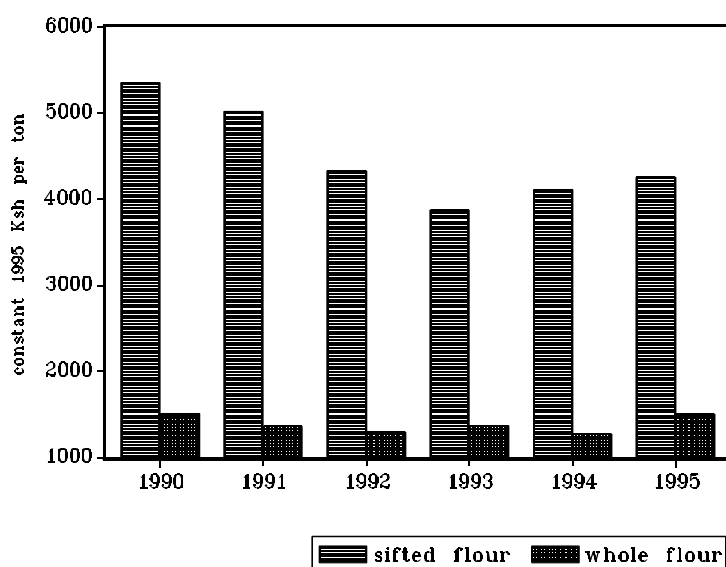
The data presented in Figures 5 and 6 also reveal an apparent decline in inflation-adjusted milling margins charged by the large-scale roller millers since market reform. In Kenya, refined maize-meal margins have declined 20 percent between January 1994 (when subsidies on refined meal and controls on maize movement were eliminated) and March 1995. In Zimbabwe, refined meal margins have, in real 1995 Z\$, declined from Z\$1,351/mt in 1993 to Z\$1,164/mt in 1994, to Z\$1,060/mt in 1995.³⁰ A similar post-reform decline in refined meal margins in Zambia has been indicated by FAO/MMAP (1994).

In addition to milling costs per-unit-of-output, there are a number of relevant criteria to be used when evaluating small-scale hammer mills versus the roller mills used by the large-scale milling sector, including employment generation, capital and capacity utilization, generation of backwards and forwards linkages, and relative profitability. Bagachwa (1992) found that in Tanzania, hammer mills were superior to roller mills with respect to each of the above criteria, with the exception of capacity utilization. Hammer mills were found to operate below their capacity due to insufficient grain supplies, power failures, and a lack of spare parts. In Kenya, Stewart (1977) found that the roller mill was technically inferior to the hammer mill, requiring more capital, labor, and foreign exchange costs relative to its output. In Zimbabwe, Rubey (1995) found that emerging alternative marketing channels, composed of hammer millers and private traders, were labor-intensive and contributed to employment growth. Hammer mill enterprises were superior to large-scale roller mills in terms of employment generation, investment capital and foreign exchange utilization, and enterprise flexibility. In

³⁰ Through May 1995. The inflation rate for 1995 was assumed to be 23 percent.

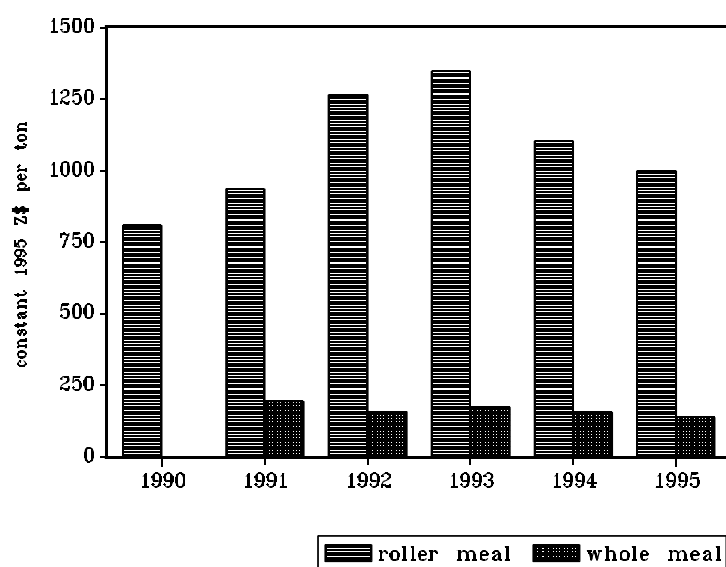
particular, production hammer mills used over seven times as much labor to produce a given output than large-scale roller mills. Production hammer mills also only required one-seventh the amount of investment capital and one-sixteenth the amount of foreign exchange to produce a given unit of output as large-scale roller mills.

Figure 5: Gross Margins for Refined Meal (Produced by Large-Scale Mills) and Whole-Maize Meal (Custom Hammer-Milled), Constant 1995 Ksh/ton, Nairobi, Kenya, 1990-1995



Source: Mukumbu (for gross margins); IMF (for CPI data). NOTE: 1995 prices through May; 1995 inflation rate assumed at 26 percent; margins for refined meal include packaging and distribution to retail shops, margins for whole meal are for custom-mill charge only.

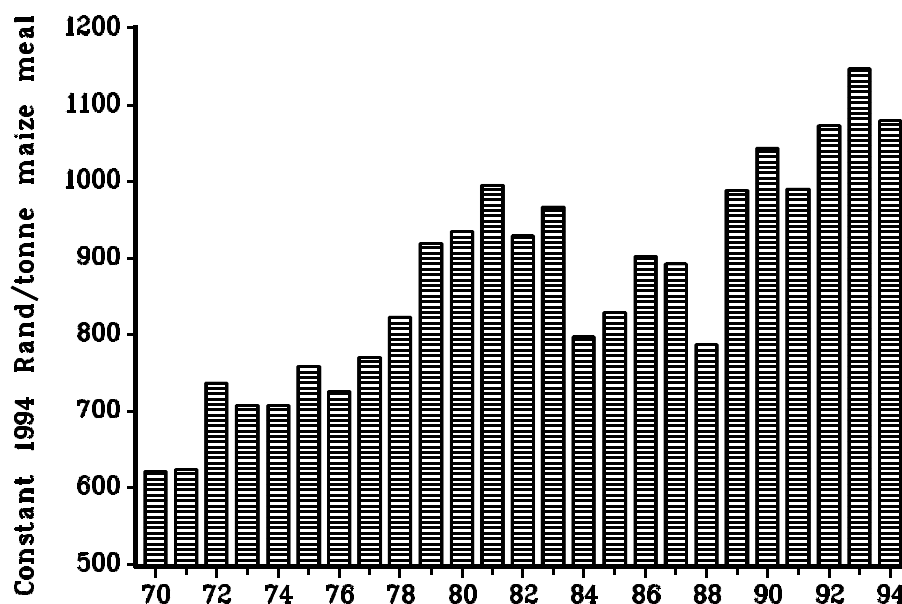
Figure 6: Gross Margins for Refined Maize Meal (Produced by Large-Scale Mills) and Whole-Maize Meal (Custom Hammer-Milled), Constant 1995 Z\$/ton, Harare, 1990-1995



Source: Chisvo. NOTE: 1995 prices through May; 1995 inflation rate assumed at 23 percent. Margins

for refined meal include packaging and distribution to retail shops. Hammer-mill margins are for custom-milling only, and do not include packaging or the opportunity cost of consumers' time to mill grain.

Figure 7. Evolution of Real Mill-to-Retail Margins for the Manufacture of Roller Meal in South Africa, 1970-1994



Source: Jayne, Hajek, and van Zyl (1994).

5.2. Consumption of Whole- and Refined-Meal Maize by Household Income

Table 4 presents households' revealed consumption patterns at various times in the four urban capitols surveyed, disaggregated by household income-quintiles. In the Zambia and Z1 Zimbabwe survey, households were disaggregated into income terciles. In all five surveys, consumption of refined meal was positively related to household income, while whole meal consumption was inversely related to household income. For example, in Nairobi, Kenya in October 1993, 59 percent of the households in the lowest income quintile stated that they were currently consuming hammer-milled whole meal, as opposed to only 18 percent of the households in the highest income quintile.

While the inverse relationship between household income and whole meal consumption was evident in all three Zimbabwe surveys, there was a distinct increase over time in the proportion of households consuming whole meal (Figure 8). We identify three major factors accounting for this shift:

First, the direct subsidy on refined meal (which reduced its price by 7 percent in 1991, by 32 percent from February to August 1992, and by 35 percent from August 1992 to June 1993) was eliminated in June 1993.³¹ This caused a major change in the relative price of whole and refined meal. Second, a significant portion of the

³¹ Indirect subsidies in the official marketing channel still remained since the GMB's trading margin (the difference between its buying and selling prices) was insufficient to cover its costs, which were ultimately covered by treasury subvention.

refined meal available to consumers during Survey Z2 was yellow meal, as the Grain Marketing Board was selling off its inventories from the previous year's drought before selling newly-harvested supplies of white maize. This probably caused a further consumption shift during this time to whole meal, which was milled mostly using new supplies of white maize, available through informal channels. Third, real per-capita-incomes in Zimbabwe fell almost 10 percent between 1991 and 1993. This decline has been attributed mostly to the 1992 drought and the recently-initiated Economic Structural Adjustment Program (ESAP). A decline in the general purchasing power among urban consumers, according to our results, would have shifted the overall maize consumption to some extent in favor of whole meal and away from refined meal.

Between the 1993 and 1994 surveys, informal grain movement into the urban areas was legalized. This relieved a major constraint on the availability of maize grain for custom hammer milling in urban areas. Until August 1993, after local grain from urban plot production was depleted, grain became very scarce in urban areas. This accounted for the marked seasonality of hammer mill operations in Harare (Jayne and Rubey 1993; Rubey 1995). The data suggest that the additional rise in the market share of whole meal between Survey Z2 (July 1993) and Z3 (January 1994) was due at least partially to the elimination of restrictions on grain movement into urban areas.

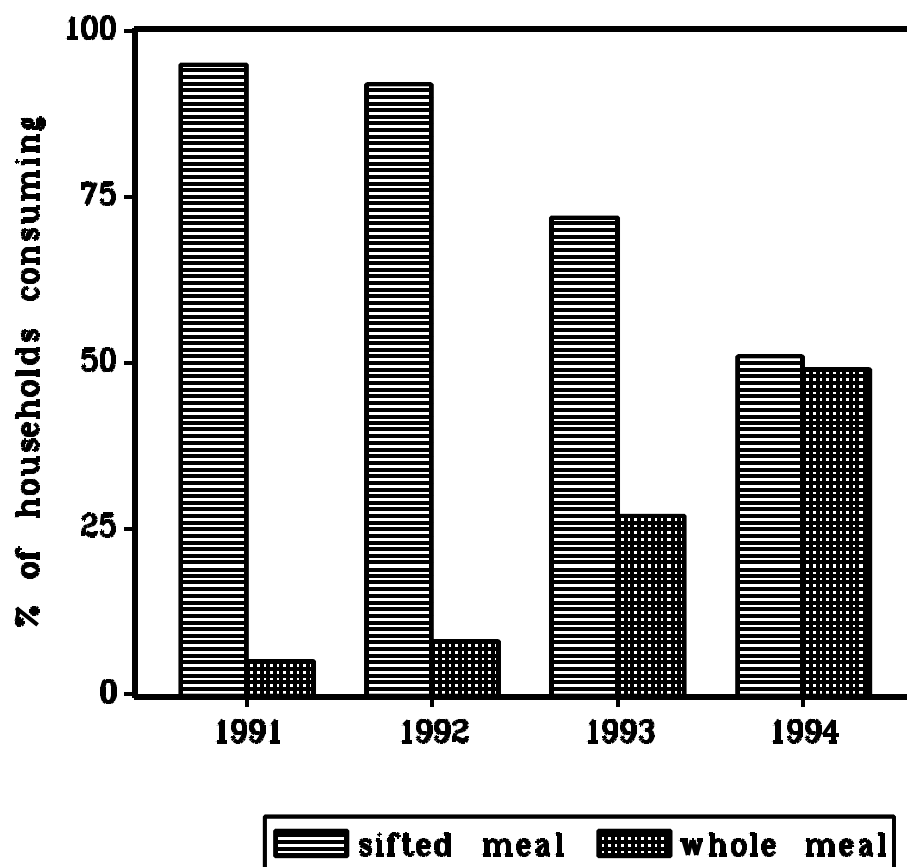
Table 4: Percentage of Households Consuming Refined and Whole-Maize Meal, Selected Urban Surveys in Eastern and Southern Africa

	Kenya 1993 (a)		Zambia 1994 (b)		Zimbabwe 1991 (c)		Zimbabwe 1993 (d)		Zimbabwe 1994 (e)		Mozambique 1994 (f)		
			----- Percent of Households Consuming -----										
Income groups	Refined	Whole	Refined	Whole	Refined	Whole	Refined	Whole	Refined	Whole	Refined	Whole	
1 (lowest 20%)	38	59	74	26	92	8	68	32	45	55	13	40	
2	53	44					67	33	47	53	12	37	
3	74	25	77	23	94	6	75	25	58	41	16	41	
4	76	22					81	21	61	38	14	28	
5 (highest 20%)	80	18	99	1	97	3	83	18	67	33	7	23	
Total Sample	64	33	83	17	94	6	72	27	56	44	12	34	

Sources: (a) Mukumbu and Jayne 1994; (b) Diskin and Sipula 1994; (c) Jayne et al. 1991; (d) Rubey 1993; (e) Chisvo and Jayne 1995; (f) Tschirley and Santos 1995.

Notes: (a) 51 percent subsidy on refined meal in effect during survey period; (b) white-maize grain shortages experienced during survey period due to drought; (b) data reported from the Zambia and 1991 Zimbabwe surveys refer to income terciles rather than quintiles; (c) 7 percent refined meal subsidy and controls on maize grain availability in effect during survey period; (d) survey conducted immediately after partial decontrol of the maize marketing system, and during continued distribution of yellow, refined meal through the official marketing system due to unused yellow maize from the 1992 drought; (e) survey conducted 9 months after most grain marketing restrictions were eliminated; (f) figures are for refined meal and whole, yellow meal.

Figure 8: Trends in Refined Meal and Whole Meal Consumption, Harare, Zimbabwe, 1991-1994.



In Mozambique, refined, white meal was unavailable in the market during the period of the survey. The large urban mills had been dependent for some years on yellow maize food aid for their supplies, due to the collapse of the formal marketing system during the war. Yet by 1994, these companies' share of the maize-meal market had fallen sharply, due to poor management, which caused large financial losses, along with decisions by donors in late 1991 to channel yellow maize food aid to the informal marketing sector. For these reasons, refined, yellow meal was also scarce in the market during the survey period. As a result, revealed preference survey results show small proportions of the Maputo population consuming refined, yellow maize, with the proportion not varying systematically by income. Note, however, that whole meal consumption does show an inverse relationship to income, as in neighboring countries.

5.3. Effects of Elimination of Refined Meal Subsidies on Urban Food Security: Kenya

The anticipated effects of eliminating subsidies on refined meal were addressed, *ex ante*, by asking respondents how they would alter their maize purchase patterns under a set of hypothetical price scenarios envisaged under subsidy elimination. We first present simple tabular responses disaggregated by household income group, and then present more detailed econometric analysis for the Kenya case study.

Table 5 presents respondents' stated preferences for whole and refined meal under a range of relative prices for the two maize meals. In all countries, the survey results show an expected increase in the market share of whole meal as its price declines relative to refined meal. In general, lower-income consumers stated a greater willingness to switch from refined-meal consumption to whole-meal consumption if the price of refined meal rose, other factors remaining constant.

The effects of eliminating refined meal subsidies on household food expenditures and food security was examined in Kenya, applying both stated and revealed preference data to a selectivity model (see Jayne, Lupi, and Mukumbu 1995 for details). The model accounted for the effects of income, hypothetical price variation between the two meals, ethnic background, family size, number of hammer mills within five kilometers of the respondents' home, whether the wife worked in full- or part-time wage employment, and an endogenous, dummy variable specifying whether the household presently consumed refined or whole meal. The model was first estimated to derive income and price elasticities of demand for whole and refined maize-meals in Nairobi. Next, changes in expenditures on the two maize meals were simulated, based on a range of prices for the two goods, disaggregated by household income.

Table 6 presents income, own-price and cross-price elasticities derived from MLE estimates of the selectivity model, evaluated at the mean values of the predetermined variables for the income group they represent. Results indicate that refined meal is a normal good, but it has a very low income elasticity. Whole meal consumption varies inversely with household income for all income strata, with an average income elasticity of -0.59. Own-price elasticities for whole meal are low and increase slightly with household income; own-price elasticities for refined meal are relatively elastic, especially for low-income consumers. The results suggest that low-income households would be more likely to reduce their purchases of refined meal when its price rises. An increase in the price of refined meal has a large positive effect on the expected demand for whole meal. A change in the price of whole meal, however, has little effect on the demand for refined meal.

Table 5: Percent of Consumers Stating a Preference for Hammer-Milled, Whole Meal Compared to Refined Meal at Specified Prices, by Income Groups

% Discount, Whole Meal	Zimbabwe 1991 (a)			Zimbabwe 1994 (b)		Zambia 1994 (c)			Kenya 1993 (d)			Mozambique 1994		
	0%	12%	25%	0%	30%	5%	15%	30%	0%	12%	22%	0%	20%	40%
Income Group	----- % Respondents Preferring to Purchase Whole Meal -----													
1	12	20	29	10	69	61	71	88	34	50	53	na	24	43
2	c	c	c	11	70	c	c	c	38	52	54	na	29	49
3	32	36	44	11	71	56	63	81	27	43	45	na	20	31
4	c	c	c	10	58	c	c	c	23	31	35	na	10	25
5	56	62	66	9	51	59	72	72	18	21	23	na	14	29
Total sample	35	40	46	10	64	57	67	80	28	40	42	na	20	35

c Sample was divided into income terciles only.

Table 6: Elasticity Estimates for Refined Meal and Whole Meal

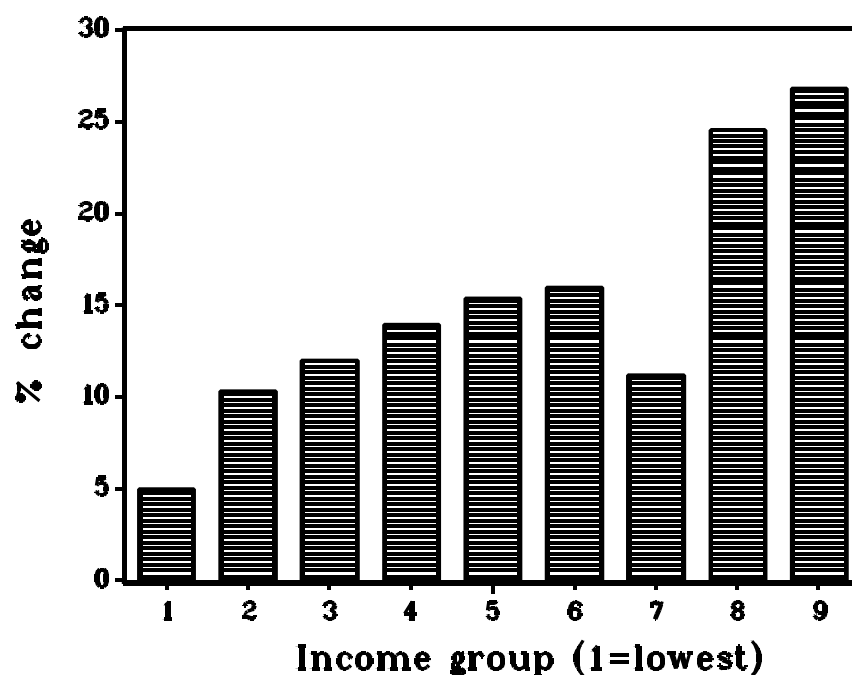
Income Quartile (average Ksh per hh)	Income Elasticity		Own-Price Elasticity		Cross-Price Elasticity	
	refined meal	whole meal	refined meal	whole meal	Q refined meal wrt P whole meal	Q whole meal wrt P refined meal
1 (2,375)	0.17	-0.50	-1.90	-0.09	0.07	2.41
2 (5,867)	0.09	-0.59	-1.44	-0.11	0.05	2.98
3 (9,909)	0.05	-0.64	-1.24	-0.12	0.04	3.28
4 (21,345)	0.05	-0.72	-0.88	-0.14	0.03	3.90
Average (8,583)	0.09	-0.59	-1.41	-0.11	0.05	3.03

These findings show that the subsidy on refined meal was regressive. Over half of the low-income groups were already consuming the less-expensive whole meal, even with the subsidy on refined meal. If the subsidy was to be removed, the results indicate, *ceteris paribus*, that the majority of consumers actually paying higher prices for refined meal would be in the higher-income categories. While the intent of the subsidy was not necessarily to improve food access at minimal leakage to unintended recipients, it is clear that the subsidy was disproportionately captured by higher-income, urban consumers.

In January 1994, the Kenyan government eliminated the subsidy on refined meal, causing its price to increase by 53 percent. Strong concerns were voiced as to whether low-income consumers could maintain their access to this food under such a sudden and large surge in the price of the major staple. However, to the authors' knowledge, no systematic information has been collected to assess the effects of subsidy elimination on commodity substitution by low-income consumers, either before or after the reform.

Jayne, Lupi, and Mukumbu (1995) simulated the net change in expected consumer expenditures on maize products by income group. For the pre-reform expenditure levels, the baseline expected demands were evaluated at the prices which had prevailed prior to reform, Kenyan Shillings (Ksh) 16.32/kg for refined meal and Ksh 13.5/kg for whole meal. The post-reform expected expenditures were evaluated using the prices prevailing three months later in March 1994, Ksh 25/kg and 14/kg for refined meal and whole meal, respectively. These quantities were calculated for each of nine income categories. For each income category, all other household variables were evaluated at their mean within that group.

Figure 9: Percentage Change in Expected Total Expenditure on Maize Meal, by Income Group, After Elimination of Refined Meal Subsidy, Nairobi Kenya



Note: Results based on March 1994 (post-reform) prices of refined and whole meal compared to December 1993 (pre-reform) prices.

On average, the removal of the subsidy leads to a 14 percent rise in expected expenditures on maize meal (Figure 9). But for the lowest two groups, the increase in expenditures on maize is expected to be only 8 percent of the total maize expenditures, and less than 1 percent of the households' income. The relatively small impact on the poor is due to their higher baseline consumption of less-expensive whole meal, and a greater expected shift to whole meal when the price of refined meal rises. This contrasts to a 25 percent increase in expenditures on maize meal for the highest income group. The expected change in maize expenditures relative to income is less than one percent for all income groups. This compares with a saving to the public treasury of over Ksh 1.4 billion per-year, or 2 percent of Kenya's gross domestic product (GDP), because of eliminating the subsidy.

These results may appear surprising in light of strong concerns among some policy makers that the elimination of the subsidy would create great hardship for urban consumers. Substantial adversity to low-income consumers would indeed be expected if consumption

habits were rigid. For example, consider the change in expected expenditures if substitution was not taken into account. Within each income group, holding the proportions of refined and whole meal purchases fixed at pre-reform levels, the change in maize expenditures after subsidy elimination would be expected to be an average of 37 percent, with increases of 25 percent and 45 percent for the lowest and highest income groups, respectively. Here the change in expenditures for the highest income group is almost as large as the 53 percent change in the price of refined meal because most of the households in this group consume refined meal. The change in expenditures for the lowest income group would be over-estimated by a factor of five. This example clearly illustrates the importance of allowing for potential product substitution *within* a particular commodity group.

5.4. Effects of Elimination of Refined Meal Subsidies on Urban Food Security: Zimbabwe

In Zimbabwe, subsidies were eliminated on maize meal in June 1993. However, subsidy elimination was also accompanied by easing the controls on informal grain movement. As a result, urban consumers had a much wider access to maize grain for custom hammer-milling at urban hammer mills. Rubey and Lupi (1995) used stated preference data from Zimbabwe to estimate a discrete choice model, where the choice of maize meal was explained by the various attributes embodied in maize-meal products. They predicted the market shares of alternative types of maize meal after subsidy removal and grain movement decontrol, as well as the resultant welfare gains and losses.

In this study, pictorially and verbally descriptive cards with specific attributes were used to describe the alternative products and obtain the stated preference data. Five attributes were selected: degree of "refinedness" (four levels, including straight-run, roller meal, *mudzvurwa*, and super-refined), product price (two levels, Z\$13.10 and Z\$21.80), color of the grain (two levels, yellow and white), travel time needed to obtain the meal (two levels, 5 minutes and 30 minutes), and packaging of the product (two levels, packaged and not packaged). The price and time levels were selected based upon focus group responses, and spanned the range of prices and travel times in the existing marketing channels. An orthogonal design was used to overcome the problem of needing 64 showcards to investigate the five attributes in the 4×2^4 factorial design (Addelman 1962). With the orthogonal design, only eight showcards were required. Consumers were shown the eight cards during the Z2 survey and asked to rate each card on a Likert scale from one (most preferred) to seven (least preferred). After rating each card, consumers were presented with each group of cards which received the same rating and asked to rank the "ties" from most preferred to least preferred. These choices were then coded from one to eight to provide a complete ordinal ranking for each respondent (see Rubey and Lupi 1995 for a more comprehensive review of these methods).

With the consumers' rankings, a discrete choice model was used to predict the market shares arising from the policy changes which influenced the prices and availability of alternative

maize meal products. Given the parameters estimated from the consumer rankings, the eventual market share of alternative maize meal products in the aftermath of market reform were predicted. Since market reforms were actually undertaken, model predictions were then compared with the actual market results that followed the removal of refined meal subsidies and maize movement decontrol.

Table 7 presents the predicted percentages of households that would choose each of the three meal types. The percentages were calculated by predicting each households' probability of choosing the three meal types, and then averaging these probabilities over the sample. Table 7 also presents the percentages of households choosing each of the meal varieties based on a separate, post-reform market survey conducted in December 1993.

Table 7: Predicted and Actual Percentages of Households Consuming Alternative Maize Products, Urban Zimbabwe

Maize Meal Product	White Super-Refined Meal	White Refined Meal	White, Whole Meal
Predicted results, where whole meal is unpackaged (June 1993)	15	52	33
Predicted results, where whole meal is packaged (June 1993)	11	39	50
Actual market survey results (December 1993)	5	41	54

Source: Rubey and Lupi (1995)

The results present two different values for the packaging dummy variable. The packaging options that were presented to respondents were pre-packaged meal in plastic bags versus meal available in bulk (unpackaged). While all the refined meals are available in the market in pre-sealed packages, whole meal is not. When obtaining whole meal, the vast majority of consumers have the maize milled while they wait. Consumers bring their own plastic bags and the processed maize flows directly into the consumer's own container. Since it is not clear

which value of the packaging characteristics should be used to predict the actual demand for whole meal, results are given for both packaged and unpackaged cases.³²

As shown in Table 7, the model based on the expressed consumer preferences for the eight different showcards predicted that 33 percent of the households would choose whole meal. The actual post-reform survey showed that 54 percent of the urban consumers were eating whole meal. In the case of unpackaged maize, however, the model predicted that 50 percent of the households would choose whole meal. In both cases, the model predicted a major shift towards whole meal. When the assumption was made that straight-run meal was only available as an unpackaged product, the model under-predicts the share of households consuming whole meal. However, when the assumption was made that the straight-run meal is widely available as a packaged product, the market share prediction of whole meal (50 percent) was quite close to the actual market shares prevailing in December 1993 (54 percent). For both cases, the model over-predicted the percentages of households consuming the super-refined meal relative to the actual post-reform consumption.

The welfare effects of subsidy removal and the introduction of alternative maize-meal products after June 1993 were also estimated in this study. Maize-meal subsidies, such as those that existed in Zimbabwe, were a response to an increasingly acute "food price dilemma." On the one hand, there were pressures to increase producer prices and spur agricultural supply response, but on the other hand, the Zimbabwean government had a strong desire to keep retail food prices low. Consumer food subsidies, which reduce the retail price of food while still permitting remunerative producer prices to prevail, are a costly, temporary solution to this dilemma (Timmer, Falcon and Pearson 1983). In Zimbabwe, large maize-meal subsidies were fiscally unsustainable. Maize-meal subsidies amounted to 2 percent of the GDP in 1992/93. When administered on such a scale, food subsidies often required large amounts of borrowing by the government, which in turn contributed to inflation, and ultimately contributed to poor aggregate growth rates.

An annual welfare measure was calculated for three policy scenarios. In Scenario 1, consumer subsidies on refined meal were removed, but white, whole meal and all types of yellow maize-meal remained unavailable. In Scenario 2, subsidies were removed and prohibitions were lifted on transporting maize into urban areas for processing into whole meal, but yellow maize-meal would still be unavailable. Scenario 3 assumed subsidy removal, with access to both white, whole meal and yellow maize-meal products.

As shown in Table 8, the welfare effects of the three policies are quite revealing. As one would expect, the removal of consumer subsidies for refined meal (Scenario 1) caused the retail price of maize meal to rise, leaving all consumers worse off in the short-term. In

³² Custom-milled whole meal is different from whole meal sold in bulk in that the customer can closely monitor the processing of the grain. Consumers rarely purchase whole meal in bulk, at least partly out of a desire to inspect the maize kernels (and milling premises) for cleanliness.

absolute terms, consumers in the higher income groups would incur larger losses than the lowest income group. While subsidy removal made consumers worse off in the short-term, subsidy removal entailed considerable fiscal savings for the government, with these savings exceeding consumers' welfare losses. Rubey and Lupi (1995) estimated that the yearly savings to government from ending subsidies would be Z\$204 per-survey-household, while Table 8 shows the average annual welfare loss per household would be Z\$168. Furthermore, to the extent that subsidy removal would reduce the tax burden on consumers over time, and reduce government deficits that curtail economic growth, the losses consumers would incur from subsidy removal were over-estimated.

In Scenario 2, subsidy removal was coupled with the removal of maize movement restrictions that limited access to white, whole meal. On average, consumers would still be worse off in the short-term with Scenario 2, but the average welfare loss would be sharply reduced by the introduction of the whole-meal product. For the lowest income quintile, the introduction of the "inferior" white, whole-meal product almost completely ameliorated the adverse effects of subsidy removal, with the average annual welfare loss predicted to fall to \$0.09 per-household from \$91.84 in Scenario 1. The second lowest-income quintile would actually realize a net welfare gain (\$5.56) in the short-term from accompanying subsidy removal with the introduction of the white, whole-meal product.

Scenario 3, in which subsidy removal was coupled with reforms that would spur the availability of whole meal and yellow maize-meal products, made all income quintiles except the highest better off in the short-term. For all but the richest 20 percent of the urban population, the negative effects of subsidy removal would be more than offset by the benefits arising from the availability of a more diverse set of maize-meal products. On the average, welfare gains would be \$40.38 per-household, with the lowest two income quintiles realizing gains of \$55.16 and \$84.16 per-household. The introduction of yellow maize-meal would have a disproportionately positive effect on lower income households, since yellow maize-meal has characteristics of an inferior good. Scenario 3 was also dependent on yellow maize-meal products selling at a 10 percent price discount relative to white maize-meal products, a logical assumption given the historically higher yellow maize yields vis-a-vis white maize yields in Zimbabwe.

Table 8: Welfare Effects of Subsidy Removal and Market Reform, Comparison of Three Scenarios by Income Quintiles

	SCENARIO 1: Subsidy removal	SCENARIO 2: Subsidy removal with market reforms that make whole meal available	SCENARIO 3: Subsidy removal with market reforms that make whole and yellow maize-meal available
Overall Average	-168.15	-23.69	40.38

Highest income quintile	-288.60	-88.49	-26.93
2nd highest quintile	-170.75	-30.35	32.02
Middle income quintile	-140.34	-10.81	51.76
2nd lowest quintile	-160.65	5.56	84.16
Lowest income quintile	-91.84	-0.09	55.16

Source: Rubey and Lupi (1995)

In each of the three scenarios, a major conclusion was that the short-term welfare losses to urban Zimbabwean consumers associated with the immediate effects of consumer subsidy removal would be mitigated by complementary market reforms that would essentially eliminate well-established restrictions on the private transportation of maize grain into urban areas (Rubey and Lupi 1995). The major implication is that coupling consumer subsidy removal with an improved access to a broader range of food staples ameliorated many (if not all) of the immediate adverse effects of subsidy removal, especially for lower-income groups. In the long-run, urban consumers would also realize considerable benefits from subsidy removal that were not measured here, including possibly lower rates of taxation due to the reduced pressures on government budgetary resources, and lower inflation from reduced government deficits.

With the 1993 market reforms, the decentralized maize marketing channels developed rapidly, particularly those composed of urban grain traders and hammer mills. The number of hammer mills in Harare and Chitungwiza rose from 57 to 85 in 18 months (Rubey 1995). The amount of whole meal processed at each mill also rose: At Harare and Chitungwiza, the hammer mills' total throughput was 5,076 tons in June 1993, about three-and-one-half times the peak amount processed in June 1991. The volume of maize sold by urban traders has also increased greatly since the reforms of mid-1993.

Some Zimbabwean hammer millers, however, particularly those that have begun to manufacture bagged maize-meal products and compete directly with large-scale millers, face problems in the post-reform era. Sales of packaged, refined meal, though decreasing in terms of total urban consumption, continue to be dominated by two industrial milling companies. The greatest constraint to hammer millers who sell packaged meal are the difficulties faced in product marketing, despite these mills' lower wholesale prices. Much of the difficulty stems from their inability to penetrate markets where large-scale millers enjoy the advantages of conglomerate power and historical dominance. Many small retailers, especially those in rural

areas, are dependent upon the distribution networks provided by the large-scale millers and are reluctant to undertake measures that would jeopardize regular deliveries of their stock. Even those retailers who considered stocking low-priced, roller meal from hammer millers expressed uncertainty about the reliability of supplies from hammer millers. Also, the structure of food retailing in urban areas suggests that the opportunity exists for possible monopolistic collusion. Almost half of the urban consumers purchase bagged maize meal at large supermarkets owned by two conglomerates (Rubey 1995).

Hammer millers who package meal have developed several strategies to overcome their marketing problems, including vertical integration into retail shops, cultivating relationships with select retail buyers, and targeting institutional buyers (Rubey 1993). Most small-scale milling operations have been self-financed by well-established, indigenous businesspersons. For most new entrants, formal credit markets are inaccessible due to the (1) complexities of making a formal loan application with the required supporting documents; or (2) difficulty in obtaining loans without possession of a title deed or collateral. Although the small-scale milling industry will undoubtedly continue to develop through re-investment and owners' savings, a broader-based, more equitable development of the industry would require: (1) greater transparency, and perhaps technical assistance, in commercial lending procedures for small-scale enterprises; and (2) the granting of title deeds to rural businesspersons in communal areas.

5.5 The Potential to Improve Households' Access to Food Through Greater Availability of Yellow Maize

Another consumer product with potential self-targeting possibilities is yellow maize. Yellow maize has often been administratively blocked from entering consumer markets in much of Eastern and Southern Africa, in spite of lower production costs relative to white maize in most of the region. There appears to be an unexploited potential to reduce food prices to lower-income groups by allowing poor consumers the choice of consuming yellow maize-meal instead of white.

Mozambique provides an excellent case study. It is the only country in Southern Africa where the retail market has been allowed to operate relatively freely in pricing different types and colors of meals. Research by MSU has identified at least ten different types of maize meals available in retail markets, if one considers both color and processing differences. In addition, three types of grain are generally sold at retail establishments: yellow from food aid, domestic white, and white maize from Zimbabwe, Swaziland, or South Africa.

The 1994 survey provided strong evidence that consumers across the income spectrum would be willing to switch from white to yellow maize, but that this effect was especially strong among the lowest-income consumers. Thus, these results showed that yellow maize was relatively self-targeting to low-income groups. Table 9 presents the proportion of households purchasing selected products during the past year, and the mean household incomes per-adult-equivalent consumer of those purchasing and not purchasing these products. Key results are that a substantial proportion of consumers purchased yellow grain and meals, and that those who did purchase yellow products have incomes well below those who never purchased them during the past year.

Table 9: Mean Household Income Per-Consumer Adult-Equivalent by Purchasers and Non-Purchasers of Selected Products

Product	Percent purchasing in Past Year	Mean Monthly Household Income/Adult-Equivalent	
		Purchasers	Non-Purchasers
Yellow grain	65.3 %	Mt 84,032	Mt 115,549
Whole yellow meal (FMACF)	34.3 %	Mt 78,180	Mt 102,637
Refined yellow meal from CIM (FMASF/CIM)	12.3 %	Mt 71,287	Mt 97,748
White grain	93.6 %	Mt 96,608	Mt 62,210
Rice	81.4 %	Mt 95,823	Mt 90,870

Source: Tschirley et al. 1993

Table 10 breaks down the percent of households purchasing each product by income quintile.³³ For the three yellow-maize products, the percentages of households purchasing held steady through the first three or four quintiles, then decreased substantially in either the fourth or final quintile. This result shows that it is the highest-income consumers who would be the least likely to consume yellow-maize products. The results in Tables 9 and 10 suggest that yellow grain, and especially whole, yellow meal, tend to be self-targeting products for poor consumers, in the sense that higher proportions of low-income consumers choose of their own volition to consume these products. The results from further research, discussed below, will shed further light on this issue.

³³ Households in quintile number 1 are those 20 percent with the lowest incomes per-resident-adult-equivalent consumer. Quintile 5 contains the 20 percent of households with the highest incomes per-resident-adult-equivalent consumer.

Table 10: Percent of Households Purchasing Selected Products, by Income Quintile

Product	Income Quintile				
	1 (22,627)	2 (41,300)	3 (62,056)	4 (96,239)	5 (252,950)
	---- Percent Purchasing in past year ----				
Yellow grain	68.8	69.7	72.7	66.7	50.0
Whole, yellow meal	40.3	36.8	40.8	28.2	23.0
Refined, yellow meal from CIM	13.0	11.8	15.6	14.1	6.7
White grain	93.6	90.8	90.9	97.4	98.7
Rice	88.5	77.2	79.5	83.5	78.2

Source: Tschirley et al. 1993

To better understand the dynamics of consumer choice when prices change, sampled consumers were presented with a price game. In this game they were first asked to choose between two alternative maize products at identical prices (equal to the mean of the actual market prices of the two products at the time of the survey). They were then asked how low the price of the less preferred product would have to fall before they would change their decision and purchase it. No actual transactions took place; consumers were simply asked to indicate what they would do in the given situations. Alternative price scenarios were presented between yellow and white grain, between yellow grain and whole, yellow meal, between white grain and whole, yellow meal, and between whole, yellow meal and refined, yellow meal from the large-scale mill in Maputo. It is important to note that each of these products was present in the market on a more or less continuous basis for the past several years. Thus, consumers were expected to be familiar with each of these products. In each case, the consumer was allowed, if they wished, to not purchase either maize product, choosing instead more expensive rice or refined, white meal from Swaziland. This type of game has been used frequently in consumer research. It is designed to determine the price premium level that consumers would be willing to pay for different colors of maize and different levels of meal processing. When combined with income data, these games can indicate **who** (in terms of income) would most quickly change to the less preferred product as its price falls.

Table 11 presents results from these games when consumers had to choose between white and yellow grain. **At equal prices**, nearly all the consumers indicated that they would purchase white grain. Very few chose not to purchase grain altogether, or chose to purchase rice or highly-refined white meal from Swaziland. This result was not surprising, given the historical preferences for white maize, and the superior pounding attributes of the flinty white varieties

Table 11: Maputo Consumer Survey: Consumer Choices of Products When Priced Equally

Preferred Product	Frequency	Percentage
White grain (GMB)	372	95.6
Indifferent	1	0.3
Yellow grain (GMA)	7	1.8
Neither, would purchase rice	6	1.5
Neither, would purchase refined white meal from Swaziland (FMBSF/SZ)	3	0.8
TOTAL	389	100.00

Source: Tschirley et al. 1993.

as opposed to the dent yellow varieties supplied by food aid.

The striking results are found in Tables 12 and 13. Table 12 shows that, with a price discount of only 14 percent on yellow grain (Mt 600 vs. Mt 700 for white grain), one-quarter of the sampled households indicated that they would choose to consume yellow grain rather than white, **and these consumers on average have substantially lower incomes than all other consumers.** By the time yellow grain has been discounted 43 percent relative to white, more than 70 percent of the sampled households indicated that they would switch to yellow. Table 12 provides more detail on the discount level that would cause different consumers to switch to yellow grain. Two results stand out. First, lower-income consumers would be clearly more likely to switch to yellow maize at modest price discounts (34.7 percent of the poorest) than higher-income consumers would be (only 10.0 percent for the highest-income consumers). Yet regardless of income, about three-quarters of all consumers would switch to yellow grain if it was discounted at least 43 percent below white; at these large price discounts, higher-income consumers would be just as likely as lower-income consumers to switch to yellow maize.

Table 12: Maputo Consumer Survey: Percent of Consumers Indicating They Would Switch From White Grain to Yellow Grain With Price Discounts on Yellow Grain

Percentage Discount on Yellow Grain	Percentage Switching to Yellow	Cumulative Percentage Switching	Mean Monthly Income/Adult Equivalent of Those Switching
14	25.1	25.1	Mt 58,427
29	14.4	39.5	Mt 100,289
43	31.3	70.8	Mt 108,387
> 43	4.4	75.2	Mt 91,409
Would not switch	24.8	---	Mt 106,682

Source: Tschirley et al. 1993.

Table 13: Cumulative Percent of Consumers, by Household Income Quintile Who Indicate that They Would Switch From White to Yellow Grain with Price Discounts on Yellow Grain.

Percentage Discount on Yellow Grain	Income Quintile				
	1	2	3	4	5
	---- Cumulative Percentage Switching to Yellow Grain ----				
14	34.7	37.8	21.1	20.5	10.0
29	45.3	58.1	31.0	35.6	27.1
43	69.3	77.0	67.6	74.0	65.7
> 43	72.0	79.7	74.6	79.5	70.0
Would not switch	28.0	20.3	25.4	20.5	30.0

These results are important for three reasons. First, they suggest that large volumes of yellow grain that are available at prices significantly below white grain prices (as occurred throughout 1993 due to excessive food aid supplies) could substantially reduce the demand for white maize. This would have direct negative consequences for farmers, and would reduce the incentive for traders to invest in the marketing system for white maize. Each would bring about negative consequences for Mozambique's economic development.

Second, on a more positive note, a 14 percent price differential would be one that could most likely be maintained in an open market setting, given the relative prices of white and yellow grains in world markets, and the apparently superior productivity of yellow grain in Southern African countries such as Zimbabwe, Zambia and South Africa. Thus, without food aid, but with commercial imports of cheaper yellow maize, poor consumers would benefit.

Finally, the poorest consumers would be those who would most quickly switch to yellow grain when its price fell relative to white. This suggests that poorer consumers would have the most to lose if yellow maize became unavailable in the market, or if its price rose substantially. As food aid diminishes in Mozambique, serious attention must be given to ways in which the substantial market demand for yellow maize among low-income consumers can be met. This could be accomplished through a fully-liberalized import policy on food grains, through efficient domestic production of yellow grain, or through some combination of each. The Government of Mozambique and donors should investigate the possibility of a research program to develop yellow flint varieties, possibly using material from Malawi.

Limited data from Zambia show that when yellow maize was imported in response to the 1992 drought and injected into the local markets, its price was about 10 percent to 35 percent lower than white maize for comparably refined meals (Diskin and Sipula 1994). During this period, yellow maize accounted for about two-thirds of the total maize available in Zambia. The market also priced refined meal approximately 10 to 30 percent less than super-refined meal, for both yellow and white.

The experience of Mozambique and Zambia suggests that other SSA countries could use the market to target less-expensive food to vulnerable groups by allowing consumer preferences to determine the full range of products available and the price differentials between them. Such an approach would contrast markedly with the longstanding policies implemented throughout much of Southern and Eastern Africa that restrict consumers' access to less-refined white or yellow maize-meal, and heavily subsidize the more refined meals from large-scale, refined milling firms.

Allowing the market to determine the demand for yellow maize could also increase the policy options available to the government that would ensure sufficient maize supplies at stable prices. One of the great disadvantages for countries that depend on white maize is that the world market is very "thin," meaning that only a small proportion of the total production is marketed, and thus relatively small changes in market volume have a large effect on prices. Weather-induced changes in import requirements in Southern Africa can markedly affect the world price of white maize and exhaust world supplies, as in 1992 and 1995. The result is that prices in a given country are largely forced to adjust to domestic production fluctuations. Combined with the unstable weather encountered in many of these semi-arid countries, price fluctuations can be extreme.

By contrast, the world market for yellow maize is the largest, in terms of physical volume, of any grain. Over the 1980-92 period, yellow-maize prices have been 15 percent less, on average, than for white maize (Fisher 1993). The yellow-maize market is also quite stable. Between 1980 and 1992, the US Gulf price of Number 2 yellow maize diverged more than 10 percent only twice from its 1980-92 trend. In addition, yellow maize is always available on the world market. Finally, yellow maize has active futures and options markets that allow countries to reduce the risks associated with grain trading. If governments make the political decision that their constituents will not have access to yellow maize, in spite of an apparent niche for it among low-income consumers in some countries, then it is important to recognize that this decision entails relatively higher stock levels and stockholding costs, higher white-maize prices, and higher import costs in the event of shortfalls. These costs must be passed on to either the consumers, producers, or taxpayers.

6. CONCLUSIONS AND POLICY IMPLICATIONS

Much of the literature on food pricing and marketing has stressed the tradeoffs between producer incentives, consumer prices, and government budget costs. However, the interests of both producers and consumers may be simultaneously promoted through policies that reduce food marketing costs. The survey evidence presented in this report indicates that food market reforms in Zimbabwe, Zambia, Mozambique, and Kenya have raised consumers' access to previously-suppressed marketing technologies and the staple foods they produce, thereby offering consumers a greater choice of price-differentiated products.

Contrary to the perceptions of some politicians in the region, there has been a rapid rise in the urban consumption of hammer-milled whole meal, and investments in new hammer-milling equipment and small-scale trading. The shift in market shares from refined to whole meal, associated with the recent elimination of large subsidies on refined meal in Kenya, Zambia, and Zimbabwe, has substantially reduced the hardship to low-income urban consumers.

6.1. Summary of Conclusions

The findings of this synthesis report are summarized as follows:

1. Urban hammer mills have promoted household food security by providing a low-cost alternative to a sole reliance on roller-milled meal for staple food consumption in much of Eastern and Southern Africa. Custom hammer milling shifts the task of procuring, bagging, and milling from the miller to the consumer. This appears to be a welcome choice, especially for low-income, urban consumers who appear to readily accept a lower level of marketing service in exchange for a lower-priced good. Food market reform in these countries has greatly expanded consumers' ability to make this choice. Fortunately for consumers in Maputo, the large, urban center in the region with perhaps the greatest number of absolutely low-income households, hammer-milled maize products have been widely available for a number of years.
2. Since the removal of controls on maize movement and refined meal subsidies the retail price for hammer-milled, whole meal has ranged from 55 to 80 percent those of refined meal manufactured by large-scale millers. At observed purchase price levels, the availability of whole meal has allowed cost savings to consumers equal to 4-13 percent of the lowest quintile's household in the capital cities of Harare and Nairobi. In Maputo, hammer-milled maize meals, whether white or yellow, are at least 15 percent less expensive than roller-miller products of the same color. These are significant cost savings for lower-income consumers.
3. The proportion of urban consumers consuming whole meal has risen from the pre-market reform levels of approximately 5 to 15 percent, to about 40 to 60 percent since the

reforms in Nairobi, Lusaka, and Harare. While there are no studies of the pre-reform period in Maputo, it is clear that significant proportions of Maputo consumers have chosen hammer-milled products for some time.

4. In all the countries surveyed, there is an inverse relationship between whole meal consumption and household income, and a positive relationship between household income and refined meal consumption. Survey results indicate that refined meal subsidies were untargeted and their benefits were actually inversely related to household incomes. In Nairobi, a 53 percent increase in the price of refined meal, *ceteris paribus*, was estimated to increase maize meal expenditures by 7 percent for the lowest household income-quartile in Nairobi, as compared with a 25 percent increase for the highest income-quartile. This is because low-income consumers have a greater likelihood of consuming less expensive, whole maize meal, and these consumers (for those who do purchase refined meal) appear more likely to shift to whole meal when the price of refined meal rises. Removal of the subsidy in Kenya was estimated to raise the expected household maize-meal expenditures by less than 1 percent of all income groups' household income.

These findings suggest that, if a return to maize subsidies was deemed necessary, a subsidy on whole meal would involve less leakage and have a greater impact on the food security status of the poor than a subsidy on refined meal. However, such a strategy could prove difficult to monitor, and might involve leakage to animal feed.

5. New investment in hammer milling has increased rapidly since market reform. In Zambia, hammer mills increased between 1992 and 1994 from an estimated 4,156 to approximately 6,000 mills. The number of hammer mills operating in Nairobi has increased 80 percent between 1987 and 1993. Hammer mills operating in Harare have increased from 57 to 85 during 18 months between 1992 and 1994. In Maputo, at the beginning of the 1970s, official statistics listed only 3 hammer mills in the city. In 1995, there were 155 licensed hammer mills operating, and as of early 1994, over 90 percent of these had come into operation since the inception of the government's economic reform program.
6. Refined meal margins, adjusted for inflation, have appeared to decline since the advent of key market reforms. The decline in refined meal margins appears to be in response to the loss of roller millers' market share due to increased competition from hammer mills.
7. Hammer millers in urban areas still operate under a number of constraints. In Zimbabwe, post-reform constraints include: (1) continued seasonal grain shortages, which depress throughput and profitability; (2) vertical integration between some large-scale roller millers and retail outlets, which present barriers to entry for small and emerging hammer-milling firms seeking to expand their markets; and (3) low levels of working capital and access to credit which would enable emergent millers to expand into grain procurement and distribution.

The future development of competitive food marketing systems in the region will require a conducive policy environment to overcome other remaining constraints. Strategies requiring further investigation include (1) changes in the selling practices of some marketing boards, which still provide large-scale mills more assured access to state grain stocks than small-scale traders and millers, and consumers; (2) changes in marketing board pricing policy, which in some cases is designed to capture market share rather than promote the development of a competitive private marketing system (e.g., setting a very low margin between buying and selling prices early in the season to capture throughput from private trading channels); (3) measures to promote competition at the retail level of the food marketing system to counteract entry barriers faced by firms lacking vertically-integrated retail outlets.

The findings of this report are consistent with the premise, forwarded in Section 3.6, that consumer behavior appears quite dependent upon political decisions that affect the choices consumers have available in the market. Current consumption patterns may be influenced by policies and investment decisions of prior decades. Habit formation and perceptions may act to reinforce and entrench the effects of otherwise transitory policy decisions. Importantly, many of these political decisions were designed to achieve other objectives and so could not have foreseen the dynamic side-effects on consumption they created.

However, the reduction of food marketing costs does more than reduce food prices for consumers. More importantly, it may improve production incentives that generate dynamic changes in farm investment, technology adoption, production costs, and cropping patterns that increase real incomes for both rural and urban households. Lower food costs in grain-deficit areas release resources for reallocation to other crops or non-farm activities with higher expected payoffs. The Ricardian argument that food costs may be an important determinant of the supply and price of labor, and hence the cost of production in industrial and exportable cash-crop sectors, has been empirically supported from recent research in the Sahel (Delgado 1992). The interactions between food costs and the development of viable cash-cropping opportunities are discussed further below.

A contribution of this set of country studies is to show how revealed and stated preference information can be combined to uncover anticipated price and substitution effects in situations where cross-sectional variation on prices is lacking. While stated preference data, alone and in combination with revealed preference data, has been used extensively in environmental and health economics, market research, and other research areas, this article suggests potentially useful applications in estimating *ex ante* behavioral response to future structural changes where information on observed behavior does not exist. In situations where the products of interest are available in the market and familiar to respondents, the combination of revealed and stated preference data can provide especially meaningful, policy-relevant information that would otherwise be unobtainable in an environment where detailed panel survey data is limited or non-existent.

These techniques may be particularly important in the case of anticipating the effects of food subsidy elimination in developing countries. Removal of food subsidies, commonly implemented under donor pressure, has sometimes led to urban riots and the downfall of governments. Policy makers' demand for useful and timely information on expected consumer response to alternative policies is just as strong in situations where detailed food balance tables and revealed preference panel data are limited or non-existent. This report summarizes *ex ante* approaches for estimating the effects on the food security status of urban consumers of eliminating refined-meal subsidies in most of Eastern and Southern Africa, in particular the countries of Zimbabwe, Kenya, Mozambique, and Zambia.

Through longstanding subsidies, government policy in much of Eastern and Southern Africa has encouraged the consumption of highly-refined, expensive, and less nutritious maize meal compared to informally-produced, whole meal. Improved knowledge of consumer behavior may potentially raise decision makers' receptivity to a wider range of policy options. Public policies and investments designed to improve the functioning of alternative marketing channels may be a more cost-effective way of improving food access to low-income consumers than a return to untargeted subsidies on refined products involving substantial costs for a country's treasury.

6.2. Implications for Governments, Donors, and Non-Governmental Organizations (NGOs)

1. The implications of the most-recent Generalized Agreement on Tariffs and Trade (GATT) negotiations and the 1995 U.S. Farm Bill are that there will likely to be far less food-aid resources available from the U.S. and the European Community than during the past three decades. In this environment, there will be a greater need to identify food crops and processing technologies that are self-targeted, in order to provide the broadest possible range of coverage to vulnerable groups with the food-aid resources available.
2. Title III-type and other forms of monetized food aid will be more cost-effective if distribution networks that currently market less costly, lower value-added staples are identified. The shift in consumption toward custom hammer-milled, whole maize-meal reflects a preference among many consumers in Eastern and Southern Africa to forego higher value-added food products for cheaper ones with lower marketing services. The approach of emphasizing lower-cost products is in contrast to monetizing food aid through marketing channels that produce and distribute higher-cost, higher value-added products. The latter approach, which occurred during the 1992 drought in Zimbabwe, created serious setbacks for the development of a competitive, and low-cost, private grain marketing system that donors were actually trying to encourage (Jayne and Rukuni 1994; Rubey 1995).

A contrasting example comes from Mozambique, where CARE and USAID developed a pilot program to provide small maize millers the right to bid for Title III food aid along with the large consignees who traditionally bid for the monetized food. Available evidence indicates that the pilot project was successful in introducing more competition at the first-purchaser level, thus spreading the benefits of Title III to a wider group of merchants, and increasing the supply of cheaper whole maize-meal on the market. It also helped a group of small millers complete a successful experience of cooperation with donors and NGOs, and in the process, facilitated their ability to compete in the maize marketing system. Importantly, the recognition that small maize millers might play a useful role in monetization activities was clarified by the existence of a database and understanding, built up over several years, that yellow maize and whole meal provided a potential to self-target low-income consumers more cost-effectively than existing procedures in the market.

3. State, donor, and NGO investment choices may not be neutral with respect to consumption effects. Programs involving rural food-for-work, local food purchase and distribution activity, monetization programs, triangular food transactions, etc., may have long-term effects on the evolution of local consumption patterns. Household food security may be either positively or negatively affected, depending on the foods favored by the investment and political choices. While numerous objectives are undoubtedly considered in the choice of NGO, donor, and state investments, we stress the need to consider the potential dynamic and long-term effects of such investments on the incentives and food choices available to consumers.
4. Inappropriate choices of commodities for relief and/or development purposes, in addition to transferring scarce donor resources to less-needy households, also depress the demand in local markets and introduce price shocks and unpredictability that makes future reliance on food markets less attractive for both buyers and sellers.
5. The design of public institutions supporting agriculture are not neutral with respect to crop production and consumption. The historical records for Eastern and Southern Africa show that crop breeding investments and the rules governing agricultural trade that were established 60 years ago by colonial governments have had an enduring influence on consumption patterns in the 1990s. Furthermore, using techniques that help incorporate information about consumer preferences into decision-making can have a high pay-off (Boughton et al. 1995). Since planning public-sector investments involves making educated guesses about future economic conditions, stated preference techniques used within the context of a subsector perspective can be a useful tool. For example, consumer preferences for specific attributes of maize, including its color and the endosperm composition, may have important implications for the design of maize breeding programs. Since scientists' perceptions about consumer preferences influence the direction and scope of research on improved maize varieties, the design of agronomic research would benefit from incorporating what is known about the consumer demand for maize with alternative

attributes, such as a yellow color or flinty endosperm (Rubey, Ward, and Tschirley, 1995).

REFERENCES

- Adamowicz, W., J. Louviere, and M. Williams. 1993. Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities. *Journal of Environmental Economics and Management* 26.3:271-292.
- Ahmed, R., and N. Rustagi. 1987. Marketing and Price Incentives in African and Asian Countries: A Comparison. In *Agricultural Marketing Strategies and Pricing Policy*, ed. Dieter Elz. Washington, D.C.: World Bank.
- Alderman, Harold. 1991. Food Subsidies and the Poor. In *Essays on Poverty, Equity and Growth*, ed. G. Psacharopoulos. Oxford: Pergamon Press.
- Amani, H.K.R., N. Lipumba, and S. Kapunda. 1990. Agricultural Market Reform in Tanzania: The Restriction of Private Traders and its Impact on Food Security. In *Food Security Policies in the SADCC Region: Proceedings of the Fifth Annual Conference on Food Security Research in Southern Africa*, Oct. 16-18, 1989, eds. M. Rukuni, G. Mudimu, and T. Jayne. Harare: University of Zimbabwe/Michigan State University Food Security Project, University of Zimbabwe.
- Amin, Nick. 1990. Peasant Differentiation and its Implications for Land Redistribution in Zimbabwe. Paper presented at the Conference on Land Policy in Zimbabwe, 13-15 February, Harare, Zimbabwe.
- Arrighi, G. 1983. Labor Supplies in Historical Perspective: A Study of the Proletarianisation of the African Peasantry in Rhodesia. In *Essays on the Political Economy of Africa*, eds. G. Arrighi and J.S. Saul. New York: Monthly Review Press.
- Bagachwa, M.S.D. 1992. Choice of Technology in Small and Large Firms: Grain Milling in Tanzania. *World Development* 20.1 (January):97-107.
- Ben-Akiva, M., and T. Morikawa. 1990. Estimation of Switching Models from Revealed Preferences and Stated Intentions. *Transportation Research* 24a:485-495.
- Binswanger, H., and K. Deininger. 1993. South African Land Policy: The Legacy of History and Current Options. *World Development* 21.9:1451-1475.
- Boughton, Duncan, Eric Crawford, Julie Howard, James Oehmke, James Shaffer, and John Staatz. 1995. *A Strategic Approach to Agricultural Research Program Planning in Sub-Saharan Africa*. MSU International Development Working Paper No. 49. East Lansing, MI: Department of Agricultural Economics.

- Bundy, C. 1979. *The Rise and Fall of the South African Peasantry*. Berkeley and Los Angeles: University of California Press.
- CBS (Central Bureau of Statistics). 1989. *National Agricultural Statistical Sampling Frame II*. Nairobi: Ministry of Planning and National Development.
- Chisvo, Munhamo. 1992. Grain Marketing Reform, Household Food Security and Nutrition in Zimbabwe. Unpublished M. Phil thesis, University of Zimbabwe at Harare.
- Chisvo, Munhamo, and T.S. Jayne. 1995 (forthcoming). The Evolving Role of the Grain Marketing System in Promoting Household Food Security in Zimbabwe. Report to USAID/Harare.
- Christiansen, Robert, and J.G. Kidd. 1987. *Malawi's Agricultural Export Strategy and Implications for Income Distribution*. International Economics Division, Economic Research Service, U.S. Department of Agriculture. Staff Report No. AGES870224.
- Companhia de Moçambique. 1934. *Produtos de Exportação Cultivados No Território Da Companhia de Moçambique*. Porto: Direcção de Agricultura Da Companhia de Moçambique.
- Cornia, A., R. Jolly, and F. Stewart. 1987. *Adjustment with a Human Face*. Oxford: Clarendon Press.
- CSO. 1985. *Population and Projected Growth Rate Data Files for Harare and Chitunguiza*. Harare: Central Statistics Office.
- Delgado, C. 1992. Why Domestic Food Prices Matter to Growth Strategy in Semi-Open West African Agriculture. *Journal of African Economies* 1.3 (November): 446-471.
- Dickie, M., A. Fisher, and S. Gerking. 1987. Market Transactions and Hypothetical Demand Data: A Comparative Study. *Journal of the American Statistical Association* 82 (397): 69-75.
- Diskin, Patrick, and Kipola Sipula. 1994. Maize Meal Preferences and Consumption in Lusaka, Zambia: Implications for Reducing Urban Food Prices." Report to USAID/AFR/ARTS/FARA, Washington, D.C.
- Drakakis-Smith, David. 1991. Urban Food Distribution in Asia and Africa. *The Geographic Journal* 157.1 (March): 51-61.
- FAO/MMAP. 1994.

- Fogel, Robert W. 1994. Economic Growth, Population Theory, and Physiology: The Bearing of Long-term Processes on the Making of Economic Policy. *American Economic Review* 369-395.
- Freeman, Donald B. 1991. *A City of Farmers: Informal Urban Agriculture in the Open Spaces of Nairobi, Kenya*. Kingston:McGill-Queens University Press.
- Gerrard, Christopher. 1981. Economic Development, Government-Controlled Markets, and External Trade in Food Grains: The Case of Four Countries in East Africa. Ph.D. dissertation, University of Minnesota.
- GMB (Grain Marketing Board, Government of Zimbabwe). Various years. *Report and Accounts*. Harare:Grain Marketing Board.
- Greene, W.H. 1992. *LIMDEP User's Manual and Reference Guide: Version 6.0*. New York: Econometric Software.
- Greene, W.H. 1993. *Econometric Analysis*, Second Edition. New York: MacMillan.
- Guyer, Jane. 1984. Naturalism in Models of African Production. *Man* 19.3 (September):371-388.
- Hedden-Dunkhorst, B. 1990. The Role of Small Grains in Semi-Arid Smallholder Farming Systems in Zimbabwe: Preliminary Findings. Draft mimeo, SADCC/ICRISAT, Matopos.
- Hensher, D.A., and M. Bradley. 1993. Using Stated Response Choice Data to Enrich Revealed Preference Discrete Choice Models. *Marketing Letters* 4:139-151.
- Howard, Julie. 1994. The Impact of Investments in Maize Research and Dissemination in Zambia. Ph.D. dissertation, Michigan State University, Department of Agricultural Economics.
- Iliffe, John. 1990. *Famile in Zimbabwe, 1980-1960*. Harare: Mambo Press.
- Instituto Dos Cereais de Moçambique. 1974. *Relatorio Das Actividades No Ano De 1973*. Maputo: Mozambique.
- Jansen, Doris. 1977. *Agricultural Policy and Performance in Zambia: History, Prospects and Proposals for Change*. Berkeley: University of California, Institute of International Studies.

- Jayne, T.S. 1994. Do High Food Marketing Costs Constrain Cash Crop Production? Evidence From Zimbabwe. *Economic Development and Cultural Change* 42.2 (January): 387-402.
- Jayne, T.S., and M. Chisvo. 1991. Unravelling Zimbabwe's Food Insecurity Paradox. *Food Policy* 16.5 (August): 319-329.
- Jayne, T.S., and M. Chisvo. 1992. Zimbabwe's Grain Marketing Policy Challenges in the 1990s: Short Run vs. Long Run Options. In *Food Security Research in Southern Africa: Policy Implications: Proceedings of the Sixth Annual Conference of Food Security Research in Southern Africa*, eds. J.B. Wyckoff and Mandivamba Rukuni. Harare: University of Zimbabwe.
- Jayne, T.S., and Lawrence Rubey. 1993. Maize Milling, Market Reform and Urban Food Security: The Case of Zimbabwe. *World Development* 21.6 (June): 975-988.
- Jayne, T.S., and Mandivamba Rukuni. 1993. Distributional Effects of Maize Self-Sufficiency in Zimbabwe: Implications for Pricing and Trade Policy. *Food Policy* 18. 4 (August): 334-341.
- Jayne, T.S., and Mandivamba Rukuni. 1994. Managing the Food Economy in the 1990s. In Rukuni and Eicher (eds), *Zimbabwe's Agricultural Revolution*, ed. M. Rukuni and ?? Eicker. Harare: University of Zimbabwe Publications.
- Jayne, T.S., Milan Hajek, and Johan van Zyl (1995). *An Analysis of Alternative Maize Marketing Policies in South Africa*. International Development Working Paper No. 50. East Lansing, Michigan State University, Department of Agricultural Economics.
- Jayne, T.S., Frank Lupi, and Mulinge Mukumbu. 1995. *Food Subsidies and Food Security in Urban Kenya: An Analysis Using Revealed and Stated Preference Data*. Staff Paper No. 95-23. East Lansing, Michigan State University, Department of Agricultural Economics.
- Jayne, T.S., M. Rukuni, M. Hajek, G. Sithole, and G. Mudimu. 1991. Structural Adjustment and Food Security in Zimbabwe. In *Toward an Integrated National Food Policy Strategy: Proceedings of the Second National Consultative Workshop*, eds. J. Wyckoff and M. Rukuni. Harare: University of Zimbabwe).
- Johnson, C.W., K. Byergo, P. Fleuret, E. Simmons, and G. Wasserman. 1980. *Kitale Maize: The Limits of Success*. Project Impact Evaluation No. 2. Washington D.C.: USAID.

- Kean, Stuart, and Adrian P. Wood. 1992. Agricultural Policy Reform in Zambia: The Dynamics of Policy Formulation in the Second Republic. *Food Policy* 17.1 (February): 47-63.
- Kenya Colony and Protectorate. 1952. *Report of the Board under the Chairmanship of Sir William Ibbotson on the Marketing of Maize and other Produce*. Nairobi: Government Printer.
- Kenya Government. 1966. *Report of the Maize Commission of Inquiry*. Nairobi: Government Printer.
- Keyter, Carl. 1975. Maize Control in Southern Rhodesia: 1931-1941: The African Contribution Toward White Survival. Local Series 34. *Central African Historical Association*.
- Kirsten, J.F., and H.J. Sartorius von Bach. 1992. Surplus Producers and the Food Price Dilemma in Traditional Agriculture in Southern Africa: Empirical Evidence from the Farmer Support Programme. *Agrekon* 31.4 (December).
- Kuznets, Simon. 1941. Statistics and Economic History. *Journal of Economic History* 1.1: 26-41.
- Laraki, Karim. 1990. Ending Food Subsidies: Nutritional, Welfare, and Budgetary Effects. *World Bank Economic Review* 3.3: 395-408.
- Lele, U. 1990. Structural Adjustment, Agricultural Development and the Poor: Some Lessons from the Malawian Experience. *World Development* 18.9 (September): 1207-1219.
- Low, Allan. 1986. *Agricultural Development in Southern Africa: Farm Household-Economics and the Food Crisis*. London: James Curry.
- Maddala, G.S. 1983. *Limited Dependent and Qualitative Variables in Econometrics*. Cambridge: Cambridge University Press.
- Masters, William, and E.A. Nuppenau. 1993. Regional Price Differences for Maize in Zimbabwe: A District-Level Analysis. *World Development*, October.
- Mazambani, D. 1982. Aspects of Peri-Urban Cultivation and Deforestation Around Harare. In *Geographical Perspectives on Development in Southern Africa*, eds. G. Williams and A. Wood. Lusaka: Commonwealth Geographic Bureau, Regional Conference.

- Miracle, M.P. 1966. *Maize in Tropical Africa*. Madison, Wisconsin: University of Wisconsin.
- Mkandawire, Martin M.M.K. 1993. *A Survey Work on Factors Affecting the Consumer Preference on Use of Mgaiwi Versus Ufa Woyera Among Rural Households*. Blantyre, Malawi: Monitoring and Evaluation Unit, Blantyre Agricultural Development Division.
- MLAWD. 1993. *Proposals for the Liberalisation of Agricultural Pricing and Marketing and the Development of Efficient and Competitive Marketing Boards*. Harare: Government of Zimbabwe, Ministry of Lands, Agriculture and Water Development.
- MOA/MSU Research Team. 1994. *Who Eats Yellow Maize? Some Preliminary Results of a Survey of Consumer Maize Meal Preferences in Maputo*. Working Paper 18. Maputo: Republic of Mozambique, Ministry of Agriculture.
- Mosley, Paul. 1975. *Maize Control in Kenya 1920-1970*. Bath: University of Bath, Center For Development Studies.
- Mosley, Paul. 1983. *The Settler Economies: Studies in the Economic History of Kenya and Southern Rhodesia 1900-63*. Cambridge: Cambridge University Press.
- Mosley, Paul. 1987. The Development of Food Supplies to Salisbury (Harare). In *Feeding African Cities: Studies in Regional Social History*, ed. J. Guyer. Manchester: Manchester University Press.
- Moyo, Sam, Nelson Moyo, and Rene Lowenson. 1985. *The Root Causes of Hunger in Zimbabwe: An Overview of the Nature, Causes and Effects of Hunger, and Strategies to Combat Hunger*. Working Paper 4. Zimbabwe, Harare: Institute for Development Studies.
- Mozambique. 1970. *Estatística Agrícola de Moçambique*. Maputo: Direcção dos Servicos de Economia e Estatística.
- Muir, K. 1981. *Economic Review of Crop Production in Zimbabwe*. Working Paper 1/81. Mount Pleasant, Zimbabwe: University of Zimbabwe, Department of Agricultural Economics and Extension.
- Mulinge, Mukumbu. 1992. The Effects of Market Liberalization on the Maize Milling Industry in Kenya. In *Proceedings of Conference on Maize Supply and Marketing Under Market Liberalization, held 18-19 June*. Nairobi: Egerton University, Policy Analysis Matrix Project.

- Mulinge, Mukumbu, and T.S. Jayne. 1994a. *Maize Consumption and Market Reform in Urban Kenya: Technical Report*. Tegemeo Working Paper 1. Nairobi: Egerton University, Tegemeo Institute.
- Mulinge, Mukumbu, and T.S. Jayne. 1994b. *Urban Maize Meal Consumption Patterns: Strategies for Improving Food Access for Vulnerable Urban Households in Kenya*. Tegemeo Institute for Agricultural Policy and Development Working Paper 1. Nairobi: Egerton University.
- Odhiambo, Mark, and David Wilcock. 1990. Reform of Maize Marketing in Kenya. In *Food Security Policies in the SADC Region*, eds. M. Rukuni, G. Mudimu, and T. Jayne. Harare: University of Zimbabwe.
- Oyejide, T.A. 1990. Agricultural Incentives in the Context of Structural Adjustment in Nigeria. In *IFPRI Policy Brief No. 5*. Washington, D.C.: International Food Policy Research Institute.
- Pinckney, Thomas C. 1988. *Storage, Trade, and Price Policy under Production Instability: Maize in Kenya*. International Research Report 71. Washington D.C.: Food Policy Research Institute.
- Pinstrup-Andersen, Per. 1988. *Food Subsidies in Developing Countries: Costs, Benefits, and Policy Options*. Baltimore: Johns Hopkins University Press.
- Richards, A. 1939. *Land, Labour and Diet in Northern Rhodesia: An Economic Study of the Bemba Tribe*. London: Oxford University Press.
- Rohrbach, D.D. 1989. *The Economics of Smallholder Maize Production in Zimbabwe: Implications for Food Security*. International Development Paper No. 11. East Lansing: Michigan State University, Department of Agricultural Economics.
- Rubey, Lawrence. 1993. Consumer Maize Meal Preferences in Zimbabwe: Survey Results and Policy Implications. A report prepared for the Ministry of Lands, Agriculture and Water Development, and USAID/Zimbabwe.
- Rubey, Lawrence. 1994. The Grain Milling Industry in Zimbabwe: Impact and Implications of Policy Reform. A report prepared for the Ministry of Lands, Agriculture and Water Development, and USAID/Zimbabwe.
- Rubey, Lawrence. 1995. Maize Market Reform in Zimbabwe: Linkages Between Consumer Preferences, Small-Scale Enterprise Development and Alternative Marketing Channels. Ph.D. dissertation, Michigan State University.

- Rubey, Lawrence. Forthcoming. *Improving the Design of Food Policies in Drought Years: Lessons from the 1992 Southern Africa Drought (Zimbabwe Country Study)*. MSU International Development Working Paper. East Lansing: Michigan State University.
- Rubey, Lawrence, and Frank Lupi. 1995. *Predicting the Benefits of Market Reform in Zimbabwe: A Stated Preference Approach*. Staff Paper 95-16. East Lansing: Michigan State University, Department of Agricultural Economics.
- Rubey, Lawrence, Richard Ward, and David Tschirley. 1995, forthcoming. Incorporating Consumer Preferences into the Design of Maize Technology Development Strategies. In Africa's Maize Revolution, eds. Derek Byerlee and Carl K. Eicher.
- Rukuni, Mandivamba. 1990. *The Development of Zimbabwe's Agriculture 1980-1990*. Working Paper AEE 7/90. Mount Pleasant, Zimbabwe: University of Zimbabwe, Department of Agricultural Economics and Extension.
- Rusike, Joseph. 1995. Personal communication to author.
- Sahn, D., and A. Sarris. 1991. Structural Adjustment and the Welfare of Rural Smallholders. *World Bank Economic Review* 5.2:259-289.
- Shopo, Thomas. 1985. *The Political Economy of Hunger in Zimbabwe*. Working Paper No. 2. Harare: Zimbabwe Institute of Development Studies.
- Sithole, Gordon, Munhamo Chisvo, and Share Jiriyenga. 1993. *Evaluating the Effects of the Liberalisation of Maize and Maize Meal Marketing in Zimbabwe*. A draft consultancy report for the Ministry of Lands, Agriculture, and Water Development.
- Smale, Melinda, and Paul Heisey. 1994. Grain Quality and Crop Breeding when Farmers Consume their Grain: Evidence from Malawi. Presented at 1994 International Agricultural Economics Association meetings in Harare, Zimbabwe, August 1994.
- Soroko, David. 1993. *Memo on Maize Marketing and Pricing Policy in Kenya*. Nairobi: Agriculture Office, USAID/Nairobi.
- Southern Rhodesia, Colony of 1924. *Official Yearbook of the Colony of Southern Rhodesia, No. 1*. Salisbury: Government Printer.
- Srivastava, R.K., and I. Livingstone. 1983. Growth and Distribution: The Case of Mozambique. In *Agrarian Policies and Rural Poverty in Africa*, eds D. Ghai and S. Radwan. Geneva: International Labor Office.

- Stampley, Gary, L. 1993. Demographic and Expenditure Profiles of Zambian Households: Evidence from the June 1991 Zambian Household Expenditure and Income Survey. Iowa State University Staff Report 93-SR 63, September.
- Stewart, Francis. 1977. Maize Milling in Kenya. In *Technology and Underdevelopment*, ed. F. Stewart. New York: MacMillan Press.
- Swait, J., and J.J. Louviere. 1993. The Role of the Scale Parameter in the Estimation and Use of Generalized Extreme Value Models. *Journal of Marketing Research* 30:305-314.
- Timmer, C.P., W. Falcon, and S. Pearson. 1983. *Food Policy Analysis*. Baltimore: Johns Hopkins University Press.
- Tschirley, David, and Ana Paula Santos. 1994. *Who Eats Yellow Maize? Some Preliminary Results of a Survey of Consumer Maize Meal Preferences in Maputo, Mozambique*. Staff Paper No. 94-76. East Lansing: Michigan State University, Department of Agricultural Economics
- Tschirley, David L., Cynthia Donovan, and Michael Weber. 1995, forthcoming. Food Aid and Food Markets: Lessons from Mozambique. *Food Policy*.
- Tschirley, David, Cynthia Donovan, Michael Weber and Rui Benfica. 1993. *The Pricing and Distribution of Yellow Maize Food Aid in Mozambique: An Analysis of Alternatives*. Staff Paper No. 93-69. East Lansing: Michigan State University, Department of Agricultural Economics.
- Weinmann, H. 1972. *Agricultural Research and Development in Southern Rhodesia, 1890-1923*. Department of Agriculture Occasional Paper 4. Harare: University of Zimbabwe.
- Weinmann, H. 1975. *Agricultural Research and Development in Southern Rhodesia, 1924-1950*. Series in Science No. 4. Harare: University of Zimbabwe.
- West, C., with F. Pepping, I. Scholte, W. Schultink, W. Jansen, and H. Albers. 1987. Food Composition Table. Wageningen, Netherlands: Wageningen Agricultural University. Mimeo.